CRISP

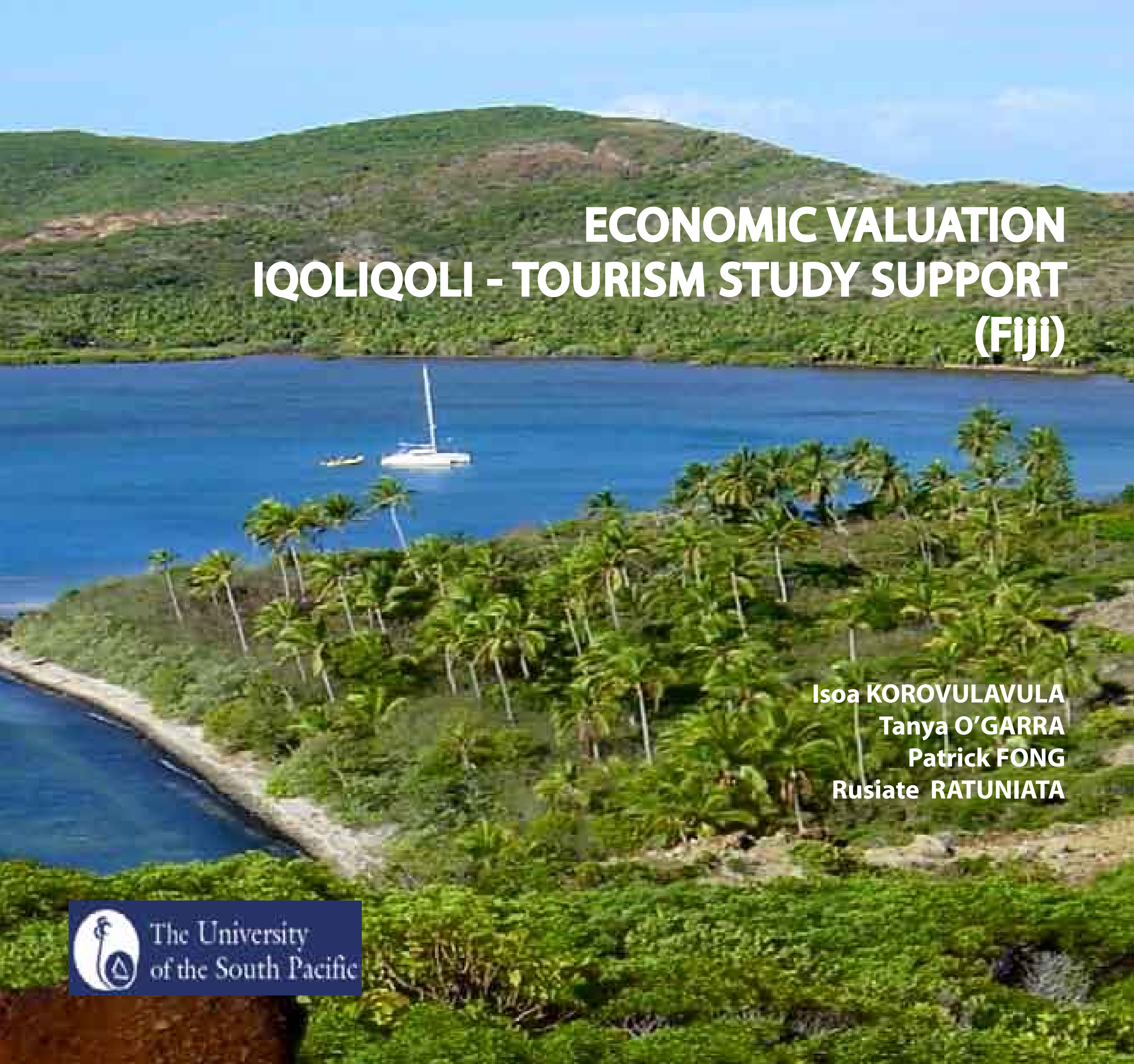
Coral Reef InitiativeS for the Pacific
Initiatives Corail pour le Pacifique

COMPONENT 2A - Project 2A2

Knowledge, monitoring, management and beneficial use of coral reef ecosystems

January 2008

FINAL REPORT



ECONOMIC VALUATION IQOLIQOLI - TOURISM STUDY SUPPORT (Fiji)

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CRISP

Coral Reef InitiativeS for the Pacific
Initiatives Corail pour le Pacifique

The CRISP programme is implemented as part of the policy developped by the Secretariat of the Pacific Regional Environment Programme for a contribution to conservation and sustainable development of coral reefs in the Pacific

The Initiative for the Protection and Management of Coral Reefs in the Pacific (CRISP), sponsored by France and prepared by the French Development Agency (AFD) as part of an inter-ministerial project from 2002 onwards, aims to develop a vision for the future of these unique eco-systems and the communities that depend on them and to introduce strategies and projects to conserve their biodiversity, while developing the economic and environmental services that they provide both locally and globally. Also, it is designed as a factor for integration between developed countries (Australia, New Zealand, Japan, USA), French overseas territories and Pacific Island developing countries.

The CRISP Programme comprises three major components, which are:

Component 1A: Integrated Coastal Management and watershed management
- 1A1: Marine biodiversity conservation planning
- 1A2: Marine Protected Areas
- 1A3: Institutional strengthening and networking
- 1A4: Integrated coastal reef zone and watershed management

Component 2: Development of Coral Ecosystems
- 2A: Knowledge, monitoring and management of coral reef ecosytems
- 2B: Reef rehabilitation
- 2C: Development of active marine substances
- 2D: Development of regional data base (ReefBase Pacific)

Component 3: Programme Coordination and Development
- 3A: Capitalisation, value-adding and extension of CRISP Programme activities
- 3B: Coordination, promotion and development of CRISP Programme

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COMPONENT2A

Knowledge, monitoring and management of coral reef ecosytems

PROJECT 2A-1 :
Postlarvae (fish and crustacean) capture and culture for aquarium trade and restoking

PROJECT 2A-2:
Improvement of knowledge and capacity for a better management of reef ecosystems

PROJECT 2A-3 :
Synopsis and extension work on indicators for monitoring the health of coral ecosystems and developing a remote sensing tool

PROJECT 2A-4 :
Testing of novel information feedback methods for local communitis and users of reef and lagoon resources

PROJECT 2A-5 :
Specific studies on i) the effects on the increase in atmospheric CO_2 on the health of coral formation and ii) the development of eco-tourism

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- Mr Reddy (Department of Lands, Government of Fiji)
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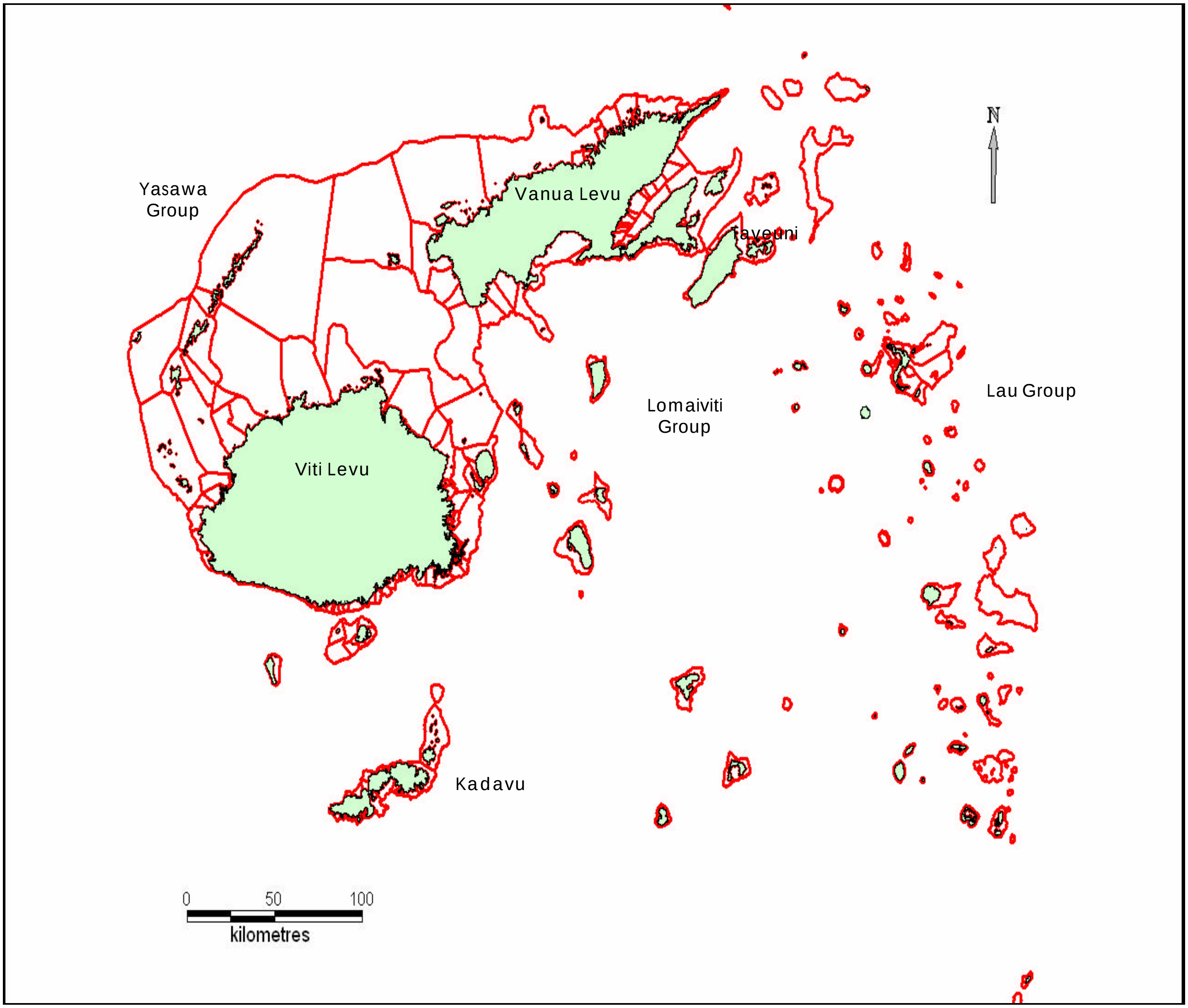
Figure 1: Fiji Traditional Customary Fishing Ground '*Qoliqoli*' (marked in red) in Fiji



Executive Summary

The primary aim of this study is to determine the value of natural assets that affect the two key stakeholders in the tourism industry the Fijian taukei ni vanua/iqoliqoli owners and the resort owners. Figure 1 illustrates the entire iqoliqoli in Fiji. The underlying factor that led to this study was the possible and potential positive and negative implications of the impending iqoliqoli Bill legislation may have on the tourism industry. Moreover the study is one of the first steps to seek some means at which the overall harmonious relationship between Fijian taukei ni vanua/i qoliqoli and resorts can be maintained.

The three sites that were identified for the study were:

- The Coral Coast which is along the south western coast of Viti Levu (Old but still a vibrant tourism activity area in Fiji);
- The tourism areas and iqoliqoli on the island of Kadavu (new tourism development area – one of the outer islands located on south of Fiji); and
- Mamanuca island resorts to the South-west of Nadi Airport.

The only site out of three sites that had relevant data on saleable natural assets of the iqoliqoli was the eleven iqoliqoli along the Corals Coast. The other two sites Kadavu and the Mamanucas had inadequate data available. The biological data was collected from Coral Cay assessments in 2005.

The Total Economic Value (TEV) framework was used for the literature review and the analysis of data. It is important to note that a full economic valuation of Fiji's natural resources has not been carried out. This report indicates that there are gaps and a more in-depth economic valuation ought to be done for coral reef, mangrove and related ecosystems.

The various economic valuation studies and report reviewed in this study show that production approach and replacement cost method are used to quantify the monetary direct and indirect use value respectively. Contingent Valuation Method and Benefit Transfer methods are used to quantify non-use values.

The following are the findings based on the primary objectives of the study.

The eleven iqoliqoli along the Coral Coast indicate saleable assets (fish and invertebrates) or its direct use value based on two scenarios of MSY ranged from F$3,001,422.02 to F$8,025,022.29 per Km^2 per year in scenario A (or F$30,014.22 to F$80,250.02 per hectare per year) and F$75,723.07 to F$547,998.90 per Km^2 per year in scenario B (or F$757.23 to F$5,480 per hectare per year). In addition the direct use value of mangrove is about US$11,000 a hectare (Hamilton and Snedaker eds. in Brown et al. 1993).

The coral reef system as reported by various studies elsewhere has a total economic value which includes tangible and intangible assets in the range of US$1,373 per hectare to US$1.02 million per hectare. There were inadequate data to make such valuation in Fiji, but assuming tangible value to be a major component of total economic value, the lower limits are in good agreement. Most international calculations of the TEV is in the range of US$7,000 to US$12,000 per hectare.

The approximate average economic value of the use of marine resources and ecosystem by tourists namely swimming, snorkelling, scuba diving, reef walking and kayaking/ canoeing/ water sports fishing (as determined by the information in the Fiji International Visitor survey) is estimated to range from be F$74.08 million a year, or F$171.20 per visitor per year to F$335.05 million or F$777.74 per visitor per year (based on 2003 Tourist data).

The non-use value (option, quasi-option, bequest and existence values) cannot be calculated because of inadequate information and data as well as time constraint in relation to this specific study. However, according to Sisto (1999) based on the application of benefit transfer valuation method the disturbance regulation of coral reef and mangrove in Fiji are approximately F$307.2 million and F$105 million respectively.

In future there is a real need to conduct in-depth economic valuation studies on the indirect use values, option values, existence values and bequest values of coral reef, mangrove and related ecosystems in order to fully capture the TEV of iqoliqoli. This can only be done if reliable and relevant biological and socioeconomic data are available.

The specific resort survey in Fiji had a poor response and better co-operation by resorts would lead to more accurate data on tourist resource use per area.

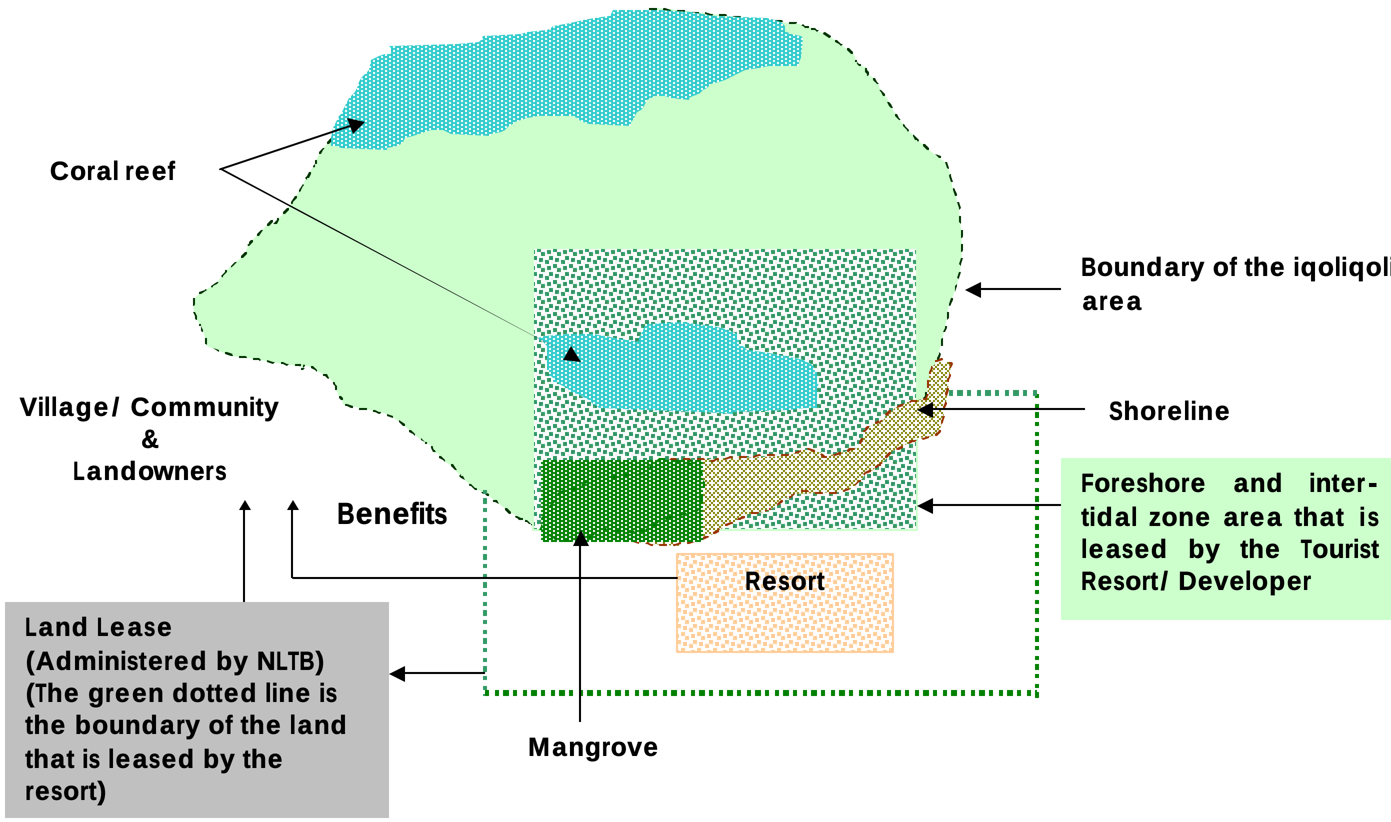
1 Introduction

The main purpose of the economic valuation study is to provide a framework that can be used as a basis for discussing compensation in relation to the iqoliqolqi development issues. In this case the focus is on tourism development and activities. The iqoliqoli is the customary fishing ground which extends from the high-tide water mark along the shoreline to the most outer reef crest (that is it can be either a fringing or a barrier reef). Hence, a iqoliqoli may consist of the following biophysical features: shoreline with mudflats and/or beaches; mangrove ecosystem, fringing reef system, lagoon and barrier reef system. According to the Qoliqoli Bill (2006) iqoliqoli is defined as the any area of seabed or soil under the waters, sand, reef, mangrove swamp, river, stream or wetland or any other area, recognised and determined within customary fishing grounds under the Fisheries Act or as clarified in accordance with this Act, and includes any customary fishing grounds reclaimed before or any qoliqoli area reclaimed after the commencement of this Act.

The report is divided into six major sections. The first section is an introduction to the objectives and scope of the study. The second describe the method that was applied in the research particularly the framework at which the required information was reviewed and assessed. The third section is the result and discussion of the outcomes of the investigation. The fourth section specifically sums up the result of the findings as it relates to the objective of the study. The fifth section puts forward recommendation on how some critical aspects of economic valuation need to be carried out in future in order to come up with more reliable and realistic economic values of coral reef and related ecosystems. In addition this section also proposes a framework at which a formula of compensation of iqoliqoli can be explored and be used for further discussion.

In order to develop a meaningful framework for the development of a iqoliqoli compensation formula it is important that key factors and issues are identified and its inter and intra-relationships, conditions or requirements are integrated into the framework. Figure 2 below is a hypothetical iqoliqoli area and its possible biophysical, socioeconomic and institutional attributes.

Figure 2 Typical iqoliqoli's biophysical, socioeconomic and institutional attributes



1.1 Objective

The principal objectives of the study are to:

- Carry out an economic valuation of three representatives iqoliqoli based on saleable assets (fish and invertebrates) to provide a range of values per area unit. Evaluation will be based on existing biological surveys and market costs.
- Carry out an evaluation of a coral reef system that combines sale-able assets as well as internationally accepted intangible (service) values. A survey of such studies done internationally will be undertaken and valuations adjusted based on Fiji economic realities.
- Carry out a separate evaluation of the iqoliqoli based on tourist use. This will be done by looking at how many tourists use the iqoliqoli different ways and what value this brings to the industry.

1.2 Research Team

The economic valuation study team were Patrick Fong, Rusiate Ratuniata, Tanya O'Garra and Isoa Korovulavula.

2 Method: economic valuation approaches applied in the study

A literature review was conducted on economic valuation specifically on coral reefs, coastal ecosystems and tourism. A survey questionnaire was sent to a number of resorts to gather information on tourist use of coastal and marine ecosystems (refer to Annex 1). For the Coral Coast case study the Coral Cay biological data provided the principal basis for the valuation of the tangible saleable marine resource assets.

The consultancy examined three sites as a case study for this exercise. The three sites that have been identified are:

- The Coral Coast which is along the south western coast of Viti Levu (Old but still a vibrant tourism activity area in Fiji);
- The tourism areas and iqoliqoli on the island of Kadavu (new tourism development area – one of the outer islands located on south of Fiji); and
- Mamanuca island resorts south-west of Nadi airport, a major tourism destination.

The coral coast has all relevant biological and socioeconomic data to enable the quantification of monetary value of all the tangible assets. The following were iqoliqoli that were part of the study along the coral coast located on the south-western part of Viti Levu. They are: Korolevu-i-Wai; Vanua Ko Conua kei Naivikikabuta; Vanua ko Yavusauna kei Voua; Yavusa ko Burenitu; Yavusa ko Nadruku; Vanua ko Madudu; Vanua ko Nasigatoka; Vanua ko Tabanivono I Ra; Yavusa Ketenamasi, Leweitaqalulu, Tacini, Nalotawa, Lewei; Yavusa Noi Naculaca and Vanua of Komave comprising of Yavusa Vusu.

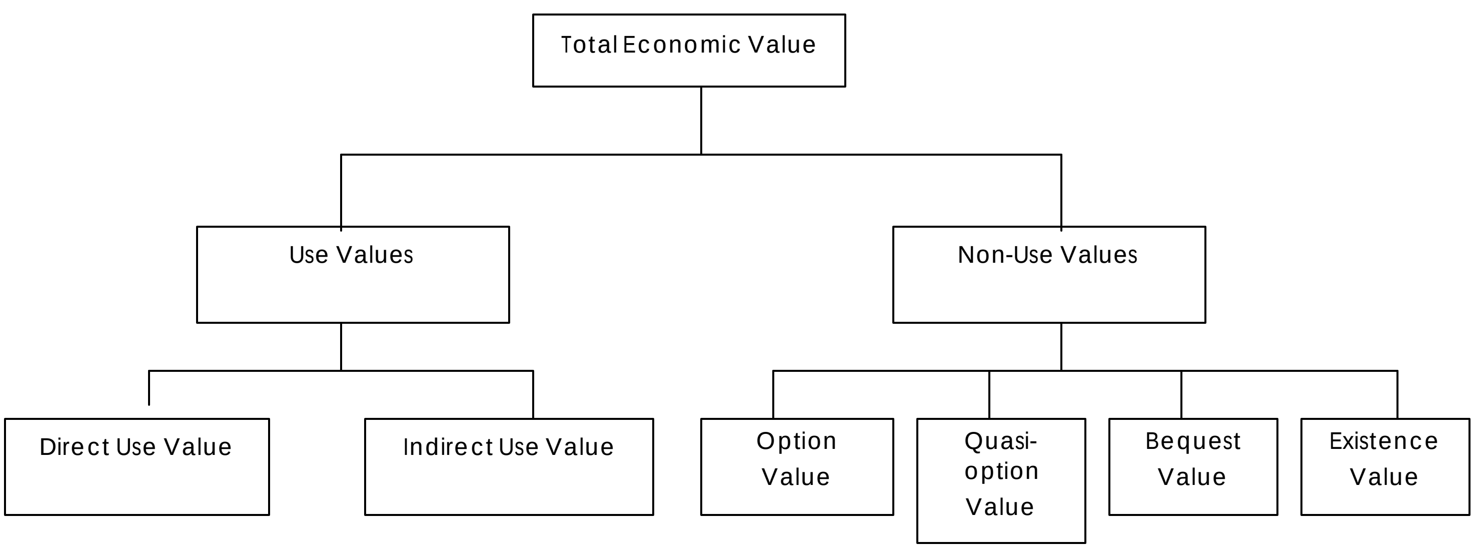
The tourism areas and iqoliqoli on the island of Kadavu cannot be adequately covered in this study because of the lack of tourism, biological and socioeconomic data. There was also poor response from resort owners in completing the questionnaires that were sent to them.

The tourist resorts Mamanucas and Yasawas provided some data but not adequate to gauge reliable tourist use values specifically of the *iqoliqoli*.

2.1 Total Economic Value Framework

The findings from the literature review and data gathered from the survey were analysed using the Total Economic Value (TEV) framework as depicted in Figure 3. It is important to note that the TEV concept is limited to anthropogenic values only. In other words the resource is valued exclusively in terms of the values it yields to humans; no intrinsic value is attributed to it. Table 1 illustrates the important biophysical goods and services that can be potentially economically valued in a *iqoliqoli*.

Figure 3 Total Economic Value



(Source: adapted from Cesar and Chong, 2005)

TEV therefore can be summarised as:

TEV = ***Direct Use + Indirect Use + Option Value + Quasi-Option + Bequest Value + Existence Value***

The following are the brief descriptions of the various economic value categories.

2.1.1 Use Values

Use Values comprise of two categories and they are direct use and indirect use values.

2.1.1.1 Direct Use

Direct uses usually include the most obvious and important market based consumptive and non-consumptive use. For instance in a iqoliqoli a consumptive use would include subsistence, artisinal inshore fisheries, recreational fishing, and large-scale commercial fishing. A non-consumptive use would include tourism activities such as snorkeling and scuba diving. Other non-consumptive uses would be coral mining and live rock harvesting for aquarium purposes.

2.1.1.2 Indirect Use

The indirect use values are values derived from the indirect uses largely comprised of an area's ecological functions such as shoreline protection, breeding habitat for migratory species, wastewater treatment (one of the services provided by mangrove and wetland systems), climatic stabilisation and carbon sequestration.

2.1.2 Non-Use Values

Nonuse values are derived independently of any current or expected future contact with the resource itself or with the tangible services that it provides. Non-Use values are categorized into four categories and they are option, quasi-option, bequest and existence values.

2.1.2.1 Option Value

Option value is the value an individual attaches to keep alive the possibility of one day to be able to benefit from the resource. Therefore since it is the value attached to potential use, its current non-use value is attributable to its potential use value in future. An example of this would be the potential of extracting and developing a pharmaceutical product sometime in the future from a natural resource which may not be used or consumed at all in the present time by people.

2.1.2.2 Quasi-Option Value

Quasi-Option Value is related to option value. The only difference is the emphasis of uncertainty and irreversibility. In other words quasi-option value is the value attached by delaying any action or decision that would cause irreversible degradation.

2.1.2.3 Bequest Value

Bequest value is the value an individual place on his/ her satisfaction attributed to the continued existence of a biophysical resource for future possible benefit of others, either known or unknown to him or her.

2.1.2.4 Existence Value

Existence value is the value that an individual places (not necessarily among persons currently and prospectively active in the market) on the environment or a particular ecosystem to obtain satisfaction from the mere knowledge that part of that natural environment or ecosystem remains.

In summary the method applied in this study is that the economic values were collated from the available literature. In some cases annualized to 2003 Fiji dollar per km^2 (the fin-fish and invertebrates values from the Coral Coast survey was annualized using discount rates given in the paper i.e. 10%). The estimates were organized given in studies into value categories (direct, indirect and non-use).

Table 1 Summary of the Key iqoliqoli Biophysical systems that provide important goods or services

Total Economic Value Components	Key iqoliqoli Biophysical system that provide important goods or services		
	Coral reef	Foreshore/ lagoon	Mangrove
Direct extractive use			
Fin-fisheries (commercial)	x	x	x
Fin-fisheries (subsistence)	x	x	x
Other fisheries e.g. shellfish (commercial)	x	x	
Other fisheries e.g. shellfish (subsistence)	x	x	x
Other food (e.g. seaweed)		x	
Timber/ firewood (commercial)			x
Timber/ firewood (subsistence, local use)			x
Non Timber Forest Products (e.g. medicines, dyes)			x
Curio/ jewelry/ handicrafts	x		
Coral/ live rock for aquarium trade	x		
Aquarium fish	x		
Coral blocks/ lime	x		

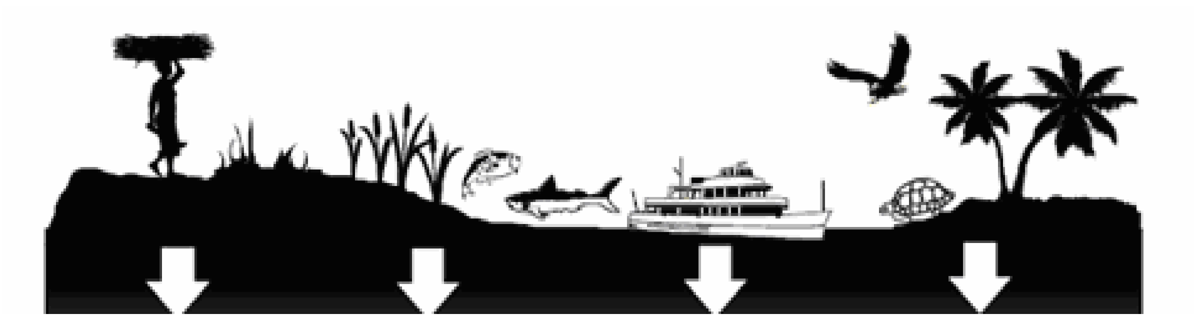
Table 1 Summary of the Key iqoliqoli Biophysical systems that provide important goods or services			
Total Economic Value Components	Key iqoliqoli Biophysical system that provide important goods or services		
	Coral reef	Foreshore/ lagoon	Mangrove
Direct non-extractive use			
Tourism/ recreation	x	x	x
Indirect use			
Coastal/ shoreline protection	x		x
Waste assimilation	x		x
Maintenance of biodiversity	x	x	x
Support for other key habitats & species	x	x	x
CO_2 sink			x
Non-use values (independent of use)			
Bequest value	x	x	x
Existence value	x	x	x
Option & values	x	x	x
quasi-option	x	x	x

Furthermore the literature review will also identify various economic valuation methods of quantifying use and non-use values.

3 Results – Literature Review and Data Gathered

In the literature review several studies were identified that have attempted to estimate total economic values (TEV) (or at least values that incorporate some indirect as well as direct use values) for the coral reef (fringing and barrier reefs), mangrove ecosystems and the shoreline and beaches. This report will address each of the non-marketed goods and services provided by the marine ecosystems within iqoliqolis in turn. This will involve a brief description of each of these goods or services, an overview of valuation methods used to place a monetary value on these goods and services, a brief review of studies carried out in this area, and an evaluation of the relevance of carrying out such a valuation for this project. In order to capture the complete economic value of the iqoliqoli it is therefore important to examine goods or services provided by the three main biophysical features as stated above (coral reef, mangrove and shoreline and beaches) that can be found in a 1qoliqoli. Figure 4 illustrates the types of economic values can be assessed in an iqoliqoli.

Figure 4 Biophysical Features of the Iqoliqoli with its different Economic Values



Direct Values
Production and Consumption goods such as:
- Fish
- Firewood
- Building materials
- Shells
- Corals
- Tourism
- Transport etc

Indirect Values
Ecological Services and functions such as:
- Shoreline protection
- Prevention of saltwater intrusion
- Storm and flood control
- Carbon sequestration
- Wildlife habitat
- Biodiversity etc.

Optional Values
Premium placed in future possible uses and applications such as:
- Extractive
- Leisure
- Pharmaceutical
- Industrial

Existence Values
Intrinsic significance in terms of:
- Culture
- Aesthetic
- Heritage
- Bequest etc.

Source: Emerton, 2002

3.1 Total Economic Value of Coral Reef

3.1.1 Coral Reef Use Values

3.1.1.1 Direct Use Value

For this study the main direct use values that had available data were fisheries, recreational and tourism. Fisheries data were primarily financial market values associated with harvesting fish from an area. In addition recreation and tourism data were market values based on expenditures by tourist and visitors on the use of the coastal and marine environment for recreational purposes.

3.1.1.1.i Fisheries

Because of the limited data available as well as time constraint the most practical and logically means to elicit the monetary value of the direct use value of the qoliqoli in terms of fisheries was to use of the marine biological survey findings that were conducted by Coral Cay Conservation. They key areas that were used for the monetary valuation were anthropocentric value of marine resources. These were fin-fish and invertebrates. The fin-fish data were collected by using belt transect methodology.[1]

The total number of fin-fish and invertebrates collected in the sub-sample of the iqoliqoli was extrapolated to cover the total iqoliqoli hectares.

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[1] The belt transect methodology as applied by Coral Cay Conservation allows comparison of relative abundances across the region. The method is non-extractive and as such has no detrimental impact to fish populations in the area. Using the same 100 metre tape, four 5 metre wide by 20 metre long sections were surveyed (centred on the transect line) (Raines, P. et al. 2005). A 5-meter gap was left un-surveyed between sections to make each section a distinct statistical unit (Raines, P. et al. 2005). Absolute numbers of fish, target species, and families were recorded (Raines, P et al. 2005). A similar method was utilised for sampling invertebrate taxa (Raines, P. et al. 2005). Four 2 metres wide by 20 metres sections were surveyed (centred on the transect line) (Raines, P. et al. 2005). Again, a 5-metre gap was left un-surveyed between sections. The smaller survey area was a compromise to the increased time required to complete accurate invertebrate census per unit area (Raines, P. et al. 2005).

The value of saleable assets (i.e. fin-fish and invertebrates) was calculated by multiplying the biomass of fin-fish and invertebrates in the *iqoliqoli* (assessed by Coral Cay Conservation) by the market price. This aggregate amount is the value if all consumptive marine resources are fished and sold thus there will be literally none left. This in turn would mean that there will be no more economic value of the iqoliqoli for the following year and in perpetuity. In other words valuing the whole fin-fish and invertebrates stock would be incorrect. Hence what is valued is the percentage of the total fin-fish stock and invertebrates *(as measured by Coral Cay)* consumed or sold by local communities. However the data for this is not available. For this reason the sustained biological yield of 3.4 tonnes of fisheries in a qoliqoli per Km^2 per year based on Jennings and Polunin 1995 findings of six iqoliqoli in Fiji was applied to determine the economic value of each of the iqoliqoli along the Coral Coast. They also reported that taking more than 5 percent of the biomass in a given year lead to increased stress to the ecosystem. "There are thus good reasons for adopting a quicker and more simple valuation techniques using Maximum Sustainable Yields (MSYs) although commonly sought MSYs are sensitive to assumptions. However, by multiplying MSY by appropriate market or substitute prices this method can provide adequate estimates this method can provide adequate estimates of reef productivity values" (Spurgeon, 1992: 530).

Table 2 provides the result of the economic valuation of saleable assets (fish and invertebrates) and their monetary values per area unit. The unit in this study is squared kilometres. The key focus of this study is the Coral Coast iqoliqolis as illustrated in Figure 5. The gross present value was calculated based on the discount rate of 10% for a 99 years lease. The discount rate[2] was based on the

[2] There are two main reasons why discounting is used. First is to do with *time preference*. This basically means that individuals prefer to enjoy benefits sooner, and costs later, rather than the other way round. A cost or benefit of a given amount has a lower subjective value, the later it arises. This may be due to a myopia, an urgent need for gratification (e.g. because of poverty or greed), or the belief that future consumption will be greater (and therefore the marginal utility of a given unit of consumption will be less). These factors apply to private individuals. Governments, acting in a rational and enlightened way on behalf of their citizens, may also have social time preference, for example where they expect future incomes to be greater, where $1 now is worth more to society than the same in the future. Second, is to do with opportunity cost of capital. This is means that a sum of money is worth more now than the same amount in future because it can be employed productively, e.g. invested profitably, or lent for interest. In this case the discount rate is the inverse of the rate of

current lending and government bond rates. The municipal price for the various saleable assets in the iqoliqoli that were assessed was based on the market price from fishing outlets in Sigatoka, Nadi, Suva and Lautoka.

For each iqoliqoli, two calculations were performed, one assuming that 3.4 tonnes of biomass can be harvested or extracted per Km^2 per year and the other that 5 percent of the total biomass can be extracted per year. The resulting figures will be give a range of present value per year.

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interest. Funds used on a project which generates a given return on some future date could have been used to generate returns immediately. A discount rate reminds us of this alternative use of funds. Discounting assists the rational allocation of capital between uses that have different temporal profiles.

(Source: OECD. Economic Development Institute of the World Bank, 1995)

Table 2

I qoliqoli (Customary Fishing Ground)	Total area Km²	[3]Biomass (Tonne)	Tonne per Km²	[4]3.4 Tonne per Km² per year	Gross Value (this is the sum of the biomass of each marine resources multiplied by its respective market price in a year)	Scenario A Gross Value based on 3.4 tonnes per Km² per year)	Scenario B Gross value based on [5]5% of marine resources to be harvested/ fished in a year	Scenario A Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario B Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario A Direct Economic Value per Km² Per year (Fiji$)	Scenario B Direct Economic Value per Km² Per year (Fiji $)
Qoliqoli 1 Yavusa Nadruku of Korovisilou village in the District of Serua	2.93	784.72	267.82	9.96	3,708,167.83	372,231.26	185,408.39	23,323,701.00	1,853,935.92	7,960,307.51	632,742.63
Qoliqoli 2 Yavusa Noi Naculava of Namaqumaqua Village in the District of Serua	1.65	282.62	171.29	5.61	1,515,958.21	270,224.28	75,797.91	16,932,028.43	757,918.60	10,261,835.41	459,344.61
Qoliqoli 3 Yavusa Burenitu of Naboutini and Nabukelevu villages in the District of Serua	7.46	2,264.91	303.61	25.36	10,968,643.75	432,449.29	548,432.19	27,096,912.42	5,483,884.10	3,632,293.89	735,105.11

[3] This is the product of multiplying the abundance value (i.e. number of fin-fish and invertebrates in each iqoliqoli) by its mass (tonne)
[4] Based on Jennings and Polunin, 1995 study on 6 different iqoliqoli in Fiji, they reported that fisheries in these iqoliqolis were capable of sustaining yields of up to 3.4 tonne (3,400 kg) per km² per year or 10.2 km2 coral reef per year and that in sites where yields were less they might be increased sustainably.
[5] A catch rate of 5% of biomass per year was also reported by Jennings and Polunin (1996) was set as rough estimate upper limit of the MSY (e.g. for qoliqoli 1 it would be 5% of $3,708,167.83

I qoliqoli (Customary Fishing Ground)	Total area Km²	[3]Biomass (Tonne)	Tonne per Km²	[4]3.4 Tonne per Km² per year	Gross Value (this is the sum of the biomass of each marine resources multiplied by its respective market price in a year)	Scenario A Gross Value based on 3.4 tonnes per Km² per year)	Scenario B Gross value based on [5]5% of marine resources to be harvested/ fished in a year	Scenario A Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario B Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario A Direct Economic Value per Km² Per year (Fiji$)	Scenario B Direct Economic Value per Km² Per year (Fiji $)
Qoliqoli 4 Yavusa Davutukia, Bolabola, Keasuganaqali, Kubunicere, Noi Tubai and Naculava in the District of Korolevuiwai	1.3	130.64	100.49	4.42	735,914.31	166,496.45	36,795.72	10,432,528.97	367,927.78	8,025,022.29	283,021.37
Qoliqoli 5 Vanua ko Conua kei Naivikabuta & Yavusa Noi-Weredruga comprising Vatukarasa, Korotogo, Nawamagi, Naroro, Narata, Malevu and Nadrala in the District of Conua	0.65	17.85	27.46	2.21	98,447.85	44,546.54	4,922.39	2,791,249.02	49,220.00	4,294,229.26	75,723.07

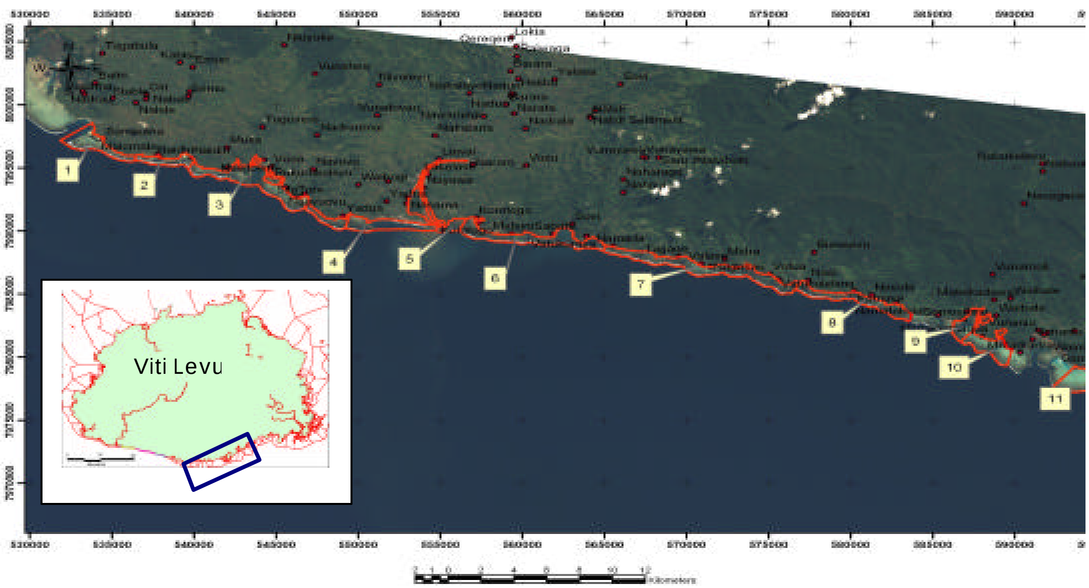
I qoliqoli (Customary Fishing Ground)	Total area Km²	[3]Biomass (Tonne)	Tonne per Km²	[4]3.4 Tonne per Km² per year	Gross Value (this is the sum of the biomass of each marine resources multiplied by its respective market price in a year)	Scenario A Gross Value based on 3.4 tonnes per Km² per year)	Scenario B Gross value based on [5]5% of marine resources to be harvested/ fished in a year	Scenario A Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario B Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario A Direct Economic Value per Km² Per year (Fiji$)	Scenario B Direct Economic Value per Km² Per year (Fiji $)
Qoliqoli 6 Vanua ko Madudu comprising Nayawa & Laselase villages in the District of Nasigatoka	4.17	685.86	164.47	14.18	3,276,366.95	231,088.09	163,818.35	14,479,787.40	1,638,052.71	3,472,371.08	392,818.40
Qoliqoli 7 Vanua ko Nasigatoka comprising Nasigatoka, Yavulo, Volivoli, Vunavutu & Nasama villages in the District of Nasigatoka	6.73	1,565.56	232.62	22.88	7,376,519.40	322,372.14	368,825.97	20,199,570.19	3,687,965.29	3,001,422.02	547,988.90

I qoliqoli (Customary Fishing Ground)	Total area Km^2	[3]Biomass (Tonne)	Tonne per Km^2	[4]3.4 Tonne per Km^2 per year	Gross Value (this is the sum of the biomass of each marine resources multiplied by its respective market price in a year)	Scenario A Gross Value based on 3.4 tonnes per Km^2 per year)	Scenario B Gross value based on [5]5% of marine resources to be harvested/ fished in a year	Scenario A Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario B Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario A Direct Economic Value per Km^2 Per year (Fiji$)	Scenario B Direct Economic Value per Km^2 Per year (Fiji $)
Qoliqoli 8 Vanua ko Yavuasuna and Voua comprising Cuvu, Yadua, Naevuevu, Rukurukulevu, Sosoinaviti, Voua, Semo, Emuri, Nadroumai and Nabau villages in the Districts of Cuvu and Tuva	3.91	738.46	188.86	13.29	3,522,579.01	264,975.10	176,128.95	16,603,119.33	1,761,148.91	4,246,322.08	450,421.72
Qoliqoli 9 Vanua Tabanivono-I-ra (Malomalo) comprising of Yavusa Leweisave, Leweinavivasa, Tabanivono, Leweinuku, Noi Lau and Leweivucini in the District of Malomalo	1.02	56.92	55.81	3.47	262,832.21	75,787.83	13,141.61	4,748,802.62	131,405.62	4,655,688.84	128,829.03

I qoliqoli (Customary Fishing Ground)	Total area Km^2	[3]Biomass (Tonne)	Tonne per Km^2	[4]3.4 Tonne per Km^2 per year	Gross Value (this is the sum of the biomass of each marine resources multiplied by its respective market price in a year)	Scenario A Gross Value based on 3.4 tonnes per Km^2 per year)	Scenario B Gross value based on [5]5% of marine resources to be harvested/ fished in a year	Scenario A Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario B Direct Economic Value (based on 99 years lease and on 10% discount rate) (Fiji $)	Scenario A Direct Economic Value per Km^2 Per year (Fiji$)	Scenario B Direct Economic Value per Km^2 Per year (Fiji $)
Qoliqoli 10 Vanua of Nasoqo comprising of Yavusa Ketenamasi, Leweitaqalulu, Tacini, Nalotawa and Leweiasiga in the District of Malolmalo	3	505.17	168.39	10.20	2,160,925.15	211,855.41	108,046.26	13,274,683.44	1,080,376.33	4,424,894.48	360,125.44
Qoliqoli 11 The Vanua of Komave comprising of Yavusa Vusu residing at Biausevu, Namatakula, Komave and Vusamaravu Villages	2.97	326.16	109.82	10.10	1,456,480.65	144,234.57	72,824.03	9,037,617.85	728,182.20	3,042,968.97	245,179.19

As indicated in Table 1 above the saleable asset (direct value) of marine resources in the various iqoliqoli in the coral coast range from F$178 to F$227,522.13 per Km^2 per year

Figure 5 **Iqoliqolis along the Coral Coast**



Source: Raines et al. 2005

There is a lack of studies on the economic value of coral reefs done in Fiji because there is not enough quality biological and socioeconomic data to actually compute a valid value (Sisto, 1999). Therefore a number of studies in other parts of the world were reviewed and the following are some summary of the relevant findings that can provide some insight as to what economic value of coral reef in Fiji would be.

De Groot (1992) estimated a Total Economic Value (TEV) for a coral reef system of the Galapagos Islands at US$120 a year for each hectare, which translates to a Net Present Value (NPV) of US$2,400 a hectare and US$2.8 billion for the entire system.

Gustavson (1998) estimated the Net Present Value (NPV) of tourism, fishing and coastal protection of Montego Bay, Jamaica at US$273 million to $US702 million. The area of the Marine Park is 1,530 hectares, implying a value of US$397,000 to US$1,020,000 for each hectare of protected area. For Indonesian coral reefs, Cesar (1996) estimated a NPV for fishing, tourism and coastal protection of US$1,373 to US$11,619 a hectare.

Costanza et al. (1998) made an estimate of TEVs for all the earth's ecosystems, based on considerable extrapolation from published studies, and these estimates need to be treated with caution. For coral reefs, Costanza et al. estimated a value of US$6,076 each year for each hectare.

The value of Florida Keys National Marine Sanctuary was valued in 1990 at US$50,000 a hectare NPV and at US$44.6 billion NPV in total (NOAA 1995).

Davis (2001) undertook an economic analysis of the Solitary Islands Marine Park in New South Wales and concluded that the park produced annual net benefits of A$5,746,700.

3.1.1.1.ii Commercial Tourism

A study of the Virgin Islands National Park in 1981, conducted by Posner, Cuthbertson et al, examined the direct economic costs and benefits associated with tourism and recreational use of the Virgin Islands National Park. Total costs of US$2.1 million, were offset by US$23.3 million a year (US$3.3 million direct benefits and US$20 million indirect benefits).

Gustavson (1998) has estimated the NPV of the value of recreation and tourism for Montego Bay coral reefs. The NPV was found to be US$315 million a year, based on 1996 data. This study included accommodation, food and beverage, entertainment, transportation, retail and miscellaneous services. Unlike other studies, the value of US$315 million is a net value, and, therefore, takes account of the costs of providing recreational goods and services, as well as direct expenditure. The total coral reef area within Montego Bay is estimated to be 42.65 hectares. Recreation and tourism are, therefore, worth approximately US$7.4 million a hectare of coral reef.

It is also possible to separate out the value of different components of tourism and recreation. For example, Dixon et al. (1992) estimated the value of dive-based tourism in the Bonaire Marine Park, located in the Caribbean Sea. This study found that gross revenue generated in 1991 was US$23.2 million, comprising expenditure on hotels, dive operations, air transport on the local airline and other purchases. This study also explored relationships between coral cover, species density and stress on sites used for diving to identify a function of damage versus diver numbers.

3.1.1.1.iii Recreation

Recreation values are often included with tourism values, although this may lead to an underestimate of recreation values of local communities.

The non-market valuation techniques called travel cost method was applied to estimate the value of recreation in the Great Barrier Reef. The net economic value for domestic and international tourists visiting the reef region was A$144 million a year, with net economic value for Australian visitors A$117.5 million, and for international visitors A$26.7 million. This figure includes all visitors to the reef region. It is worth noting that the net economic value for only those visitors that intended to see, or had seen, coral sites, was A$106 million a year.

The value of recreational services provided by Fiji coral reefs, lagoons and beaches, may be assessed on the basis of expenses undertaken by users. In 1994, visitors to Fiji brought in F$420 million in foreign exchange earnings (Lockhart, l998). How much of this should be attributed to the recreational services provided by coral reefs, lagoons and beaches depend partly on the motives bringing visitors to Fiji (Sisto, 1999).

Visitors coming to Fiji to visit family and friends, to attend school or undergo training cannot be said to be attracted to Fiji primarily because of the recreational opportunities provided by coral reefs, lagoons and beaches, although they might be enjoying those services incidentally (Sisto, 1999). Business travellers and conference participants, similarly, do not come to Fiji see to enjoy beach and water-based activities, although they might do so incidentally. It could, however, be argued that Fiji's pleasant environment is a reason why conferences are organised here in the first place. To be conservative, however, attention in this valuation exercise is restricted to holiday-makers who constituted 84 percent (Ministry of Tourism, Culture, Heritage and Civil Aviation, 2003) of the total number of visitors.

Data are available for visitor surveys on what percentage of visitors use coral reefs for various recreational activities. What is difficult to determine is what percent of visitor expenditure (in terms of days stayed or choosing to visit Fiji at all) is due to the availability of these activities. Based on Tourism data from the year 2003, the upper bound which include swimmers (64.8%), reef walkers (3.5%) and fishers (1.8%) comes to 70.1 percent in a given year. On the lower bound, assuming half of the scuba divers come specifically for this activity plus a small percentage of others might come to [6]15.5percent.

Hence the estimated economic value of tourist recreation would be the range between the lower and upper bounds. This would be 15.5% x 84% x $569million which is about F$74.08million annually or $171.20 per person per year and 70.1% x 84% x $569 which amounts to F$335.05 million annually or F$774.74 per visitor per year (per person for both recreation values are based on the total arrivals in 2003 of 430,800).

[6] This is assuming that some or even all reef walkers are also scuba divers

Table 3 Tourism Expenditure 2000-2003

Tourism Expenditure	2000 $F (M)	2001 $F (M)	2002 $F (M)	2003 $F (M)	Average for the 4 years $F (M)
Overseas Expenditure	362	445	522.4	569	474.60
Non- Organised Activities	13.34	17.29	22.6	21.84	18.77

Source: Ministry of Tourism, Culture, Heritage and Civil Aviation, 2003

Table 4 Overseas Tourists Undertaking Non-organised activities (%) in a Iqoliqoli

Non-Organised Activity	Proportion of Overseas Tourists Undertaking Non-organised activities [percent (%)]				Average for the 4 years (%)
	2000	2001	2002	2003	
Swimming	69	65	62	63	64.8
Snorkelling	59	57	61	65	60.5
Scuba diving	13	12	12	11	12.0
Reef walking	5	2	4	3	3.5
Kayaking/Canoeing/ Water sports	NA	6	4	8	NA
Fishing	2	1	2	2	1.8

Source: Ministry of Tourism, Culture, Heritage and Civil Aviation, 2003

Table 5 Proportion (%) of Overseas Visitors Undertaking Non-Organised Activities 1999-2003

Proportion (%) Of Overseas Visitors Undertaking Non-Organised Activities					
ACTIVITY	2003	2002	2001	2000	1999
	%	%	%	%	%
Swimming	63	62	65	69	74
Snorkelling	65	61	57	59	64
Fijian Meke	22	19	16	20	31
Taxi	21	24	19	22	20
Restaurant (outside resort)	17	19	16	18	17
Village Tour	18	17	11	12	15
Sailing	7	9	9	9	13
Watching Firewalking	11	10	8	6	13
Playing Golf	7	7	6	8	12
Scuba-diving	11	12	12	13	11
Playing tennis	6	7	6	6	10
Fishing (not big game)	8	8	8	7	8
Trekking/Bush walks	12	7	6	6	7
Kayaking/Canoeing/Water sports	8	4	6	N/A	N/A
Reef walks	3	4	2	5	5
Night Club/Disco	5	6	5	3	3
Horse riding	4	5	4	3	3
Parasailing, Jet Ski etc	5	5	3	N/A	N/A
Kava Ceremony	7	9	2	N/A	N/A
Lying on beach, Relaxing	17	2	2	N/A	N/A
Volleyball	2	3	2	N/A	N/A
Big game fishing	2	2	1	2	2
Garden of Sleeping Giant	2	2	2	1	2
Speedboat	1	0	1		1
Playing Bowls	1	1	1		1
Attending cinema/concert	2	2	2	1	1
Singing	5	2	1	N/A	N/A
Cruise, Boat Ride	1	1	1	N/A	N/A
Cultural Tours	2	4	1	1	1
Coral Coast Railway	*	1	1		1
Suva Gardens	1	1	1		
Bird watching	2	3	1		
Surfing	1	2	1	N/A	N/A
Other	53	35	6	13	N/A
NONE	6	7	11	13	N/A
TOTAL ACTIVITIES	363%	363%	298%	298%	315%

Others include: Reading 11%, Lovo 3%, Church Service 1%, Fish feeding 1%, Kulak Bird Park 2%, Coral viewing 1%, Massage 1%, Island hopping 1%, Bowls 1%, Wind surfing 1%, Kids Club 1%, Tour 1%, Bike riding, Table tennis, Dolphin watching, Fiji muso., Rugby, Dancing, Mini golf, Bus ride, Weaving, Gym, Squash, Football, FR visit, Sand dunes, Cycling, Crab race, Motorbike ride, School concert, Helicopter/Plane ride, Railway trip, Concert, Frog racing, Other.

Source: Ministry of Tourism, Culture, Heritage and Civil Aviation, 2003

3.1.1.2 Indirect Use Value

Due to the challenge involved in measuring indirect use values, such as the habitat function provided by coral reefs or mangroves, most existing indirect use valuations have focused on coastal protection. Here we will focus on coastal protection (which includes erosion prevention and disturbance regulation) and waste assimilation, as these are considered major benefits provided by the marine ecosystems in Fiji. Other important indirect use values, such as habitat and biological control, will be assessed in terms of impacts on fisheries.

Coral reefs provide protection to shorelines and human settlements from floods, storms and erosion. The economic value of this protection can be estimated either by valuing the cost of damage to land and homes, when the ecosystem is removed (*damage cost approach*), or valuing the cost of replacing the coral reef with protective infrastructure (*replacement cost approach*), or valuing the cost of averting damage to land and homes (*avertive expenditure approach*).

The coastal protection function of coral reefs was estimated at US$275,000 per km of shoreline per year (in 1994). According to Sisto (1999) coastal protection services of coral reefs were assessed by Costanza and co-authors (1997) at US$2,750 per ha per year. Zann and co-authors (1998) put the number of coral reefs in Fiji at 1,000, but provide no measure of their surface area, so the value presented by Costanza cannot be used directly.

3.1.2 Coral reefs Non-Use Values

3.1.2.1 Option values

Option values are not considered relevant to this study, as they typically apply to unique ecosystems (e.g. those with endemic species, or those containing the last remaining numbers of a particular species) which are in danger of being completely destroyed. This does not apply to Fiji, which has low endemism, and is not under threat of having all it's ecosystems of one type being destroyed.

3.1.2.2 *Existence values*

These refer to the value associated with the actual existence of an asset (e.g. ecosystem, cultural heritage) independent of one's use of the asset. For this reason, existence values are considered "non-use values". Valuation of existence values is a highly contested topic in environmental and resource economics, and benefit transfer exercises are not recommended at present (Adger et al, 2002). Furthermore, most existence valuation studies have been carried out in the US or other developed countries, and it is not considered viable to transfer such values to countries such as Fiji. In a summary of these developed-country values, Pearce (1993) indicates that non-use values for wild species range from US$12 to US$64 per person per year, and for wilderness areas range from US$9 to US$107 per person per year. Studies of existence values of marine resources are scant: Spash et al (2000) used the contingent valuation method to estimate non-use values associated with marine parks in Jamaica and Curacao, and found non-use values to come to US$2.08/yr per person (Curacao) and US$3.24/yr per person in Jamaica.

Constanza et al (1997) estimate an overall non-use value, which they term "cultural value" for coral reefs, which comes to a tiny US$100/km/yr (in 1994 US$). They provide no such value for mangroves. It is considered that this value is only indicative of the lack of studies undertaken in this area, and does not reflect the true non-use value associated with marine resources worldwide. It is not considered appropriate to use this value to obtain estimates for Fiji.

3.1.2.3 *Bequest values*

Bequest values represent the value attached to preserving an ecosystem for use by future generations, independent of one's own use of the ecosystem. These are considered of particular relevance in Fiji, given the importance that people attach to their way of life (Turner, 2000). The pilot study for the Navakavu

Valuation Project, coordinated by Tanya O' Garra, confirmed that bequest values were indeed very significant drivers of local preferences associated with protection of *iqoliqoli* ecosystems. For this reason, these must be considered an important value associated with *iqoliqolis* in Fiji.

There have been few studies to value bequest value. Hargreaves-Allen (2004) estimated the bequest value associated with coral reefs in the Wakatobi Marine Park in Sulawesi, using a CV survey. The bequest value was estimated at Rp 412,000 per km^2 or approximately US$412 per km^2 or US$4 per hectare (Present Value of Rp91 million or approximately US$91,000), a fifth of that associated with all the reef's benefits. More recent studies include: Ruijgrok (2006) and Togridou et al (2006). These have yet to be reviewed.

Valuation of bequest values would require a full contingent valuation survey. This involves a questionnaire in which respondents are asked for their 'willingness to pay' for a hypothetical scenario, in this case: the protection of their *iqoliqoli* for future generations (independent of one's own use of the *iqoliqoli*). Such a study is being carried out at present as part of the Tanya O' Garra's Navakavu Valuation study; however results are not yet available.

As noted previously, this valuation is only relevant for this project, if the *iqoliqoli* were to be destroyed, or if the lease were to have no expiry date. In this case, future generations would not be able to benefit from the *iqoliqoli,* and these losses would need to be taken into account. Otherwise, future generations will still be able to benefit from the *iqoliqoli*, and valuation of bequest values would be irrelevant.

3.2 Total Economic Value of Mangrove

3.2.1 Mangrove Use Values

3.2.1.1 Direct Use Value

For mangrove systems in Bintuni Bay, Indonesia, Ruitenbeek (1992) estimated a value of US$4800 a hectare and a total of US$961 to US$1,495 million for the entire system (quoted in Cartier & Ruitenbeek 1999). Only 15 percent to 35 percent of this amount is direct use value, so the majority of value is not usually identified as market values.

3.2.1.2 Indirect Use Value

Mangroves and coastal littoral vegetation provide protection to agricultural land and human settlements from floods, storms and erosion. The economic value of this protection can be estimated either by:

- valuing the cost of damage to land and homes, when the ecosystem is removed (*damage cost approach*); or
- valuing the cost of replacing the mangrove with protective infrastructure (*replacement cost approach*); or
- valuing the cost of averting damage to land and homes (*avertive expenditure approach*).

The coastal protection function mangroves were estimated at US$170,100 per km of shoreline per yr (in 1994 US$).

Mangroves and sea-grass beds have a waste assimilation function. They effectively process inadequately treated sewage and other waste, by absorbing excess nutrients, before this enters the sea (and affects fisheries and health).

Valuation of this function would be carried out using the *replacement cost approach*, by which the value of the mangrove and sea-grass bed waste assimilation function would be estimated as the value of the waste treatment system needed to replace it. Constanza et al. (1997) place the value of waste treatment function of mangroves at US$66,960/km /yr (in 1994 US$).

Given the short timescale for this project, a proper valuation will not be possible and values provided in Constanza et al (1997) will provide the most acceptable approximation. However, as noted with the coastal protection function, this valuation is only appropriate if there is to be any mangrove clearance. Otherwise, this function will continue to provide benefits to local communities.

3.2.2 Mangrove Non-Use Value

For this particular study non-use value of mangroves cannot be incorporated to the overall assessment of TEV. This is because first, there are very few studies conducted in most parts of the world specifically on the non-use values of mangroves. Hence, there was the data available was not adequate.

Mangrove option values are not considered relevant to this study, as they typically apply to unique ecosystems (e.g. those with endemic species, or those containing the last remaining numbers of a particular species) which are in danger of being completely destroyed. This does not apply to Fiji, which has low endemism, and is not under threat of having all it's ecosystems of one type being destroyed.

On the whole therefore, in terms of the TEV of mangrove the following are some key findings. An earlier study of mangroves in India estimated a TEV of over US$11,000 a hectare (Dixon 1989). Similar estimates of $US15,000, US$11,000 and US$13,000 a hectare were made for mangrove systems in Trinidad, Fiji and Puerto

Rico respectively, but these estimates may only include direct uses of fishing, forestry and tourism (Hamilton and Snedaker eds. quoted in Brown et al. 1993).

Padma Lal (1989) in her study on mangrove compensation in Fiji reported the economic value for compensating reclamation of mangroves in Fiji were as follows: for the Central Division is F$2,939 per hectare; F$217 per hectare in Western Division; and F$209 per hectare in the Northern division. This economic value was solely based on use values and non-use values were not accounted for. Hence it is thus important to note that this the main difference of the economic values reported by Padma and Brown et, al.

3.3 Total Economic Value of Beaches and Coastal Areas

Compared to the number of studies valuing the direct uses of coral reefs and mangroves (e.g. fisheries and tourism), there are very few studies valuing the coastal protection function of marine and coastal ecosystems, and most of these value the protective function of coral reefs in particular (see McKenzie et al, 2005; Gustavson, 2000; Cesar, 1996).

Constanza et al. (1997), estimates of the economic value of the world's ecosystems were assessed using a benefit transfer approach (for more information on benefits transfer see Bateman et al, 2002).

The mangrove and coral reef stated above were values used in Sisto (1998) to obtain estimates of the value of coastal protection provided by coral and mangroves in Fiji specifically. These values, however, should only be considered broadly indicative, as they were obtained by aggregating values from across the world. The coastal protection function of coral reefs and mangroves in Fiji would ideally be carried out as an independent exercise, using any of the valuation approaches outlines above, and the Constanza et al (1997) values simply used for comparison and validation. At present, there is a large-scale project at SOPAC (under Paula Holland) which is seeking to value the coastal protection function of marine ecosystems around the Pacific. This study would be a valid source of economic values.

In this particular study, economic valuation of the coastal protection functions will only be relevant in those cases where this function is threatened. This would only occur if the coral reef and/ or mangrove were to be destroyed. It is considered that destruction of the coral reef is highly unlikely (unless coral mining is to take place); however, the coastal protection function would be seriously compromised if mangrove clearance were to take place. In this case, valuation of this function would be warranted.

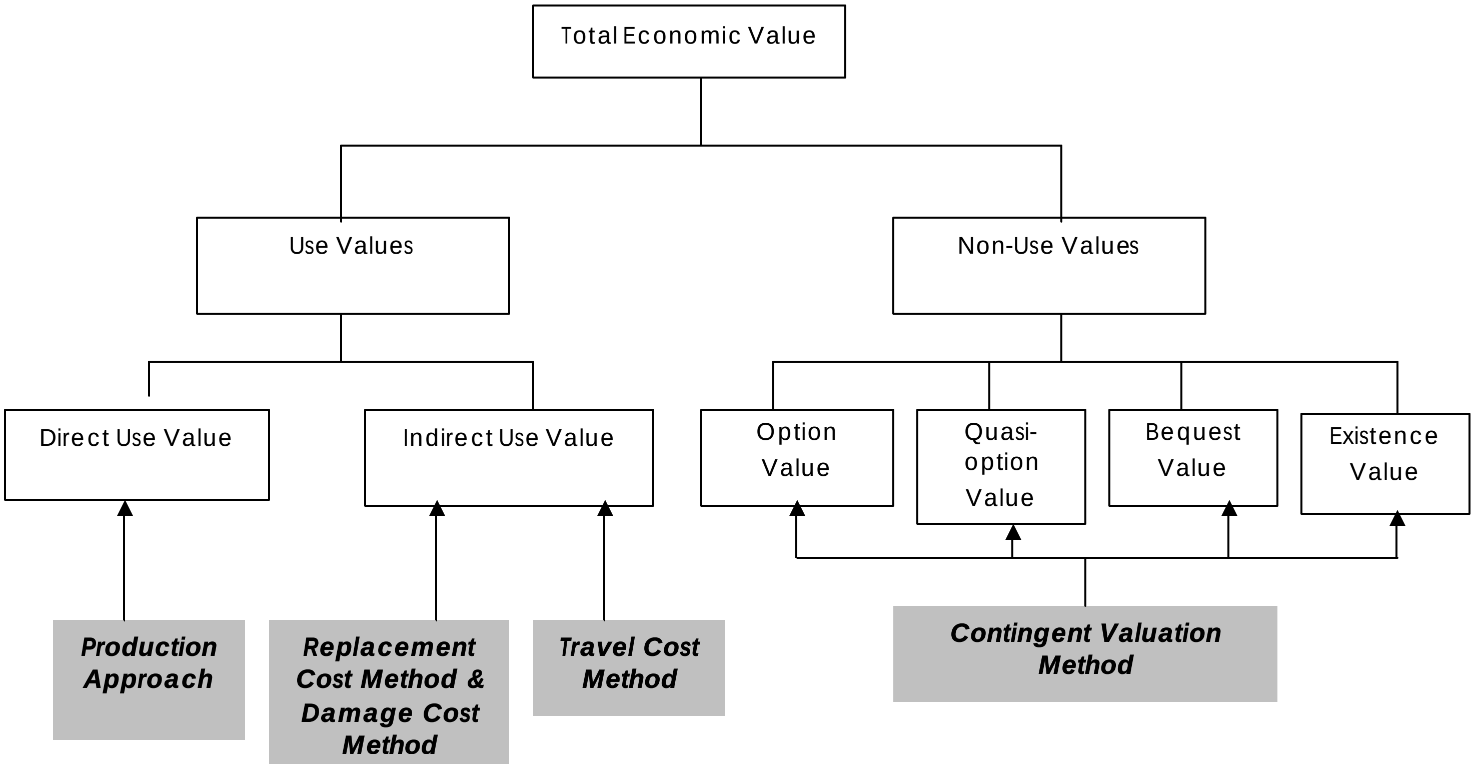
It was not possible within 2-month timescale to conduct a proper economic valuation for this study. If more funding is provided, a Fiji-specific study could be performed using estimates of the extent of coastal erosion in areas where there has been mangrove clearance, and value the land lost (using land lease prices).

3.4 Summary of Key Economic Valuation Methods Applied to Quantify TEV

In the coral reef and mangrove valuation literature reviewed above, these are the most frequently used methods.

- Production Approach - this based on observable changes in the market and market transactions.
- Travel Cost Method (TCM) – this is based on economic interpretations of behaviour; relating to travel and tourism. Real and hypothetical markets.
- Replacement Cost Method (RC) – this is the cost of replacing an ecosystem function if when system is unable to provide it (e.g. coastal protection);
- Damage Cost Method; and
- Contingent Valuation Method (CVM) this is based on hypothetical markets, can be used for use and non-use value or the expressions of value.

Figure 6



Total Economic Value
Use Values
Non-Use Values
Direct Use Value
Indirect Use Value
Option Value
Quasi-option Value
Bequest Value
Existence Value
Production Approach
Replacement Cost Method & Damage Cost Method
Travel Cost Method
Contingent Valuation Method

Table 6 Summary of the Key Findings from Literature Review and Data Gathered from Primary and Secondary Sources

Total Economic Value Components	Valuation Method	Key iqoliqoli Biophysical system that provide important goods or services			Data Collection	Economic Value Findings as relates to Fiji
		Coral reef	Foreshore/ lagoon	Mangrove		
Direct extractive use						
Fin-fisheries (commercial)	Production approach	x	x	x	Primary data from Coral Cay Conservation Study and surveys from fishing market outlets	Direct use value of coral reef resources in the various iqoliqoli in the Coral Coast based on two scenarios of MSY range from F$3,001,422.02 to F$8,025,022.29 in scenario A and F$75,723.07 to F$547,998.90 per Km^2 per year Direct use value of mangrove is about US$11,000 a hectare. (Hamilton and Snedaker eds. quoted in Brown et al. 1993).
Fin-fisheries (subsistence)		x	x	x		
Other fisheries e.g. shellfish (commercial)		x	x			
Other fisheries e.g. shellfish (subsistence)		x	x	x		
Other food (e.g. seaweed)			x			
Timber/ firewood (commercial)				x		
Timber/ firewood (subsistence, local use)				x		
Non Timber Forest Products (e.g. medicines, dyes)				x		
Direct non-extractive use						
Tourism/ recreation	Production approach	x	x		Secondary data from the Ministry of Tourism and questionnaire responses from Resorts	F$74.08 million to F$335.05a year, or F$171.20 to F$777.74 per visitor (based on 2003 data).
				x		
		x	X	x		
Indirect use						
Coastal/ shoreline protection	Replacement Cost & Damage Cost Method	x		x	Secondary data from the Literature review specifically similar studies in other parts of the world	According to Sisto (1999) disturbance regulation of coral reef and mangrove in Fiji are F$307.2 million and F$105 million
Waste assimilation		x		x		
Maintenance of biodiversity		x	X	x		

Total Economic Value Components	Valuation Method	Key iqoliqoli Biophysical system that provide important goods or services			Data Collection	Economic Value Findings as relates to Fiji
		Coral reef	Foreshore/ lagoon	Mangrove		
Support for other key habitats & species		x	X	x		respectively
Non-use values (independent of use)						
Bequest value	Contingency Valuation	x	X	x	Secondary data from the Literature review specifically similar studies in other parts of the world	Cannot be calculated because of inadequate information and data as well as time constraint in relation to this specific study
Existence value		x	X	x		
Option & values		x	X	x		
quasi-option		x	X	x		

4 Discussion and Conclusion

The eleven iqoliqoli along the Coral Coast indicate saleable assets (fish and invertebrates) or its direct use value based on two scenarios of MSY ranged from F$3,001,422.02 to F$8,025,022.29 in scenario A (or F$30,014.22 to F$80,250.02 per hectare per year) and F$75,723.07 to F$547,998.90 per Km^2 per year in scenario B (or F$757.23 to F$5,480 per hectare per year).

The coral reef system as reported by various studies elsewhere has a saleable and economic value which include tangible and intangible between the range of US$1,373 per hectare to US$1.02 million per hectare. As indicated in saleable assets of vertebrates and invertebrates along the Coral Coast the saleable value of coral reef system will be determined on the quality of health of reef system and the abundance of marine resources in given site or iqoliqoli. For this reason the biophysical condition of a coral reef system can only be assess through a proper biological and ecological baseline assessment.

The most logical way to value the use of marine resources and ecosystem by tourists is to use the proportion of holiday maker's expenditure in the following non-organised activities namely swimming, snorkelling, scuba diving, reef walking and kayaking/ canoeing/ water sports fishing. These non-organised activities are referred as recreational activities. These are estimated to be F$177.20 to F$777.74 per visitor per year.

Based on numerous other economic valuation studies, the direct use values from the fisheries and tourism are much higher than non-use values (as long as the coral reef and related ecosystem or habitats are not destroyed) and these can be used as a basis for compensation valuation.

5 Recommendation

There is a real need to conduct in-depth economic valuation studies on the indirect use values, option values, existence values and bequest values of coral reef and related ecosystems in order to fully capture the TEV of iqoliqoli. This can only be done if reliable and relevant biological and socioeconomic data are available.

TEV and its corresponding non-market valuation approaches and methods is a good basis of facilitating an objective and systematic compensation procedure of the *iqoliqoli*. However, it is also crucial that other considerations such the present goodwill payments and non-monetary benefit should be included in the formulation of a compensation formula.

The key tourism economic valuation component requires a visitor survey to determine how the iqoliqoli health determines visitor destinations and deciding to come to Fiji.

Most of the current compensation claims are based on a percentage of the resort's profit. Other benefits such as employment etc. are recognised as "goodwill payments." For this reason and based on some responses from resort owners Figure 7 s a proposed compensation framework if the current Qoliqoli Bill (in its original form) is passed in the Fiji parliament. Figure 8 are the key requirements to a compensation process.

Figure 7 Proposed compensation framework if the current Qoliqoli Bill (in its original form)is passed in the Fiji parliament

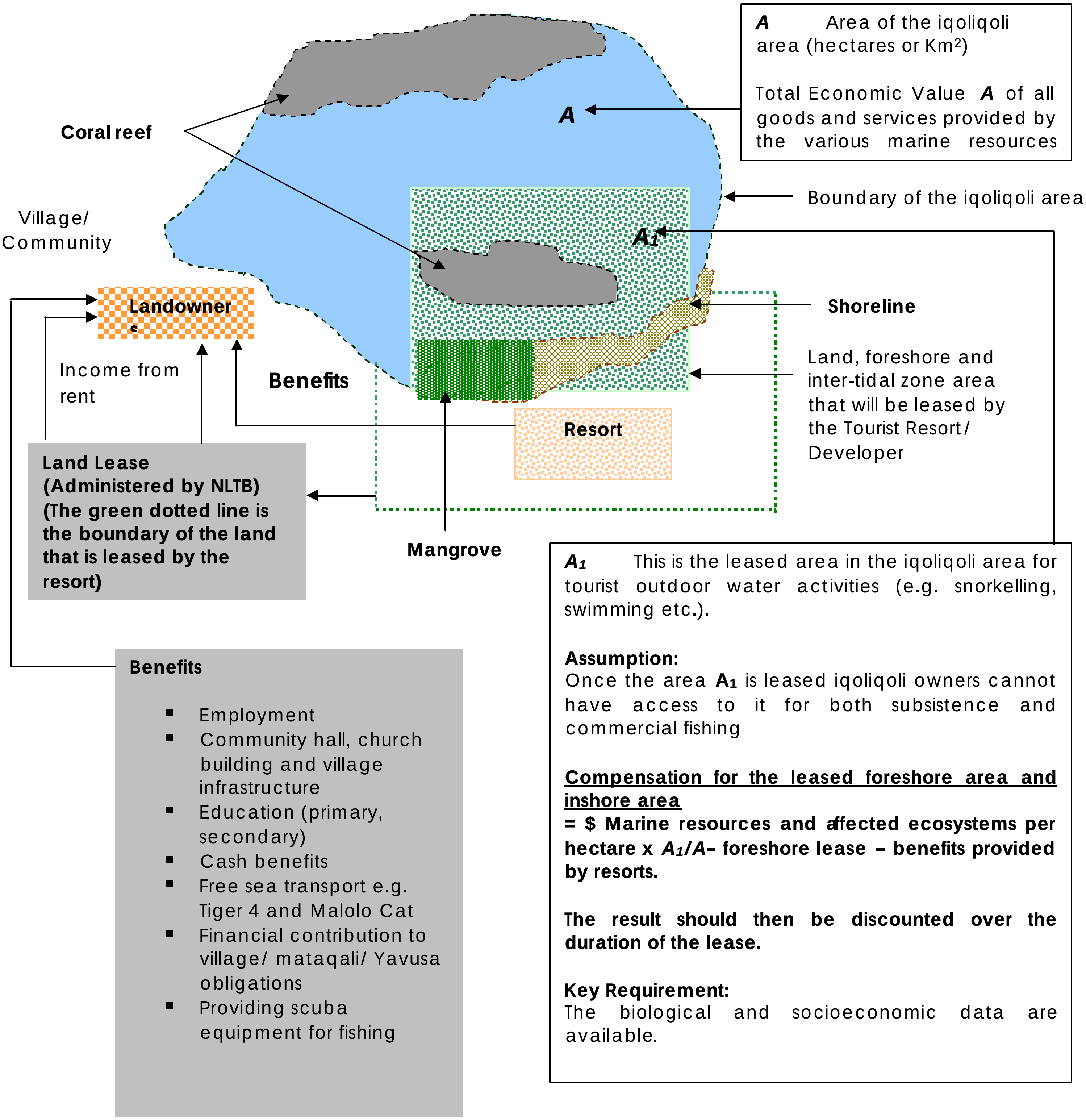
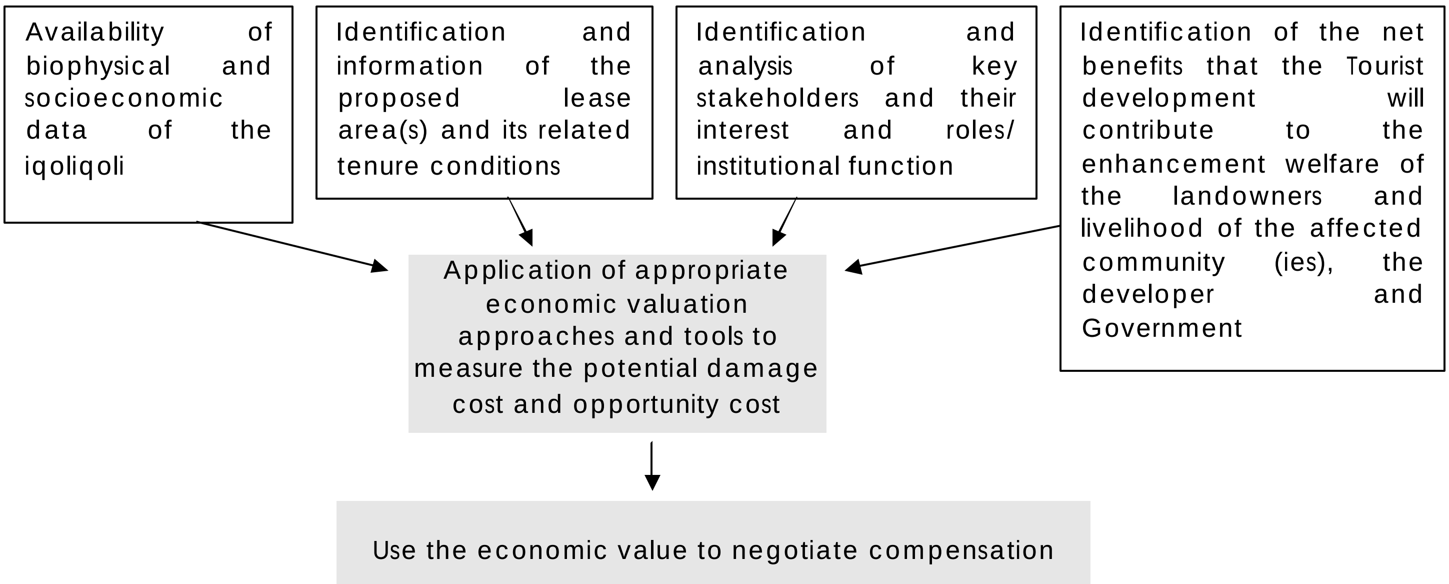


Figure 8 Key requirements for compensation



References

Adger et al (2002) 'Tropical forest values in Mexico', in *Valuing the Environment in Developing Countries,* David Pearce, Corin Pearce and Charles Palmer (editors), Edward Elgar: Cheltenham, UK

Bateman, I., Carson, R.T., Day, B., Hanemann, M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S., Ozdemiroglu, E., Pearce, D.W., Sugden, R., and Swanson, J., (2002) *Economic Valuation with Stated Preference Techniques: A Manual*, Edward Elgar: Cheltenham, UK.

Brown, K., Pearce, D., Perrings, C. and Swanson, T. (1993) *Economics and the Conservation of Global Biodiversity, Working Paper No. 2*, Global Environment Facility, Washington D.C.

Cesar H (1996) *Economic Analysis of Indonesian Coral Reefs*. The World Bank, Washington DC.

Cesar H and Chong CK (2004) 'Economic Valuation and Socioeconomics of Coral Reefs: Methodological issues and three case studies', p14-40 in Ahmed M, Chong CK and Cesar, H. (Eds) *Economic Valuation and Policy Priorities for Sustainable management of coral reef,* WorldFish Centre Conference Proceedings 70

Constanza R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Naeem, S., Limburg, K., Paruelo, J., O'Neill, R.V., Raskin, R., Sutton, P. and Van den Belt, M. (1997) 'The value of the world's ecosystem services and natural capital', *Nature,* 387, 253-260

de Groot, R.S. (1992) Functions of nature: evaluation of nature in environmental planning, management and decision making, Wolters-Noordhoff. (Reported in Cartier and Ruitenbeck 1999).

Dixon, J.A., Scura, L.F. and van't Hof T. (1992) Meeting Ecological and Economic Goals: The case of Marine Parks in the Caribbean (Publisher unknown).

Emerton, L., 1999. Economic tools for the management of marine protected areas in eastern Africa. IUCN World Conservation Union, Nairobi.

Gustavson K. (2000) 'Values Associated with the Local Use of the Montego Bay Marine Park', in Gustavson, K., Huber, R.M. and Ruitenbeek, J. (eds) Integrated Coastal Zone Management of Coral Reefs: Decision Support Modelling, Report for the World Bank, Washington D.C, U.S.

Hargreaves-Allen, V. (2004) 'Estimating the Total Economic Value of Coral Reefs for Residents of Sampela, a Bajau Community in Wakatobi Marine National, Sulawesi. A Case Study', MSc Thesis, Imperial College London: UK

Jennings, S and Polunin N.V.C., (1995) Comparative size and composition of yield from six Fijian reef fisheries. *Journal of applied ecology*, Vol. 46: 28-46.

Jennings, S and Polunin N.V.C., (1996) Effects of fishing effort and catch rate upon the structure and biomass of Fijian reef fish communities. *Journal of applied ecology*, Vol. 33: 400-412.

Lal, P. N. (1989) 'Report on the Mangrove Re-compensation System in Fiji,' Fiji Government, Fiji

Lal, P.N. (1990) 'Conservation or Conversion on Mangroves in Fiji: An Ecological Economic Analysis,' Environment and Policy Institute East-West Centre, Occasional Paper No. 11, Hawaii

Lal, P.N and Cerelala, A. (2005) 'Financial and Economic Analysis of Wild Harvest and Cultured Live Coral and Rock in Fiji,' Foundation of the Peoples of the South Pacific International (FSPI), South Pacific Regional Environment Programme (SPREP), Government of Fiji.

Laws of Fiji, Act [Cap 158], Chapter 158, Fisheries. Government of Fiji.

McKenzie, E., Woodruff, A. and McClennen, C. (2005) 'Economic Assessment of the True Costs of Aggregate Mining in Majuro Atoll, Marshall Islands', SOPAC Technical Report, December 2005

Ministry of Agriculture, Forests and Fisheries, (1993) *Annual Report 1992. Fiji Fisheries Division*. Fiji Government

Ministry of Agriculture, Forests and Fisheries, (1999) *Annual Report 1998. Fiji Fisheries Division*. Fiji Government.

Ministry of Forests and Fisheries, (2002) *Annual Report 2001. Fiji Fisheries Department* . Fiji Government.

Ministry of Forests and Fisheries, (2005) *Annual Report 2004. Fiji Fisheries Department*. Fiji Government.

Ministry of Tourism, Culture, Heritage and Civil Aviation, (2001) *2000 Fiji International Visitor Survey Summary Report*, Stollznow Research, Government of Fiji

Ministry of Tourism, Culture, Heritage and Civil Aviation, (2002). *2001 Fiji International Visitor Survey Summary Report*, Stollznow Research, Government of Fiji

Ministry of Tourism, Culture, Heritage and Civil Aviation, (2003). *2002 Fiji International Visitor Survey Summary Report*, Stollznow Research, Government of Fiji

Ministry of Tourism, Culture, Heritage and Civil Aviation, (2004). *2003 Fiji International Visitor Survey Summary Report*, Stollznow Research, Government of Fiji

Pearce, D. (1993) *Economic Values and the Natural World,* Earthscan: London, UK

Posner, B. Cutherbertson, C et al. (1981) *Economic Impact Analysis of Virgin Islands National Park*, Great Barrier Reef Marine Park Authority, Townsville.
Qoliqoli Bill, No. 12. Government of Fiji.

Raines, P., Comley, J. and Rowlands, G. (2005) *The Coral Coast, Viti Levu, Fiji. A Marine Resource Assessment*. Coral Cay Conservation, Ministry of Tourism, Culture and Heritage and Civil Aviation, Fiji

Ruijgrok, E.C.M. (2006) 'The three economic values of cultural heritage: a case study in the Netherlands', *Journal of Cultural Heritage*, 7, 206–213

Spash, C., ten Bosch, J.D.W., Westmacott, S. and Ruitenbeek, J. (2000) 'Lexicographic preferences and the contingent valuation of coral reef biodiversity in Curacao and Jamaica', in Gustavson, K., Huber, R.M. and Ruitenbeek, J. (eds) Integrated Coastal Zone Management of Coral Reefs: Decision Support Modeling, Report for the World Bank, Washintgon D.C.:U.S.

Sisto, N. (1999) 'The economic valuation of Fiji's major natural ecosystems', The Journal of Pacific Studies, Vol. 23, 1, 71-90

Spurgeon, J.P.G., (1992) The Economic Valuation of Coral Reefs. *Marine Pollution Bulletin* 24 (11): 529-536.

Spurgeon, J.P.G., (1998) The Socio-economic Costs and Benefits of Coastal Habitat Rehabilitation and Creation. *Marine Pollution Bulletin* 37 (8-12): 373-382.

Togridou, A., Howardas, T. and Pantis, J.D. (2006) 'Determinants of visitors' willingness to pay for the National Marine Park of Zakynthos, Greece', *Ecological Economics,* (in press)

Turner, R.K. (2000) 'The place of economic values in environmental valuation', In: Bateman, I.J., Willis, K.G. (Eds.), *Valuing Environmental Preferences*, Oxford University Press, Oxford

ANNEX 1 QOLIQOLI AND TOURISM ECONOMIC VALUATION PROJECT QUESTIONNAIRE

Background

1. Name of hotel/ resort:
2. Year of establishment of hotel:
3. Qoliqoli owner (village nearby):
4. Landowner:

Water-sports Activities

5. What are the recreational activities or water sports that your hotel offers to your guest and how much does a guest has to pay for each of these activities?

(Please tick existing activities and specify cost)

Recreational activities	Please tick here	Fee for single in F$				Number of Tourist			
		02	03	04	05	02	03	04	05
Dive trip									
Snorkeling									
Surfing									
Wind surfing									
Game fishing									
Sport fishing									
Sunset cruise									
Beach picnic									
Kayaking									
Banana boat cruise									
Glass-bottom boat fish watch									
Shark feeding watch									
Others *(please specify)*									

6. *Please fill the table below*

	2002	2003	2004	2005
What was the total number of guests that stayed in your hotel over these periods				
What was the total number of guest or percentage that used the *i qoliqoli* for recreational activities				
What is the occupancy rate of your hotel				

7. What are some other services that your hotel use from the *i qoliqoli* (e.g. fishing for food for the guest or staff etc.)

Lease and Benefits

8. What is the current lease arrangement (including actual amount paid annually and to who) and what does your hotel offers to resource owners in term of goodwill payments (is it a one off payment or paid annually and how much) and other benefits (e.g. scholarship, employment at what level etc.). Please detail information

9. What are the conditions outlined for the foreshore lease and land lease, in terms of duration, exclusivity and access rights both for the resource owners and your hotel.

VINAKA VAKALEVU FOR YOUR TIME AND EFFORT!!!