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# The Journal of Pacific Studies

*Volume 36 Issue 2, 2016*

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## **Impacts of Total Factor Productivity on Agricultural Growth in Pacific Island Countries**

*Hong Chen, Biman Chand Prasad & Baljeet Singh*

### **ABSTRACT**

*The agriculture sector plays an important role in small Pacific Island economies and has significant impacts on the livelihood of households. However, total agricultural production and productivity in these economies are generally low. This, together with limited sources of factor inputs, calls for improving technical efficiency and technology to enhance agriculture production. Based on the Malmquist index approach, this study computes growth of total factor productivity and its components, namely, pure technical efficiency growth, scale efficiency growth and technological growth for the agriculture sector of 15 Pacific Island countries over 1980-2012. Impacts of these productivity growth measures are further quantified by estimating panel data regression models using the generalized method of moments estimators. There is sufficient statistical evidence that agriculture's total factor productivity growth and its components, which though are slow in Pacific Island countries, contribute significantly to these small economies' agricultural growth.*

**Keywords:** *Agriculture, productivity, growth*

## **INTRODUCTION**

The role of the agriculture sector in Pacific Island countries (PICs) cannot be over emphasized. In the case of Papua New Guinea and the Solomon Islands, agriculture contributes around 35-40 per cent to GDP, whereas in Samoa, Tonga, Fiji and Vanuatu, agriculture's contribution to GDP lies between 12-20 per cent. Agriculture also provides income and a means of livelihood to around 50-70 per cent of the total population and remains an important foreign exchange earner for countries in the region.

However, factors such as limited productive agricultural land, rapid population growth in most of PICs and the current wave of trade liberalization (i.e., removal or elimination of subsidies, tariffs and non-tariff barriers to trade) require these countries to improve efficiency and competitiveness of the agriculture sector. An increased productivity and production of the agriculture sector will improve food security, employment creation and enhance living standards of the people in the region. In addition, efficient agricultural production is important for growth and development of other sectors such as the tourism industry. Enhanced productivity will also improve trade performance of PICs. PICs are also experiencing increasing levels of urbanisation and improving agriculture productivity is vital for feeding the growing urban population.

In this context, for better agricultural policy, it is imperative; (i) to measure and decompose total factor productivity (TFP) and (ii) to examine the impacts of TFP and its components, namely, technical efficiency and technology, on the growth of agriculture production. Decomposition of TFP into technical efficiency and technological progress can provide insight to policy makers with respect to technological progress in the agriculture sector and how efficiently this sector is using its endowment.

Therefore, the main purpose of this study is to identify the contribution of TFP to production growth in the agriculture sector of small Pacific Island countries. The sample in this study covers 15 PICs, namely, Cook Islands, Fiji, French Polynesia, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, New Caledonia, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu over the period 1980-2012. The non-parametric data envelopment analysis (DEA) approach is used to compute the Malmquist indices which form the measures of TFP and its components. Contribution of agricultural production efficiency and technical progress in the agriculture sector is estimated by a panel regression model using the generalized method of moments estimators. From a policy-making point of view, this study is novel in that it is the first study that examines TFP and its components' impacts on the growth of agriculture production in PICs.

The rest of the paper is organized as follows: Section 2 gives a brief overview of the agriculture sector in Pacific Island countries; Section 3 presents a brief literature review; Section 4 describes methodology and data which are used to compute productivity measures, followed by the presentation of computed productivity measures; Section 5 quantifies impacts of agricultural productivity growth on agricultural production growth in PICs; and Section 6 provides conclusion and policy recommendations.

## **OVERVIEW OF THE AGRICULTURE SECTOR IN PACIFIC ISLAND COUNTRIES**

There is reasonable diversity in the agriculture sector among the South Pacific Island countries. The large Melanesian countries (Fiji, Papua New Guinea, Vanuatu and Solomon Islands) own some of the best natural resources in the region. Except Fiji, all other Melanesian countries are agrarian societies heavily dependent on agriculture as a source of income and livelihood, while they also experience a very high population growth rate.

The Fijian economy has become reasonably diversified since the 1970s, and accordingly agriculture's contribution to total GDP declined from 24 per cent in 1970 to 12 per cent in 2010. Yet, agriculture remains a significant contributor to Fiji's economy in terms of its importance to the informal sector in this country. Nevertheless, Fiji's agriculture sector which experienced one of the strongest growths in the 1980's performed poorly over the last two decades. Growth of agricultural production was 4.3 per cent in the period 1980-1990 and thereafter, it experienced negative growth rates of 0.28 and 1.8 per cent in the periods 1991-2000 and 2001-2010 respectively. The strong performance in the early period can be attributed to the strong performance of the sugar industry, government support provided to the agriculture sector and the relatively stable domestic economic environment. The rice production in Fiji increased from 17846 tonnes in 1980 to 31827 in 1989 when it achieved 66 per cent self-sufficiency and thereafter, it gradually declined (Prasad and Narayan, 2005). The average rice production in the period 1980-1990 was 23567 tonnes per annum, but it declined to 18000 and 13107 tonnes over 1991-2000 and 2001-2010 respectively, mainly due to the withdrawal of government support and the non-renewal of some of the land leases by landowners in the later period. A similar decline was also noticed in meat, coconut and milk production, which declined by 3, 1.8 and 0.25 per cent per annum respectively in the period 1990-2000. These industries experienced a moderate positive growth rate in the period 2001-2010; however, any such gain was offset by a huge decline in the sugar industry due to the expiry of land leases and gradual removal of preferential prices.

Unlike Fiji, other Melanesian countries generally experienced a positive agricultural growth rate over all periods, except for Vanuatu which had a slight negative growth rate in the period 1991-2000. Papua New Guinea, which is the largest of all Melanesian countries in terms of population and natural resources, experienced positive agricultural growth rates of 1.8, 2.98 and 1.95 per cent per annum over the periods 1980-1990, 1991-2000 and 2001-2010 respectively. A similar trend was also experienced by the Solomon Islands which achieved increasing positive growth rates of 1.25, 2.37 and 4.1 per cent over the same three periods respectively. Vanuatu experienced a positive growth rate of 3.6 per cent per annum in the period 1980-1990, then a negative growth rate of 0.85 per cent in 1991-2000, before experiencing a positive growth rate of 1.79 per cent per annum in the period 2001-2010.

Out of the two Polynesian countries, Samoa experienced a negative growth rate of 1.8 per cent in the period 1980-1990 and thereafter, it managed to achieve increasing positive growth rates of 0.39 and 3.1 in the periods 1991-2000 and 2001-2010 respectively. Similarly, Tonga experienced a negative growth rate of 3.1 per cent per annum in 1980-1990, then positive growth rates of 1.78 and 1.28 per cent per annum over the periods 1991-2000 and 2001-2010 respectively.



While most of the countries under study have made some progress in agriculture output growth, there is a lack of innovation in terms of producing new crops, commodities and processing. Also, due to the lack of genetic diversity, many agricultural commodities are extremely vulnerable to biotic and abiotic stresses, and generally fail to produce desired results when under stress (Singh, Ghodake and Quartermain, 2007).

Poorly defined property rights, particularly those relating to land, are also seen as a major hindrance to any innovative investment in the agriculture sector. Except for Fiji, about 80-90 per cent of land in the region is customarily owned and cannot be easily accessed by outside developers. Moreover, over the last two decades political instability has negatively contributed to agricultural growth in the Melanesian countries (Duncan and Chand, 2002). There was a significant decline in the availability of agricultural labour in Samoa and Tonga over the last two decades. In addition, poor rural infrastructure is a major constraint to agriculture development (Manning, 2007).

## **LITERATURE REVIEW**

There are a number of studies which attempt to analyse and decompose agricultural productivity in developed and developing countries. These studies found mixed evidence of total factor productivity progress, and factors contributing to TFP progress/regress varied across studies. For instance, Mugeru and Ojede (2014) examined technical efficiency in African agriculture using recent advances in bootstrap DEA over the period 1966-2001. The study found evidence of technical inefficiency in the cases of many African countries, and in fact, technical efficiency declined over the period under study.

Tipi and Rehber (2006) examined the technical efficiency and total factor productivity in agriculture for South Marmara region of Turkey within a data envelopment analysis framework during the period 1993-2002. The study found evidence of total factor productivity progress, and technical efficiency was driving TFP progress. Swinnen and Vrankan (2010) examined the effect of reform on agricultural productivity in Central and Eastern Europe and Former Soviet Republics for 1989-2005 within a data envelopment analysis framework. The study found all countries experienced a decline in total factor productivity in the initial stage of the transition, and then a productivity progress in the later stage. There was some observed variation in the length and depth of productivity regress and progress across the countries. Rezitis (2010) investigated agricultural productivity and convergence for European countries and the United States using the Window Malmquist index for 1973-1993. The study found evidence of TFP progress across these countries; however, there was a wide variation of total factor productivity progress in the agriculture sector across the countries. The study further found evidence of  $\beta$ -convergence and absence of  $\sigma$ -convergence. Ajetomobi and Odeniyi (2011) used a non-parametric analysis approach and examined productivity growth in the Economic Community of West African States (ECOWAS) agriculture sector during 1971-2007. The study, however, found that generally there was a decline in TFP over the whole period with fluctuations. Chen et al. (2008) examined the total factor productivity growth in China's agriculture sector using the Malmquist index and sequential technologies. Using the province level data, the study found that total factor

productivity increased by 1.5 per cent annually and it was driven by technical progress. Further analysis revealed that technical progress was driven by tax cuts, public investment on research and development, infrastructure, and mechanisation.

In some of the earlier studies, Nin, Arndt and Preckel (2003) examined agriculture productivity in developing countries using a modified nonparametric approach. The study found that most of the countries under study experienced a positive productivity growth over the period under study, and that it was mainly driven by technical change.

## COMPUTATION OF PRODUCTIVITY MEASURES

An investigation of impacts of productivity growth requires a quantification of productivity. Productivity in this study refers to total factor productivity, which includes pure technical efficiency, scale efficiency, and technology. The first part of this section describes briefly the method to be used to quantify productivity measures, followed by a description of data required for such quantification. The third part presents the computed growth rates of total factor productivity and its components.

### THE MALMQUIST INDICES

The construction of the Malmquist index is based on the non-parametric data envelopment analysis of the frontier production function, which is widely used in the literature on productivity. According to pioneering studies such as Caves *et al.* (1982) and Färe *et al.* (1994), for each time period  $t = 1, 2, \dots, T$ , the production technology  $F^t$  models the transformation of inputs,  $x^t \in R_+^N$ , into outputs,  $y^t \in R_+^M$ , i.e.,  $F^t = \{x^t, y^t\} : x^t \text{ can produce } y^t\}$ .

The output distance functions are defined as

$$(1) \quad D_o^t(x^t, y^t) = \inf\{\theta : (x^t, y^t/\theta) \in F^t\} = (\sup\{\theta : (x^t, \theta y^t) \in F^t\})^{-1}$$

where  $\theta$  measures technical efficiency. Thus the distance functions are the reciprocal of the ‘maximum’ proportional expansion of the output vector  $y^t$ , given inputs  $x^t$ . They completely characterize the technology. In particular, note that  $D_o^t(x^t, y^t) \leq 1$ , if and only if  $(x^t, y^t) \in F^t$ . In addition,  $D_o^t(x^t, y^t) = 1$ , if and only if  $(x^t, y^t)$  is on the boundary or frontier of technology. A similar definition is given by  $D_o^{t+1}(x^{t+1}, y^{t+1})$ , the distance at period  $t + 1$  relative to the technology at  $t + 1$ .

Färe *et al.* (1994) specify the output-based Malmquist productivity change index as follows:

$$(2) \quad M_o(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)} \cdot \left[ \left( \frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})} \right) \left( \frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

The ratio outside the brackets measures an economy’s efficiency relative to the best performer’s efficiency (that is, the change in the distance of observed production from maximum potential production) and therefore, captures the ‘catching-up’ progress to the frontier. We denote

efficiency index by *EFF*. The geometric mean of the two ratios inside the brackets measures technology level relative to the best performer's technology level. We denote technology index by *TECH*. TFP index is the product of efficiency and technology measures ( $TFP = EFF \cdot TECH$ ).

All three indices will be measured compared to value 1. A Malmquist index greater than 1 represents improvements in TFP, while an index of less than 1 signals deterioration in TFP performance. Improvements in any of the components are also associated with component indices greater than 1 and deterioration is associated with component indices of less than 1. Annual growth rates of TFP and its elementary components (denoted by *TFPG*, *EFFG* and *TECHG*) can be obtained by subtracting the corresponding Malmquist index by 1:

$$(3) \quad TFPG = (TFP - 1) \cdot 100$$

$$(4) \quad EFFG = (EFF - 1) \cdot 100$$

$$(5) \quad TECHG = (TECH - 1) \cdot 100$$

Following Krüger (2003), relative levels of efficiency, technology and TFP can be obtained accordingly:

$$(7) \quad CUMEFF_k^{t+N} = D_k^t(x_k^t, y_k^t) \cdot \prod_{t+1}^{t+N} EC_k^{t+N}$$

$$(8) \quad CUMTECH_k^{t+N} = D_k^t(x_k^t, y_k^t) \cdot \prod_{t+1}^{t+N} TC_k^{t+N}$$

$$CUMTFP_k^{t+N} = D_k^t(x_k^t, y_k^t) \cdot \prod_{t+1}^{t+N} TFC_k^{t+N}$$

The Malmquist indices are widely used in the measurement of productivity since Färe et al. (1994) applied the DEA approach in computation of distance functions to form the Malmquist indices. Moreover, studies such as Lovell (1996) found that the Malmquist indices provide more satisfactory reorientation towards productivity measurement compared to parametric-stochastic frontier analysis. Another advantage of the DEA approach is that it allows further decomposition of TFP into technical efficiency and technology. This decomposition is important as it helps to quantify sources of productivity and evaluate the effect of productivity sources on production growth.

## DATA

The sample for the current analysis covers 15 Pacific Island countries (Cook Islands, Fiji, French Polynesia, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, New Caledonia, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu) over 1980-

2012. The series required for computing the Malmquist indices include:

Net production value in agriculture (constant 2004-2006, USD million);

Net capital stock in agriculture (constant 2005 prices, US\$ million). This series includes data on land development, livestock (fixed assets), livestock (inventory), machinery & equipment, plantation crops, and structures for livestock;

Total economically active population in agriculture (estimated & projected, unit: 1000 persons); and

Arable land (unit: Ha).

These four series' data are obtained from the database of Food and Agriculture Organization (FAO) of the United Nations.

There are some missing values in this database, which are handled as follows. Firstly, missing values in the total economically active population in agriculture for Marshall Islands, Micronesia (Federated States of) and Tuvalu are estimated by means of multiple imputation using data on total population at the country level. Secondly, the missing values in net production are interpolated based on a log-linear relationship between net production and economically active population in agriculture. Thirdly, two linear relationships (between arable land and economically active population, and between arable land and agriculture production) are used in the interpolation of arable land, and missing values in arable land are the average of two interpolated values. Lastly, two log-linear relationships (between net capital stock and net production, and between capital stock and economically active population in agriculture) are used in the interpolation of net capital stock, and missing values in net capital stock are the average of two interpolated values. The country level data are summarized in Table 1.

**TABLE 1:** *Agriculture production, capital stock and population by country over 1980-2012*

Country	Net Production Value (constant 2004-2006 prices, USD million)				Net capital stock (constant 2005 prices, USD million)			
	1980-1990	1991-2000	2001-2006	2007-2012	1980-1990	1991-2000	2001-2006	2007-2012
Cook Islands	6.8	4.5	3.0	2.4	23.3	18.3	8.1	7.7
Fiji	215.4	228.1	221.2	203.7	798.9	974.2	977.8	676.0
French Polynesia	21.2	20.5	23.0	24.6	86.1	87.6	88.4	87.9
Kiribati	15.3	16.1	20.2	26.7	223.4	210.8	197.0	241.2
Marshall Islands	2.2	3.0	2.2	4.1	21.7	26.9	30.7	32.1
Micronesia (Fed.State of)	19.9	12.5	10.8	10.9	128.6	83.8	76.0	90.5
Nauru	0.4	0.6	0.6	0.6	10.3	14.2	14.0	16.1
New Caledonia	18.3	20.9	22.5	22.5	571.0	596.7	577.8	345.8
Palau	2.3	2.8	3.5	2.6	5.2	5.3	6.7	4.7
Papua New Guinea	1516.9	1911.5	2279.2	2676.0	1802.5	2114.7	2370.9	2388.7
Samoa	52.7	40.8	45.6	51.0	402.9	305.2	327.2	364.2
Solomon Islands	65.2	78.2	92.5	115.6	158.6	174.1	185.6	203.6
Tonga	25.4	24.4	24.5	34.0	130.0	123.2	118.5	143.6
Tuvalu	0.7	0.8	0.8	0.9	15.4	16.2	13.3	13.2
Vanuatu	59.8	63.0	58.8	70.3	447.6	543.9	593.6	498.9

TABLE 1 (continued)

Country	Economically active population (1000 persons)				Land (1000 Ha)			
	1980-1990	1991-2000	2001-2006	2007-2012	1980-1990	1991-2000	2001-2006	2007-2012
Cook Islands	3.0	2.7	2.0	2.0	2	2	2	1
Fiji	108.5	121.9	122.9	128.4	120	176	170	152
French Polynesia	30.8	34.2	34.1	32.4	2	3	3	4
Kiribati	9.0	9.9	10.3	11.0	2	2	2	3
Marshall Islands	5.9	6.9	6.2	5.9	1	1	1	2
Micronesia (Fed.State of)	12.4	13.9	12.4	11.8	8	3	3	2
Nauru	1.0	1.0	1.0	1.0	24	24	23	23
New Caledonia	26.7	31.3	32.0	32.2	8	8	7	7
Palau	1.8	2.0	2.0	2.0	3	1	1	1
Papua New Guinea	1239.0	1571.2	1841.1	2102.4	182	196	229	292
Samoa	26.0	23.3	19.9	18.6	17	17	12	9
Solomon Islands	78.6	106.3	128.0	145.8	12	12	16	18
Tonga	11.8	12.9	12.0	11.4	16	16	15	15
Tuvalu	1.0	1.0	1.0	1.0	24	23	24	24
Vanuatu	28.1	31.7	34.6	37.0	20	20	20	20

Source: FAO of the United Nations and authors' estimation.

## GROWTH RATES OF PRODUCTIVITY MEASURES

Annual technical efficiency growth (*EFFG*), pure technical efficiency growth (*PEG*), scale efficiency growth (*SEG*), technological growth (*TECHG*) and TFP growth (*TFPG*) are obtained by subtracting the corresponding Malmquist indices by 1 and then multiplying them by 100. Relationships among these five growth indices include: summation of annual *PEG* and annual *SEG* gives the annual *EFFG*; and summation of annual *EFFG* and annual *TECHG* gives the annual *TFPG*. Annual growth rates of productivity measures are presented in Table 2.

To summarize, in terms of technological growth, technological regress was experienced in many PICs over 1981-1990, except for Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu; most PICs, except Fiji, French Polynesia and Kiribati, had rapid technological progress over 1991-2000; over 2001-2006 most PICs continued experiencing rapid technological progress, except for Cook Islands, Fiji, French Polynesia and Kiribati; and over 2007-2012 all PICs under study experienced technological regress.

With respect to pure technical efficiency, over 1981-1990 deterioration in pure technical efficiency was seen in most PICs except for Samoa, Solomon Islands and Tonga; over 1991-2000 improvement in pure technical efficiency was seen in most PICs except for French Polynesia, Kiribati, Marshall Islands and Samoa; over 2001-2006 PICs experienced either deterioration or negligible improvement in pure technical efficiency; and over 2007-2012, there still lacked evidence of improvement in pure technical efficiency in PICs, except for Tuvalu and Vanuatu.

With regard to scale efficiency, Vanuatu was the only PIC which made noticeable progress in scale efficiency over 1981-1990; over 1991-2000, most PICs made more or less progress in scale efficiency except for Tonga, Tuvalu and Vanuatu; scale efficiency deteriorated in most PICs over 2001-2006 except for Nauru, New Caledonia, Tuvalu and Vanuatu. Over 2007-2012, apart from Marshall Islands, Nauru, New Caledonia, Samoa, Tuvalu and Vanuatu, the other PICs

made more or less progress in scale efficiency.

In terms of total factor productivity, PICs as a whole experienced evident deterioration in TFP over 1981-1990 and 2007-2012; while significant enhancement and slight enhancement were seen in 1991-2000 and 2001-2006 respectively.

Over the whole period 1981-2012, PICs as a whole experienced a slight decline in pure technical efficiency with an average growth rate of -0.3 per cent per annum, stagnancy in scale efficiency, little progress in technology with an average growth rate of 0.5 per cent per annum, and consequently, little improvement in total factor productivity with an average growth rate of 0.2 per cent per annum.

TABLE 2: Computed annual productivity growth by country over 1981-2012

Series	Period	Cook Islands	Fiji	French Polynesia	Kiribati	Marshall Islands	Micronesia (Fed. States of)	Nauru	New Caledonia	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Technical efficiency growth (per cent)	1981-1990	-8.5	-10	-11.8	-18.5	-11.7	-4.6	-9.1	-7.8	-5.9	-3.4	2.2	1	2.5	-2.9	-1.3
	1991-2000	9.4	11	13.3	22.2	13.1	4.6	9.7	8	5.9	3.4	0	0.8	1	7.5	7.2
	2001-2006	0	-0.1	-0.9	-0.4	-0.6	-0.9	0.5	0.4	-2.1	-1.6	-0.9	-1.8	-0.4	-3.5	-4.6
Technological growth (per cent)	2007-2012	0	-2.4	-2.5	-2.2	-4.4	-3	-4.3	-4.2	-2.2	-2.2	-1.5	-2.4	1.1	2.1	4.9
	1981-1990	-17.6	-12.3	-13.4	-12.6	-10.6	-10.2	-8	-7.4	-5.5	2.7	4.7	4.9	8.5	9	12.7
	1991-2000	1.8	-1.4	-2.8	-0.2	6.7	8.2	8	13.1	8.8	13.6	10.2	9	13.2	15.3	15.7
Pure technical efficiency growth (per cent)	2001-2006	-14.9	-14.3	-14.3	-0.1	0.1	0.3	10	10.3	11.6	8.8	8.5	9.3	10.1	10.2	11.3
	2007-2012	-10.6	-10.5	-11.6	-9.8	-7.8	-7.7	-4.6	-4.9	-2.3	-0.3	1.7	-2.5	0.5	-1.6	-0.4
	1981-1990	-7.1	-9.3	0	0	0	-3.8	-8.4	-7	-5.1	-2.5	2.2	1	2.4	-3.1	-7
Scale efficiency growth (per cent)	1991-2000	7.6	10.2	-0.1	-0.4	-0.2	3.7	8.8	7.3	5.3	2.6	0	0.8	1.1	7.6	7.5
	2001-2006	0	0	-0.7	0.1	0	0.3	0.4	0.1	0.2	0.1	0	-0.5	0.5	-3.6	-4.9
	2007-2012	0	-2.5	-2.5	-2.6	-4.3	-3.6	-3.7	-3.4	-3.6	-3	0	-2.6	0	3.2	5
Total factor productivity growth (per cent)	1981-1990	-1.6	-0.8	-11.8	-18.5	-11.8	-0.8	-0.8	-0.8	-0.8	-0.8	0	0	0.1	0.1	6.1
	1991-2000	1.6	0.7	13.4	22.7	13.4	0.9	0.7	0.6	0.6	0.8	0	0	-0.1	-0.1	-0.3
	2001-2006	0	-0.1	-0.2	-0.4	-0.5	-1.2	0.1	0.3	-2.3	-1.6	-0.9	-1.4	-1	0.2	0.3
Total factor productivity growth (per cent)	2007-2012	0	0.2	0	0.4	-0.1	0.7	-0.7	-0.9	1.5	0.8	-1.5	0.2	1.1	-1	-0.1
	1981-1990	-24.6	-21.1	-23.6	-28.7	-21.1	-14.4	-16.3	-14.7	-11.1	-0.8	7.1	6	11.1	5.8	11.2
	1991-2000	11.4	9.4	10.2	22	20.7	13.1	18.5	22.2	15.2	17.4	10.3	9.8	14.3	24	24.1
Total factor productivity growth (per cent)	2001-2006	-14.9	-14.4	-15.1	-0.5	-0.4	-0.7	10.5	10.8	9.3	7.1	7.6	7.3	9.6	6.4	6.2
	2007-2012	-10.6	-12.6	-13.8	-11.8	-11.8	-10.5	-8.7	-8.9	-4.4	-2.6	0.2	-4.8	1.6	0.5	4.4

Source: Authors' computation based on the data envelopment analysis approach.

## IMPACTS OF TOTAL FACTOR PRODUCTIVITY ON PRODUCTION GROWTH

This section presents the models and estimators based on which impacts of productivity growth are quantified. This is followed by panel integration tests and panel data regression findings.

### THE MODEL AND ESTIMATORS

Impacts of productivity growth on production growth in the agriculture sector of PICs are estimated based on the following two panel data regression models:

$$(9) \quad \Delta \ln Y_{it} = \beta_0 + \beta_1 \Delta \ln K_{it} + \beta_2 \Delta \ln P_{it} + \beta_3 \Delta \ln L_{it} \\ + \beta_4 PEG_{it} + \beta_5 SEG_{it} + \beta_6 TECHG_{it} + \sum \phi_p DUM_{p,it} + \gamma_i + u_{it}$$

$$(10) \quad \Delta \ln Y_{it} = \delta_0 + \delta_1 \Delta \ln K_{it} + \delta_2 \Delta \ln P_{it} + \delta_3 \Delta \ln L_{it} \\ + \delta_4 TFPG_{it} + \sum \varphi_p DUM_{p,it} + \lambda_i + v_{it}$$

where

$Y$  = net agricultural production, and  $\Delta \ln Y$  is annual growth of agricultural production (per cent);

$K$  = net capital stock in agriculture, and  $\Delta \ln K$  is annual growth of agricultural capital stock (per cent);

$P$  = economically active population in agriculture, and  $\Delta \ln P$  is annual growth of population in agriculture (per cent);

$L$  = arable land, and  $\Delta \ln L$  is annual growth of arable land (per cent);

$PEG$  = growth of pure technical efficiency (per cent);

$SEG$  = growth of scale efficiency (per cent);

$TECHG$  = growth of technology (per cent);

$TFPG$  = growth of total factor productivity (per cent);

$DUM$  = a set of dummy variables to represent the occurrence of typhoons and cyclones, with value 1 to time spans when disasters were observed and 0 otherwise. These dummy variables are time and country variant. Some dummy variables are further combined based on Wald tests for parameter constraints.

$\gamma$  and  $\lambda$  = country-specific heterogeneity. They can either be fixed effects or random effects in respective equations; and

$u$  and  $v$  = independently and identically distributed error terms in respective equations.



The above two models are estimated based on a sample of 15 PICs over 1981-2012. To reduce short-term fluctuations' effects on obtaining robust estimation results, 4-yearly moving averages are used instead of annual data. Hence, the whole period 1981-2012 is divided into eight time spans: 1981-1984, 1985-1988, 1989-1992, 1993-1996, 1997-2000, 2001-2004, 2005-2008, and 2009-2012.

Data on net agricultural production are obtained from the World Bank database; data on net capital stock in agriculture, economically active population in agriculture, and arable land are from the FAO of the United Nations; data on growth of pure technical efficiency, growth of scale efficiency, growth of technology, and growth of total factor productivity are calculated by using the DEA approached presented in Section 4.1.

Given the number of time periods is less than the number of countries in the panel sample of the current study, the difference generalized method of moments (GMM-DIFF) and system generalized method of moments (GMM-SYS) estimators are employed to produce consistent estimation results. The GMM estimators separate fixed effects from idiosyncratic errors that are heteroskedastic and correlated within but not across individuals. These estimators instrument the differenced variables with all their available lags in levels, and instrument the untransformed variables with suitable lags of their own first differences (Arellano and Bond, 1998; Roodman, 2009). Furthermore, robust panel corrected standard errors are used to address the possibility of country-wise heteroskedasticity, and error autocorrelation is addressed by the employment of a second order autoregressive process.

#### INTEGRATION TESTS

Integration tests on individual panel variables are necessary in order to avoid the risk of obtaining spurious regression results. The Breitung panel integration test, testing the null hypothesis of non-stationary panels, yields test results as shown in Table 3.

**TABLE 3:** Panel integration tests

Variable	Time trend	Constant	Lambda	<i>p</i> -value
$\Delta \ln Y$	No	Yes	-3.3699	0.0004
$\Delta \ln K$	No	Yes	-3.9213	0.0000
$\Delta \ln P$	No	Yes	-2.9431	0.0016
$\Delta \ln L$	No	No	-6.2723	0.0000
<i>TECHG</i>	No	No	-6.8295	0.0000
<i>PEG</i>	No	No	-6.9335	0.0000
<i>SEG</i>	No	No	-8.6294	0.0000
<i>TFPG</i>	No	No	-6.9412	0.0000

Since the *p*-value in each Breitung test is less than the significance coefficient 0.01, the null hypothesis of non-stationarity is rejected at the 1 per cent significance level. This provides strong statistical evidence that all variables in Equations (9) and (10) are respectively integrated of order

0. The use of stationary variables does not lead to spurious regressions.

#### PANEL REGRESSION FINDINGS

The panel regression models as expressed in Equations (9) and (10) are each estimated by the GMM-DIF and GMM-SYS estimators. Estimation results are summarized in Table 4.

In general, all independent variables have expected effects on agriculture production growth; these independent variables are overall highly significant in all regressions; autocorrelation within countries is not evidenced as per the test results of the Arellano-Bond test for AR(2); overidentification of parameters in Equations (9) and (10) is confirmed by the Sargan test of overidentification; and exogeneity of instruments is evidenced by the difference-in-Sargan tests.

Focusing on independent variables' performance in the agriculture production growth models, the positive impact of  $\Delta \ln K_{it}$  on  $\Delta \ln Y_{it}$  is consistently evidenced across the four regressions with estimated coefficient ranging from 0.07 to 0.12. This suggests that, keeping other factors constant, a 10 percentage point increase in growth of net capital stock is associated with only around a rise of 1 percentage point in growth of net agriculture production. Also, such impact is statistically significant for at least the 10 per cent level. On the other hand, the negative impact of  $\Delta \ln P_{it}$  on  $\Delta \ln Y_{it}$ , though consistent across the four regressions, is not statistically significant. The third factor input's growth, namely, growth of arable land  $\Delta \ln L_{it}$ , has a statistically significant and positive impact on growth of agriculture production; and the magnitude of such an effect is similar to that of net capital stock growth. Furthermore, typhoons and cyclones prove devastating to the agricultural sector. It is found that the occurrence of a natural disaster reduces the growth of agricultural production by 4 to 31 percentage points.

Turning to variables of interest, namely pure technical efficiency growth, scale efficiency growth, technological growth and total factor productivity growth, these productivity growth measures have expected positive coefficients in all regressions. More specifically, pure technical efficiency growth' positive impact is statistically significant at the 10 per cent level with an estimated magnitude of around 0.15. This suggests that a 10 percentage point rise in pure technical efficiency growth increases agriculture production growth by around 1.5 percentage points, other factors remaining fixed. Growth of the other efficiency component, that is, scale efficiency growth, also has a positive impact which is highly significant at the 1 per cent level. It is found that a 10 percentage point increase in scale efficiency growth is linked with an increase of around 1 percentage point in agriculture production growth, all else unchanged. As another component of productivity growth, technological growth proves important in contributing to agricultural production growth in Pacific Island countries. Technological growth's positive impact is less quantitatively significant than that of efficiency growth. The estimated coefficient of *TECHG*'s is around 0.05, suggesting that a 10 percentage point increase in technological growth is associated with an increase of 0.5 percentage points in growth of agricultural production (Columns 1 and 2 of Table 4). Total factor productivity, as the measure of productivity as a whole in the current study, its growth's impact on agricultural production growth is statistically evident. It is found that a rise of 10 percentage points in TFP growth would lead to a rise of around 0.6 percentage points in production growth in the agriculture sector of Pacific Island countries.

**TABLE 4:** GMM Estimation of Impacts of Productivity GrowthDependent variable:  $\Delta \ln Y_{it}$ 

Independent variable	Equation (9)	Equation (9)	Equation (10)	Equation (10)
	GMM-DIF	GMM-SYS	GMM-DIF	GMM-SYS
	Coeff [z-stat]	Coeff [z-stat]	Coeff [z-stat]	Coeff [z-stat]
Constant	-	-3.527 [-6.94] ***	-	-3.302 [-6.61] ***
$\Delta \ln K_{it}$	.070 [1.75] **	.122 [3.15] ***	.088 [2.18] **	.120 [3.32] ***
$\Delta \ln P_{it}$	-.273 [-1.21]	-.201 [-1.17]	-.253 [-1.04]	-.190 [-1.07]
$\Delta \ln L_{it}$	.111 [2.05] **	.084 [1.81] **	.106 [1.92] **	.080 [1.73] **
$PEG_{it}$	.158 [1.57] *	.128 [1.62] *		
$SEG_{it}$	.092 [3.23] ***	.109 [3.96] ***		
$TECHG_{it}$	.036 [1.63] *	.051 [3.05] ***		
$TFPG_{it}$			.047 [2.03] **	.060 [3.65] ***
$DUM1_{it}$	-21 [-13.08] ***	-23 [-14.51] ***	-23 [-14.29] ***	-21 [-12.91] ***
$DUM2_{it}$	-25 [-10.78] ***	-31 [-12.45] ***	-31 [-12.19] ***	-25 [-10.62] ***
$DUM3_{it}$	-10 [-12.05] ***	-9 [-10.78] ***	-9 [-10.32] ***	-10 [-11.38] ***
$DUM4_{it}$	-6 [-9.11] ***	-5 [-6.54] ***	-4 [-5.99] ***	-6 [-8.15] ***
Number of countries	15	15	15	15
Number of time spans	7	8	7	8
Wald chi-squared ( <i>p</i> )	558.59 (0.000)	504.39 (0.000)	514.43 (0.000)	468.62 (0.000)
Number of instruments	17	23	17	21
Arellano-Bond for AR(1): z stat ( <i>p</i> )	-4.12 (0.000)	-	-4.21 (0.000)	-1.08 (0.278)
Arellano-Bond for AR(2): z stat ( <i>p</i> )	0.97 (0.331)	0.47 (0.638)	1.02 (0.306)	0.51 (0.607)
Sargan of overidentification chi-squared ( <i>p</i> )	74.58 (0.302)	100.90 (0.130)	72.54 (0.244)	88.03 (0.332)
Difference-in-Sargan tests of exogeneity of instrument subsets				
Sargan test excluding group: chi-squared ( <i>p</i> -value)	63.43 (0.291)	80.24 (0.083)	62.76 (0.194)	77.01 (0.128)
Difference (null H = exogenous): chi-squared ( <i>p</i> )	11.15 (0.430)	20.67 (0.541)	9.78 (0.550)	11.02 (0.923)

Note: \*, \*\*, \*\*\* respectively represent significance at the 10 per cent, 5 per cent and 1 per cent levels.

Significance level is decided by one-tailed hypothesis tests.

## **CONCLUSION AND POLICY SUGGESTIONS**

The agrarian crisis in Pacific Island countries cannot be tackled if the factors that are responsible for creating the problems in agricultural growth are not well understood and the effective policies undertaken. A visionary plan is needed because agriculture contributes to development not only by providing good and raw materials to the population, but as productivity rises in agriculture, this sector also contributes to the supply of labor to the nonagricultural sectors, since higher rural income increases the demand for nonagricultural as well as agricultural products. Hence, understanding the pattern of agricultural productivity growth, which is the key component of long-run agricultural growth, is very important.

This study examines the impacts of productivity growth on production growth in the agriculture sector of Pacific Island countries. It clearly shows that there are differences in PICs' agricultural output growth, not only because these countries have accumulated different quantities of factors of production including capital, labor and arable land, but also because there is variation in the effectiveness with which they combine these factors of production to production output.

The above findings would generate more interest and discussion about the crucial aspect of technological progress that it allows agricultural economy to transcend the limitations imposed by diminishing returns. In addition, this study would also generate interest for further research to explore at the microeconomic level as to what could be the reasons of technical inefficiency in the agriculture sector resulting in sluggish growth in some PICs.

To boost sustainable agricultural development, policymakers in this region should,

- (1) improve irrigation systems and road infrastructure to motivate agricultural producers;
- (2) provide higher quality services such as efficient marketing arrangements to encourage commercial farming;
- (3) improve quality and quantity of agricultural products; and
- (4) develop the food processing industry to diversify agricultural products.

These will help agricultural producers explore new markets and expand production scale, and make it possible to reduce transportation costs of agricultural exports and shipping time. Consequently, scale efficiency would increase and agricultural producers would adopt advanced machinery and managerial skills.

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## **Genetic Loss in Food Crops in the Pacific: Socio-Economic Causes and Policy Issues**

*Clement A. Tisdell*

### **ABSTRACT**

*Genetic diversity of traditional food crops is declining in the Pacific Islands. Background information on the evolution of the diversity of these crops is provided, socioeconomic reasons for this loss are outlined, the economic consequences of this loss are analysed, and the economic benefits and costs of conserving crop varieties is examined. The potential economic benefits foregone by failing to conserve a crop variety are shown to depend on the nature of the demand function for the crop's production. The economics associated with the conservation of crop diversity by in situ and ex situ methods are discussed.*

**Keywords:** *Biodiversity loss, crop varieties, gene banks, genetic capital, food crops, food security, Pacific Islands, sustainable development.*



## INTRODUCTION AND PURPOSE

Along with climate change, loss of biodiversity (particularly the disappearance of existing genetic resources) is a major threat to the long-term maintenance of human well-being. Because its effects are less visible than those of global warming (which itself is a powerful force for biodiversity loss), loss of genetic resources has received much less public attention than global warming. Nevertheless, its consequences on human well-being may eventually be similar to those of a slowly spreading cancer on its victim. The FAO has reported that in the 20<sup>th</sup> century ‘some 75 percent of plant genetic diversity has been lost as farmers worldwide have left their multiple local varieties and landraces for genetically uniform, high-yielding varieties’ (FAO, 2004, Box 5). There is also concern that human beings depend on very few plants and animal species for their food supply. It is estimated that ‘75 percent of the world’s food is generated from only 12 plant and five animal species’ (FAO, 2004, Box 5). Furthermore, the FAO reports that about 1,000 domestic animal breeds were lost in the last century and about a third of remaining breeds (of which there are believed to be about 1,335) are threatened with extinction (FAO, undated). Haussmann *et al.* (2004) also point out that ‘agriculture today is characterized by a sharp reduction in the diversity of cultivated plants’ and that there has been substantial reduction in the interspecific and intraspecific diversity of these plants.

The purpose of this paper is to examine the loss in genetic diversity of traditional food crops in the Pacific Islands. In doing so, it will consider the origins of crops and crop varieties in these islands, their importance globally and provide some information about the extent of the loss of crop varieties in the Pacific Islands. Also, it aims to identify the socio-economic causes of such losses and presents economic analyses of their potential consequences for human well-being. Moreover, policy measures and methods to conserve the variety of crops in the Pacific Islands are discussed and economic difficulties of assessing these are highlighted.

## THE GLOBAL CONTRIBUTION OF THE PACIFIC ISLANDS TO FOOD CROPS AND THEIR VARIETIES

It is not well known that the Pacific Islands contain one of the earliest areas in which agriculture first began. Renfrew (2007, pp. 210-211) indicates that gardens for the supply of food were established in New Guinea around 9000 years ago, probably around 500 years or so after wheat was first grown in the Levant in the Near East. New Guinea is believed to be the second centre in the world where plant cultivation began. Plant cultivation in South Asia, the Americas and China came much later.

While there is some controversy about the exact time-period in which the cultivation of food plants began in New Guinea, strong archaeological evidence indicates that it is one of the earliest centres in the world where agriculture evolved in the Holocene period (Denham, *et al.*, 2003), and it did so independently of other centres where agriculture originated. Taro (*Colocasia esculenta*), bananas (*Musa spp.*), and yams, (*Dioscorea spp.*) have been identified as some of the significant species cultivated in ancient times in New Guinea (Denham, *et al.*, 2003; Fullagar, *et al.*, 2006). Table 1 provides a list of food crops cultivated mostly in Melanesia in ancient times and which subsequently, diffused to other Pacific Islands. This, however, is not a complete list

of indigenous crops of the Pacific Islands. Furthermore, the origins and diffusion of these crops is complex as shown by Zerega *et al.* (2004) in relation to the origins and diffusion of breadfruit. As can be seen from Table 1, some differences in scientific opinion exist about where some of these crops were first cultivated and their origins.

TABLE 1: A list of various food crops believed to have originated in the Pacific Islands (especially New Guinea) together with relevant comments.

Species	Comments
<b>Bananas and Plantains</b> ( <i>Musa</i> spp.)	It is believed the wild <i>Emusa</i> banana was first domesticated in New Guinea and then it dispersed to Southeast Asia (Denham, <i>et al.</i> , 2003, p. 193) and subsequently, to other islands in the Pacific as they were settled. On the other hand, Bynum and Bynum (2014, p. 160) state that it originated in Southeast Asia as a domesticate. Most banana domesticates are derived from <i>Emusa</i> bananas.
<b>Breadfruit</b> ( <i>Artocarpus altilis</i> )	Breadfruit has its origins in the Pacific Islands with New Guinea, the Mariana Islands and Palau being the suggested source of species from which hundreds of varieties have been derived in the Pacific Islands. However, the origins and geographical diffusion of breadfruit in the Pacific Islands is complex (Zerega, <i>et al.</i> , 2004) Its cultivation also spread to Southeast Asia and Southern India. European colonists introduced breadfruit from the Pacific to the Caribbean to help feed slaves there (Rix and Davis, undated).
<b>Coconut</b> ( <i>Cocos nucifera</i> )	It is “thought to have originated in the coastal areas of Southeast Asia and Melanesia. In prehistoric times, it spread naturally on ocean currents eastward to the tropical Pacific Islands and westward to India and all the way to East Africa. Around 4,500 years ago, voyaging Polynesians and Indo-Malayans introduced their preferred forms to the various Pacific Islands” (Library of the University of Hawaii at Manoa, 2012a)

**Sugar Cane***(Saccharum spp.)*

All six species of sugar cane are native to New Guinea and have been used by humans for over 8000 years. Today *Saccharum officinarum* is the species mostly grown for sugar production. The use of sugar cane initially spread from New Guinea to the north into Asia, then to the east in Pacific (Benson, 2012, pp. 98-102) and subsequently, more widely.

**Taro***(Colocasia esculata)*

Although it had previously been hypothesized that taro cultivation first occurred in Asia, Fullager et al. (2006) have produced evidence that taro was most likely first cultivated in New Guinea and probably also in the Solomon Islands. Cultivation of several other aroid species has also originated in Melanesia.

**Yams***(Dioscorea spp.)*

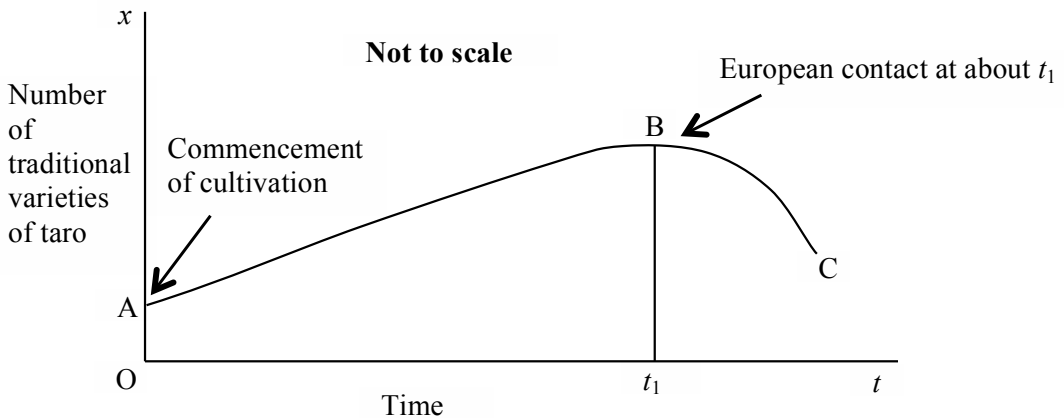
Fullager et al. (2006) have completed research indicating that New Guinea was the place where yams were originally domesticated. Their cultivation occurred subsequently in Southeast Asia and spread to other Pacific Islands. However, the origins and geographical diffusion of species of yams is more complicated than this (see, for example, Bynum and Bynum, 2014, pp. 42 -43; and Coursey, 1967).

As the cultivation of these crops spread in the Pacific, many local varieties were developed in order to make them better adapted to local ecological conditions, as has been exemplified by a case study of the breadfruit (Zerega, *et al.*, 2004). However, in recent times, many of these cultivated varieties have been lost as a result of changing socio-economic conditions and the stock of their wild relatives (for example, in New Guinea) is being eroded with the occurrence of economic growth and change. Most natural scientists believe that this narrowing of the genetic stock of these crops poses a serious threat to the sustainability of their contribution to food production. Threats to such sustainability are not only relevant to the Pacific Islands themselves, but also to other countries which rely on these crops for some of their agricultural production. For example, the preservation of the genetic capital for bananas and sugar cane could make a contribution to the sustainability of production from these crops in Australia.

Of course, some important food crops in the Pacific Islands were introduced from other parts of the world. The sweet potato (*Ipomoea batatas*) is an interesting and important example. It is reported that “Central America and Peru are generally accepted as possible centres of origin for this crop. Sweet potato cultivation in the eastern and central Pacific predates European contact by several hundred years, possibly occurring as early as 1000 CE [about 3000 years ago]” (Library of the University of Hawaii at Manoa, 2012b). It may have been introduced as the result of early contact of Polynesians with South America. It is now an important crop in the Pacific and in many other developing countries. A multitude of different varieties of sweet potatoes have been developed in the Pacific Islands.

Probably, the number of varieties of traditional cultivated crops in the Pacific increased over hundreds of years once agriculture commenced there, but following European contact and the greater integration of the Pacific Islands into the global economic system, the number of these varieties declined and in recent times, this loss appears to be happening at an accelerating rate. Taking, for example, taro (*Colocasia esculata*), this pattern might be like that shown hypothetically by curve ABC in Figure 1. The exact relationship is unknown because all the existing varieties of taro have not been fully documented, let alone many of the varieties which existed in the past.<sup>1</sup>

**FIGURE 1:** The hypothetical relationship between the number of cultivated traditional varieties of taro available in the Pacific Islands and the efflux of time. Similar patterns probably apply to other crops which were cultivated before European contact, e.g. bananas.



It is clear that increasing globalization since the beginnings of agriculture has played a major role in the global diversity of food crops both by addition and subtraction (see for example, Kiple, 2007; Kiple and Conc e, 2000; and Murphy, 2007). However, the dominant trend in recent times has been to reduce global crop diversity (Hausmann, *et al.*, 2004).

## **SOCIO-ECONOMIC CAUSES OF THE GENETIC EROSION OF TRADITIONAL FOOD CROPS IN THE PACIFIC ISLANDS**

There are several socio-economic reasons why many varieties of traditional food crops are being lost in the Pacific. Similar socio-economic causes are present elsewhere in the world. Their relative importance has not been investigated empirically as yet, and many of the socio-economic reasons for their decline have received little attention, particularly by natural scientists. Socio-economic reasons for this decline in Oceania include the following:

*MARKET REQUIREMENTS.* Many economies in the Pacific have become increasingly market-oriented and some of their food production is exported to foreign markets. There is an economic incentive to grow varieties of crops (and species of crops) that transport and store well and which are most preferred by buyers. In some markets, standardized produce is preferred, for example, for supplies to supermarkets. Masibalavu *et al.* (2002) concluded (from a survey in Fiji) that there has been significant erosion in taro landraces in Fiji and that this is associated with increasing market demands and use of taro hybrid varieties by many farmers. A report prepared by the Government of PNG points out that semi-subsistence farmers there tend to grow crop species, cultivars and landraces that are preferred by consumers and which can be sold for cash and that this is resulting in genetic erosion (FAO, 2009, p.7). Similarly, the Fijian Government has pointed out that traditional varieties of food crops are now rarely seen in local markets (FAO, 2008, p. 13) and in some localities, only export varieties are being grown (FAO, 2008, p. 17).

*IMPROVED VARIETIES.* The development of new crop varieties which are more profitable to grow or give greater yields than existing ones usually result in the erosion of existing varieties. This has for example, been stressed by Hausmann *et al.* (2004). However, the new varieties may prove to be vulnerable to new plant diseases whereas some of the varieties which are lost may have possessed resistance to these diseases. Individual farmers have no economic incentive to save traditional crop varieties to cater for this possibility. This is because the event is uncertain, is likely to be distant in time, and they are likely to be unable to appropriate significant economic benefits from their conservation decision. It might also be noted that the development of improved varieties of crops tends to be a two-edged sword. It raises current economic returns, but it also accelerates the loss of crop diversity and in the long-term, this could endanger the sustainability of agricultural production (Hausmann, *et al.*, 2004; Tisdell, 2014).

*DECOUPLING OF THE PRODUCTION OF CROPS FROM LOCAL ECOGEOGRAPHIC CONDITIONS.* Many scientific advances in agriculture reduce the extent to which the growing of crops depends on local environmental conditions. For example, artificial fertilizers, pesticides,

irrigation and so on help to reduce this dependence. Therefore, crop varieties which were once the most productive in natural local conditions are often less productive than new varieties (improved varieties) which respond well to a package of human-regulated inputs (Tisdell, 2015, Chs. 5 and 8). In many parts of the world, such decoupling has resulted in global loss of livestock breeds (Tisdell, 2003). Furthermore, as is well known, the 'Green Revolution' has resulted in considerable erosion of crop varieties (Alauddin and Tisdell, 1991).

*CROP SUBSTITUTION.* In modern times, some new crops have been introduced to the Pacific. Their cultivation resulted in land that was once used for traditional crops being used for these new crops. As a result, several local crop varieties would have been lost. Furthermore, the extension of cultivation of particular crops has a similar effect. The commercial growing of sugar cane in Fiji for exports of sugar most likely displaced some varieties of traditional crops. In PNG, the growing of commercial crops for export, such as, palm oil, coffee and cocoa, has had similar effects. The extension of markets (for example, as a result of less restricted international trade) is a major influence on the loss of local varieties of food plants and is also a factor in the loss of local breeds of domesticated animals (Tisdell, 2003; Tisdell, 2015, Ch. 6). This is because market extension promotes regional specialization in production. As a result of market extension, some agricultural activities which once existed in a region and resulted in distinct varieties of crops or breeds of animals being conserved may cease being economical. They may be replaced by other economic activities. Consequently, a global loss in biodiversity occurs.

*URBANIZATION/CENTRALIZATION OF POPULATIONS.* Considerable migration has occurred from the more remote places to central places in Pacific Island states and territories. In some cases, this has resulted in reduced crop cultivation in remote areas and subsequent loss of local landraces. Similarly, with the spread of urban centres, agricultural land is lost and this could have a negative effect on the survival of some plant varieties. Furthermore, the lifestyles and demand for different types of food of urban residents differ from those of rural residents and this alters the pattern of demand for food.

*CHANGED FOOD HABITS AND TASTES.* Food habits and tastes can change over time as a result of cultural change, alterations in the structure of society (including a society's urbanization, and changes in the nature of work) and as a result of advertising. For example, demand for convenience foods is likely to increase in households where family members are involved in wage or salary employment in urban areas. Furthermore, as a result of globalization and increased international contact, the range of available foods (for example, the availability of foods which are popular abroad) can be expected to increase. All of these factors can result in a fall in the demand for traditional foods and consequently, reduce the extent of their cultivation. For example, globalization has resulted in an increase in the demand for cereals (including wheat and rice) in the Pacific Islands. Cereals are used to supply new types of food in the Pacific Islands, such as bread, wheat biscuits and so on. These trends are further reinforced by the presence of fast food developments in some places in parts of the Pacific, for example, the establishment of McDonalds outlets. Furthermore, migration

has played a role in influencing food habits. For instance, the migration of Indians to Fiji has influenced the pattern of food consumption there.

*INCREASING IMPORTANCE OF MONETARY TRANSACTIONS AND GREATER AVAILABILITY OF FOREIGN CURRENCY.* Monetary exchange has increased in importance in the Pacific Islands, while subsistence living and barter have become less common. Hence, the market system is becoming more widespread and market extension is occurring. This facilitates loss of crop biodiversity (see point 4). In many Pacific Island nations and territories, the demand for processed food (much of which is imported) is driven by the growing importance of cash income and monetary exchange, as well as urbanization. The growth of the cash economy is facilitated by monetary remittances and by funds supplied by overseas aid. This phenomenon has resulted in some Pacific Island nations and territories being classified as MIRAB economies (Bertram, 2006; Bertram and Watters, 1985). Although this classification cannot be applied to all Pacific Island nations and territories (Tisdell, 2016) even in cases where the classification is inappropriate or barely appropriate (such as Papua New Guinea), the size of their monetary economies have grown in importance. When foreign funds flow into a Pacific Island nation as a result of overseas remittances, aid or the earning of foreign exchange as a result of exports, overseas funds become available to import food and other commodities. Dependence on local food supplies declines. While imports increase the range of foods available to Pacific Islanders, greater reliance on imports makes Pacific Islanders economically vulnerable to a decline in foreign aid, reduced overseas remittances, or a fall in export earnings.

*REMITTANCES AND MIGRATION PATTERNS.* Remittances to family members by migrants are likely to reduce economic incentives to undertake agricultural production in the Pacific Islands. There is evidence that in some jurisdiction, remittances are mainly used for consumption (Brown, *et al.*, 2013). In addition, the composition of the population in rural areas may be skewed towards the elderly (because younger family members tend to migrate). The elderly are less able to engage in agricultural production and this may further result in loss of varieties of traditional crops.

*LOCAL SUPPLIES OF AGRICULTURAL PRODUCE ARE RESTRICTED BY TRANSPORT DIFFICULTIES.* The territories of many Pacific Island nations are scattered, some parts are remote and are relatively inaccessible in relation to their central urban places. For example, transport between the outer islands of many Pacific states is costly and infrequent. This reduces their economic potential to supply food to the main urban centres in the Pacific Islands and increases the dependence of Pacific Island nations on imported food. In many cases, it is cheaper to import food from abroad rather than source it from remote areas in the Pacific Islands. There is also a further complication. As pointed out by the Government of PNG, most traditional types of food crops in the Pacific Islands are highly perishable and this limits the scope for their transport and storage. The PNG Government recommends that greater attention be given to the production of flour from root and tuber crops near their source of production in order to reduce this problem (FAO, 2009, p. 16). Also some crops such as bananas can be dried (desiccated).

Note that the price of food products does not reflect the environmental cost of their supply, for example, the extent to which their transport results in increased CO<sub>2</sub> emissions. For example, food which is transported over greater distances is likely to use a greater amount of fossil fuels and result in a higher level of CO<sub>2</sub> emissions than food supplied locally by farmers. This is why some social groups favour increased reliance on locally produced fresh food, for example, supplied in farmers' markets. However, it is not only the nature of food transportation that has consequences for CO<sub>2</sub> emissions. The use of artificial fertilizers can, for instance, add to these emissions. Furthermore, other environmental consequences of food production need to be considered. Even if consumers wanted to take these effects into account, they are hindered in doing so by lack of knowledge about the environmental consequences of their food purchasing decisions (see, for example, Tisdell, 2011, pp. 27-28). This limits the social economic value of market systems.

### **CONSEQUENCES FOR HUMAN WELFARE AND FOR ECONOMIC SUSTAINABILITY OF GENETIC EROSION IN FOOD CROPS**

The economic consequences as well as the ecological and biological impacts of a reduction in the size of the genetic stock and of changes in that stock are poorly understood. Even the existence of many varieties of traditional crops in Pacific Island countries is unknown or poorly known. This problem has been pointed out by the government of PNG and also by that of Fiji (FAO, 2008, 2009). As a result, many varieties of traditional crops could be lost without the scientific community ever knowing that they once existed, let alone having knowledge of their attributes. Moreover, acute uncertainty exists about the attributes of the available crop varieties which will prove to be valuable in the future. For example, it is difficult to know what attributes of crop varieties may prove to be valuable in counteracting crop diseases or pests that could evolve in the future. Both the occurrence of future crop diseases and the attributes of crop varieties that may counteract their negative consequences are uncertain.

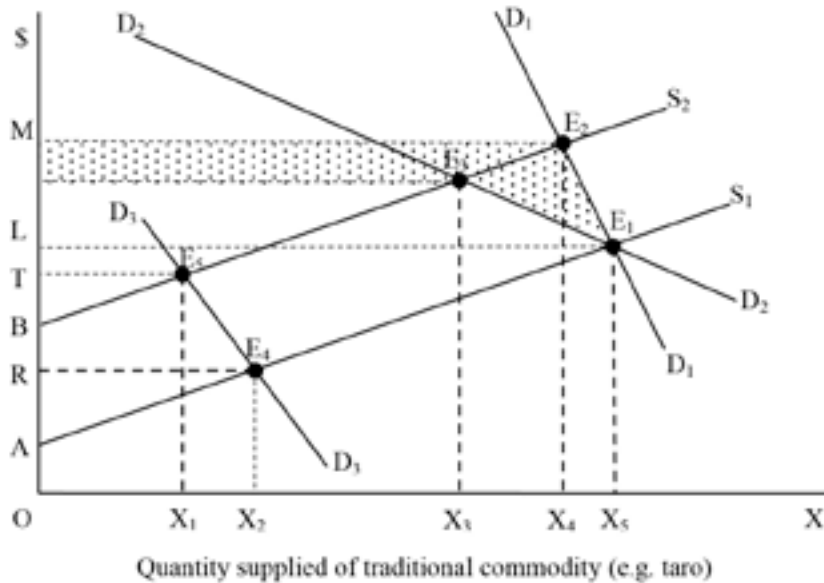
Now let us consider whether economics can provide any guidance on the possible benefits of conserving traditional crop varieties. What economic factors influence the extent of the economic loss suffered if, due to the occurrence of a disease (such as taro blight), the productivity of a favoured crop variety fails? In other words, what is the economic value of being able to avoid this loss by possibly making use of a genetic attribute of a traditional crop variety?

Figure 2 throws some light on the matter. It is assumed that the occurrence of this new disease adds to the cost of supplying the food crop, X. Whereas the original supply curve might have been as shown by line AS<sub>1</sub>, after the occurrence of the crop disease, it might shift upwards to BS<sub>2</sub>. If the demand for X is shown by D<sub>1</sub>D<sub>1</sub>, there is a considerable loss in consumers' surplus as a result of the occurrence of this disease. This loss is equivalent to the area of quadrilateral LE<sub>1</sub>E<sub>2</sub>M. On the other hand, the loss in consumers' surplus will be smaller if the demand for X is more elastic. For example, the demand curve marked D<sub>2</sub>D<sub>2</sub> exhibits greater elasticity at point E<sub>1</sub> than does D<sub>1</sub>D<sub>1</sub>. In the latter case, the loss in consumers' surplus caused by the onset of the pestilence is smaller by an amount equivalent to the dotted area. In general, the loss in consumers' surplus tends to increase with the amount by which the cost of supplying commodity X rises once the pestilence occurs, and when the demand for the commodity is more inelastic,



other things being held constant. The latter implies that consumers lack close substitutes for the focal commodity.

**FIGURE 2:** Illustration of the adverse impact on the welfare of consumers of a new crop disease which fails to be controlled due to genetic erosion



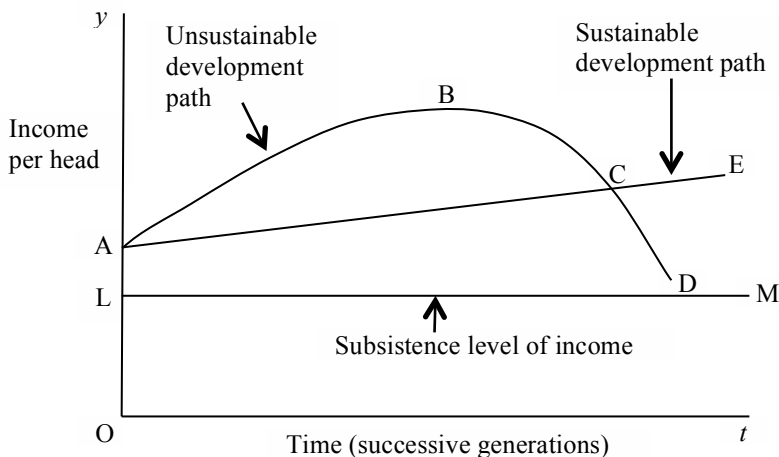
However, there is another important influence on the loss in the welfare of consumers that could result from genetic erosion in crops, and this could be more important than the elasticity of demand for a crop. It is the absolute level of demand for the crop. Other things being held constant, a loss of the type illustrated (consumers' surplus) in Figure 2 is larger, the higher the absolute demand for the commodity produced by the crop is. This can be seen from Figure 2. If, for example, the demand curve for X is as shown by line  $D_3D_3$ , the loss in consumers' surplus as a result of the pestilence is equivalent to the area of quadrilateral  $RE_4E_3T$ . This area is much smaller than when the demand curve is located at  $D_1D_1$  or  $D_2D_2$ . Consequently, the economic benefit from having a strategy to avoid a negative effect on productivity of the occurrence of a disease in a traditional crop increases with the level of the absolute demand for the food produced by that crop and when the demand for it is more inelastic. Crops which are considered to be staples (such as bananas and taro in the Pacific Islands) are likely to satisfy these conditions. This would suggest that they should have a high priority for the preservation of the diversity of their germplasm. This should, as discussed later, have an influence on conservation strategies.

There are fears that the continuing loss of existing varieties of crops will eventually result in unsustainable economic development and the impoverishment of humankind (Tisdell, 2015). The fact of the matter is that the global human population relies on a narrow spectrum of food crops for its sustenance and traditional varieties of these food crops continue to be lost (Hausmann, *et al.*, 2004). Thus, the genetic diversity of most food crops is narrowing with the passage of time. It is, therefore, possible that diseases may adversely affect the productivity of several species of crops within a limited time-span. Unfortunately, the genetic resources that might have permitted

humans to address this problem may already be lost by the time this food crisis emerges, if it does happen. This is a legitimate concern.

The problem can be illustrated by Figure 3. As a result of improved crop varieties and technological progress in agriculture, development path ABCD might be followed. Incomes per head rise at first but eventually decline as the genetic diversity of crops is lost. On the other hand, if measures are adopted to conserve the genetic diversity of crops, a development path like ACE might be followed. This is a sustainable development path. Path ABCD results in distant generations being poorer than they need be. Eventually, they could be worse off than current generations and their incomes might even fall to subsistence level, a level indicated by line LM in Figure 3 (Tisdell, 2011).

**FIGURE 3:** *Lack of conservation of genetic diversity of crops (for reasons given in Table 2) could result in the unsustainable development path ABCD whereas conservation of a greater diversity of crops might result in sustainable path ACE being followed.*



Of course, a continuing reduction in the varieties of individual food crops does not necessarily result in development path ABCD being followed, but it is a possibility that worries many scientists. If it is a possibility, what should be done about it? This depends on how much current generations care about future generations. If current generations are only concerned for the welfare basically of their children and grandchildren (as seems likely, see for example, Pearce, 1998, pp. 70-71), then an unsustainable economic development path may be chosen rather than a sustainable one. Consequently, there will be little public support for saving crop biodiversity, especially if this is costly to do. Moreover, this course of action is likely to be reinforced if (a) the likelihood of unsustainable economic development as a result of failing to conserve crop biodiversity is believed to be low or if (b) individuals are not inclined to believe that this is going to happen, unless they see concrete empirical evidence of it occurring. But, if one waits for this evidence, then, by the time it is obtained, it may be too late to reverse the downward trend. Therefore, the possibility of this type of unsustainable development path poses a challenge for rational decision-making.

## METHODS OF CONSERVING VARIETIES OF TRADITIONAL FOOD CROPS IN THE PACIFIC ISLANDS AND ECONOMIC ISSUES

A number of different techniques exist for conserving a wide range of varieties of crops. These broadly include the following:

*In situ*. Farmers can conserve traditional varieties themselves in their own fields, and the wild relatives of cultivated crops can be conserved in protected areas.

*Ex situ*<sup>2</sup>. There are two basic techniques for *ex situ* conservation:

Cultivation on state experimental farms (for example, at Koronivia Research Station in Fiji) and in botanical gardens.

*In vitro* conservation. This involves the preservation of seeds or tissues of plants. Types of *in vitro* conservation of germplasm vary. For example, cold storage with replanting of germplasm at various intervals to obtain new seeds or tissue is practised in PNG. The Secretariat of the Pacific Community, has a conservation facility in Suva which involves deep-freezing of germplasm, cryo-preservation. This may reduce the frequency with which replanting is needed to sustain the germplasm.

All of these methods involve costs and none guarantee that the germplasm to be preserved will in fact be conserved. Farmers will not conserve traditional varieties, unless this is the most economic choice from their point of view<sup>3</sup>. They may have to be sufficiently subsidized if it is intended to conserve some varieties of crops *in situ*. Field cultivation *ex situ* also is not without problems. It usually depends on the maintenance of state funding. Furthermore, *ex situ* fields where some varieties are grown may experience different environmental conditions to those in their place of origin and may not survive. Furthermore, cross-fertilization with other varieties can occur where samples of the crop varieties are grown *ex situ* in fields. In addition, costs usually result in a small population of each variety being planted in conservation fields. This increases the vulnerability of this population to environmental disasters.

*In vitro* conservation also involves biological, social and economic hurdles. There is a possibility that germplasm may lose its fertility in storage. In many cases, periodic replanting and subsequent replacement is needed to keep germplasm viable. Consequently, similar problems can occur to those that arise for *ex situ* cultivation in fields. Most of the traditional food crops in the Pacific Islands reproduce vegetatively rather than by seed and this adds to the difficulties of *in vitro* conservation. It is also possible for the equipment used in *in vitro* fertilization to fail.

According to Rao and Hodgkin (2002, p. 12), “Even under optimum conditions, accessions held [under] *ex situ* storage [*in vitro*] will need to be regenerated after a number of years. The genetic diversity of conserved material must be preserved during germplasm regeneration and this is more complex and difficult in the case of out-crossing species than inbreeders (Porceddu and Jenkins, 1982)”. However, the fact that many traditional Pacific Island crops reproduce vegetatively should reduce the outcrossing problem. On the other hand, storing their tissues *in vitro* is more challenging than storing seeds of species which can be propagated from those seeds.

Because many of the traditional food crops utilized in Oceania reproduce vegetatively, not only is conserving their diversity challenging, but it is also of high importance from a sustainability point of view. For example, Bynum and Bynum (2014, p. 605) point out that “the fact that [cultured varieties] of bananas are clones means that they are especially susceptible to pests and disease, a real worry in the modern world”.

A further problem is that available funding (from governments and aid donors) for *ex situ* crop conservation projects may be slashed or may cease altogether after a gene bank is established. This can result in the abandonment of gene banks and the loss of the genetic diversity which was entrusted to them for conservation. Ragone (2006, Slide 30) reports that four of the seven Pacific breadfruit collections which were started in the Pacific Islands were abandoned by 2006. These were the collections in Kosrae (FSM), Pohnpei (FSM), Samoa and the Solomon Islands.

Although the conservation of crop diversity involves considerable costs, as far as I know, there have been no recent estimates of the cost of *ex situ* conservation in the Pacific Islands. The PNG Government, however, has stated:

*“Conservation and maintenance of these germplasm collections in field gene-banks are very expensive. A study undertaken by the PNG Department of Agriculture & Livestock (DAL) and the Agriculture Economics Department of the University of Sydney through funding from the Australian Centre for International Agriculture Research (ACIAR) in 1998 revealed that it was costing PNG around K183,000 annually to maintain four national germplasm collections of banana, sweet potato, cassava, aibika and taro in field gene-banks”. (FAO, 2009, p.16)*

These estimates were made over 20 years ago. No up-to-date estimates for the cost of conserving the genetic diversity of crops in the Pacific Islands as a whole appear to be available. Moreover, it seems that no cost-effectiveness analysis has been done. Given that a target is to conserve a particular quantity and mixture of genetic diversity, this type of analysis would consider the relative cost of achieving that goal by adopting alternative conservation methods. While this would be a difficult task, it ought to be attempted.

The economic benefit-side of cost-benefit estimation is also difficult to assess. The economic analysis given in the previous section seems to provide some guidance. It suggests that priority should be given to conserving the genetic diversity of staple food crops. On the whole, it seems that this has happened in the Pacific Islands. Nevertheless, the past only provides a limited guide to the future. Crops which are in demand as staples for food supply may not continue in high demand in the future. Tastes do change. Furthermore, the possibility cannot be ignored that some local food crops that are little used now might become more important as a source of food supply in the future. The PNG government points out that “There are no formal arrangements in place in collecting and conserving [these] under-utilized crop species” in PNG (FAO, 2009, p. 12). This also appears to be the case in other Pacific Island states and territories.

A further issue, which has economic implications, is how many gene banks should be established in the Pacific Islands and where. To what extent should the gene bank collections be centralized within countries and in the Pacific Islands as a whole? While centralization may reduce the

cost of *ex situ* conservation, the biological effectiveness of it could be reduced. There is also the question of the extent to which *ex situ* conservation of germplasm should be duplicated at different sites. While duplication will add to the cost of conservation, it is likely to reduce the risk of germplasm being irretrievably lost due to unfortunate events.

Another issue is the extent to which the crop germplasm of one country should be conserved in another country. Although in some cases, conservation of the germplasm of a less developed country in another country could be more effective in ensuring its conservation, many donor countries worry that they will lose control of the property rights in their germplasm. This can be a contentious political issue. Clearly, there are still many economic as well as other issues to be resolved in rationally determining the best strategies for conserving the germplasm for the wide range of varieties of crops which are present in the Pacific Islands.

## CONCLUDING REMARKS

The Pacific Islands (particularly Melanesia, especially New Guinea) are the ancient source of many important crops. Some (for example, bananas and taro) were already cultivated in the Pacific about 10,000 years ago. New Guinea has the distinction of being one of the first places on earth where agriculture began. Following the origins of agriculture in New Guinea, Pacific Islanders developed a huge variety of food crops over hundreds of years as they extended their settlement of the Pacific Islands. As a result, the Pacific Islands are a rich source of germplasm which can be utilized to sustain and improve food production. This stock of germplasm consists both of natural capital and heritage capital, but unfortunately, it is now diminishing following European contact and colonization of the Pacific Islands.

With greater economic globalization and the extension of market and monetary systems (as well as a result of advances in agricultural technology and science), loss in genetic diversity (as in other parts of the world) is continuing at a rapid rate. Some of the important socio-economic and related causes of this loss of genetic diversity in food crops in the Pacific Islands were identified. There is a risk that this continuing loss will eventually reduce human well-being and result in unsustainable economic development.

Economic circumstances were identified, which would magnify the reduction in the economic welfare of consumers, if genetic loss increases the cost of supplying food provided by traditional crops. The basic theory indicates that this loss is likely to be greatest for staple food crops, that is, those for which the absolute demand is large. This loss is also higher the more inelastic the demand is for such crops, but this is of secondary importance.

There is a paucity of economic analysis of alternative strategies to conserve crop biodiversity<sup>4</sup>. Little analysis has been done of the cost of conserving the biodiversity of food crops in the Pacific and virtually no cost-effectiveness analysis has been attempted. This paper has identified several of the cost-effectiveness issues which need consideration.

It seems that policies to conserve the germplasm of food crops in the Pacific have focused on staple food crops. Although the focus appears to be appropriate on the basis of the economic theory outlined here, this preference also needs to be qualified. This is because food crops which

are staples now may not always remain so. Minor indigenous food crops may prove to be in considerable demand in the future and so efforts to conserve their germplasm may prove to be economically valuable especially when the precautionary principle is taken into account (see, for example, Tisdell, 2010). Determining the economic value of conserving crop diversity is, therefore, a continuing but important challenge.<sup>5</sup>

## ENDNOTES

- <sup>1</sup> It would be useful to be able to quantify the loss of genetic variability in food crops in the Pacific, but there are inadequate available data to do this.
- <sup>2</sup> The Commission on Genetic Resources for Food and Agriculture (2010, p.58) in the Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture states there were (at the time this report was prepared) 2,500 botanic gardens worldwide holding 80,000 plant species and 1,750 individual gene banks globally storing 7.4 million accessions of which 25-30 per cent (1.9 – 2.2 million) are distinct, that is, not duplicates. It also points out that gene bank holdings are being increasingly concentrated in fewer countries.
- <sup>3</sup> The International Treaty on Plant and Genetic Resources for Food and Agriculture (ITPGRFA) was intended in part, to provide a means for providing economic incentives to farmers to undertake crop variety conservation. However, it has proven to be weak or ineffective in promoting this purpose (Brush, 2007; Tisdell, 2015, Ch. 10).
- <sup>4</sup> It is disappointing to find that the Commission on Genetic Resources for Food and Agriculture (2010) gives no attention to the economics of conserving plant genetic resources and procedures for doing this, for instance, in gene banks.
- <sup>5</sup> I wish to thank two anonymous reviewers for the helpful comments in an earlier draft of this article and those who commented on a presentation of it in a seminar in the Faculty of Economics and Business in Suva at the University of the South Pacific.

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## **An insight into public sector readiness for change – the Fiji experience**

*Neale J. Slack and Gurmeet Singh*

### **ABSTRACT**

*The purpose of this paper is to provide an insight into public sector readiness for change from the perspective of four dimensions, namely, change management, change communication, change resistance, and readiness for change; to determine associations between these four dimensions; and to establish a prediction model for readiness for change. Using a structured survey questionnaire, data was collected from the employees of the Maritime Safety Authority of Fiji (MSAF). These research findings suggest statistically significant positive correlations exist between three change variables, namely, change management, change communication, and readiness for change; whereas, negative correlations exist between change resistance and the other 3 variables. The results also show that change management, change communication, and change resistance added statistically significantly to the prediction of readiness for change. This paper makes its theoretical contribution to the scarce theoretical strands relating to change efforts of public enterprises; and practical contribution towards prediction of readiness for change, policy making, and strategic planning at government levels.*

**Keywords:** *Change management, change communication, change resistance, readiness for change, Fiji*

## INTRODUCTION

“Public sector reform (‘PSR’) is about strengthening the way that the public sector is managed. The public sector may be overextended – attempting to do too much with too few resources. It may be poorly organized; its decision-making processes may be irrational; staff may be mismanaged; accountability may be weak; public programmes may be poorly designed and public services poorly delivered. PSR is the attempt to fix these problems” (Schacter, 2000, p.1). However, introducing change into the public sector is extremely contentious and complex (Huerta Melchor, 2008), and is an enormous challenge (Isett et al., 2012; Piening, 2013).

“With so much research undertaken and information available on managing change, it stands to reason that change programmes today should be more successful than those of more than a decade ago” (Keller & Aiken, 2009, p.1). However, up to 70 percent of change efforts fail (Beer & Nohria, 2000; Isern & Pung, 2007; Patterson, 2000). Investigating further into why change programmes fail reveals that the majority stumble on precisely the thing they are trying to transform: employee attitudes and management behaviour, exacerbated by other factors, such as, poorly planned diagnosis and data quality (Di Pofi, 2002); inadequate budget, poorly deployed resources and poor change architecture (Keller & Aiken, 2009); poor change communication (Gilsdorf, 1998; Murdoch, 1999); organisational culture, change efforts, and change-agents (Bennebroek-Gravenhorst et al., 1999); and resistance to change (Maurer, 1996).

Change specialists (Amatayakul, 2005; Kirch et al., 2005; Kotter, 1996; Kuhar et al., 2004; O’Connor & Fiol, 2006) suggest that readiness for change is a vital antecedent to successful change implementation. Kotter (1996) opines that half of the organizational change failures result from organisational leaders’ inability to establish adequate readiness. Weiner et al. (2008) reinforce the opinion of Kotter, and state that where leaders have not prepared the organisation and its employees for change, anticipated undesirable consequences result - including change effort false starts, stalling of change efforts as resistance increases, and change effort failure.

Given the significant investment of time, energy, and resources involved in change efforts; high organisational change failure rates; the lack of reliability and validity of instruments used for measuring organisational readiness for change (Weiner et al., 2008); and that since 1998 various efforts at public service reform of the predecessor organisations leading up to the public enterprise (MSAF), and of MSAF, have failed to deliver the required change management outcomes; these factors set the stimulus for this research to develop a stronger knowledge base about readiness for change, ultimately to strengthen organisational and employee efforts (Weiner et al., 2008).

Using a structured survey questionnaire, data was collected from the population of the Maritime Safety Authority of Fiji (MSAF) employees, totaling 66, and deployed in 11 locations across Fiji. Descriptive and inferential statistical analysis is performed using the Statistical Package for Social Sciences.

The paper is organized as follows: “Literature Review” followed by the background; research problem, justification, and hypothesis of the study; research methodology; results and discussion; and finally conclusions and research implications.

## LITERATURE REVIEW

### READINESS FOR CHANGE

The importance of readiness for change and how to create it is widely published, however, independence of researcher empirical assessment of different types of organisational change, and the use of different theoretical perspectives, have resulted in a proliferation of definitions of readiness for change, and inconsistency regarding the conceptual terminology (Weiner et al., 2008) - the phenomenon is described by different terms - 'readiness for change' (Armenakis et al., 1993; Chonko et al., 2002; Cook & Scott, 2005; Devereaux et al., 2006; Jones et al., 2005; Rafferty & Simons, 2006; Rampazzo, et al., 2006; Simpson & Flynn, 2007), 'change readiness' (Clark et al., 1997; Maurer, 2001; Simon, 1996; West, 1998), 'organisational readiness' (Chan & Ngai, 2007), 'organisational readiness for change' (Fuller et al., 2007), and 'readiness for organisational change' (Cunningham et al., 2002; Holt et al., 2007), to name but a few. In this research, 'readiness for change' and 'change readiness' have been used interchangeably.

Weiner et al. (2008) suggests that typically two approaches are adopted by authors in describing readiness – in psychological terms, with employees' attitudes, beliefs and intentions emphasized (Armenakis et al., 1993; Barrett et al., 2005; By, 2007; Rafferty & Simmons, 2006); and in structural terms, with organisational capabilities and resources emphasized (Prochaska et al., 2006; Levesque et al., 2001; McCluskey & Cusick, 2002). However, literature highlights a wide variation in the indicators of readiness, and the target of the readiness (individual, group, or organizational) (Weiner et al., 2008).

Weiner et al. (2008), at the individual level, define readiness for change as the degree by which employees are psychologically and behaviorally inclined toward implementation of organisational change. Armenakis et al. (1993, pp.681-682) define readiness for change as "the cognitive precursor to the behaviours of either resistance to, or support for, a change effort", and is the approach whereby employees' beliefs and attitudes about an organisational change effort are modified to perceiving the change is necessary and achievable. According to Armenakis et al., (1993), readiness for change is comprised of both resistance to change, and support of change, and is viewed as a continuum, from one extreme to the other. In contrast, at the organisational level, Lehman et al. (2002) define organisational readiness for change as the combination of the perceptions of motivational readiness, organisational resources, staff attributes, and organisational climate; however, also notes "other factors can influence whether specific interventions are adopted and implemented" (p.198).

It could be assumed that when employees are ready to accept the change, low levels of resistance to change or high levels of readiness for the change are indicators for effective organisational change (Elving, 2005). Experts (Armenakis & Harris, 2002; Elving, 2005; Kotter, 1996; Scott et al., 1995) contend that when high organisational readiness for change is present, employees are highly committed to the change effort, apply increased effort toward the change effort, and exhibit greater steadfastness in the presence of difficulties.

### CHANGE MANAGEMENT

Berger (1994, p.7) defines change management as "the continuous process of aligning

an organisation with its marketplace and doing it more responsively and effectively than competitors.” While Burnes (2000) defines change management as a continuous process of experiment and adaptation intended to align an organisation’s capacity with the demands of a volatile environment, Kotter (2011) defines the concept as a method for progressing individuals, teams, and organisations to an intended future state. According to Perkov et al. (2008, p.3), “Change management is a set of structured processes and actions, tools and techniques for managing the human side of business changes in order to align organisation’s goals with changed demands of the environment”.

Historically, organisations (in particular public service organisations) have been designed for stability rather than change (Malek & Yazdanifard, 2012a). However, in this fast changing business environment we operate in, typified by the absence of environmental stability (Breu & Benwell, 1999), effective change management is essential to coping with the enormity of change, while increasing benefits and reducing the risk of failure during the change effort (Malek & Yazdanifard, 2012a).

#### CHANGE COMMUNICATION

Change communication has been described “as the process by which information is exchanged and understood, with the objective of motivating or influencing behaviour” (Daft, 1997, p.570). Bourke & Bechervaise (2002, p.15) define change communication as the mechanism required “to construct, deconstruct and reconstruct existing realities in order to effect change”. Organisational researchers acknowledge the criticality of change communication in successful organisational change and organisational change management (Fairhurst & Wendt, 1993; Lewis & Seibold, 1996; Rogers, 1995). Notwithstanding, Lewis (2000) contends that methodical research into the effectiveness of communication strategies in change is scant.

As organisations attempt to endure increasing economic, technological, and social turmoil, they depend increasingly on their employees to acclimate to change (Stanley et al., 2005, p. 429). In addition, considering that communication is foundational to the success of all organisations during organisational change efforts, communication is even more critical (Bennebroek-Gravenhorst, et al., 2006; Elving, 2005; Elving & Hansma, 2008; Kotter, 1999). However, change communication is typically inadequately applied, creates a challenge for most organisations (D’Aprix, 1996, p.3), is often ineffective (Burke, 2008; Cummings & Worley, 2009; Fernandez & Rainey, 2006), and when inadequate, can adversely impact the change effort (Llenza, 2008). The consequences of poorly managed organisational change communication are resistance to change, and a lack of change readiness, amplifying the negative facets of the change (DiFonzo et al., 1994; Smelzer & Zener, 1992). However, the importance assigned to communication differs in the literature, and managerial change literature leans towards designating less importance to communication (Cheney et al., 2004; Lewis et al., 2006; Lewis & Seibold, 1998).

#### CHANGE RESISTANCE

The term ‘resistance’ has been defined as “coherence to any attitudes or behaviours that frustrate organisational change goals” (Chawla & Kelloway, 2004, p.485); and as “any behaviour that retains the status quo in spite of applied forces to change the status quo” (Zaltman & Duncan,

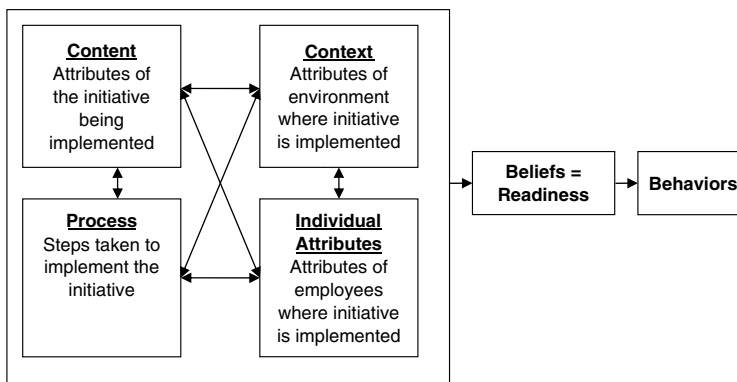
1977, p. 63).

As environmental forces escalate the requirement for employees to adjust to change (Ployhart & Bliese, 2006), employees often resist change (Cummings & Worley, 2009; Strelbel, 1996). Resistance to change is deemed to be the “enemy of change” (Yue, 2008, p.85); resistance to change is recognized as something to be eliminated or overcome (Waddell & Sohal, 1998); and employees’ resistance to change is frequently disregarded in organisations and in research (Fox & Amichai-Hamburger, 2001; Kiefer, 2005; Liu & Perrewé, 2005). Fine (1986) “suggests that a major cause of resistance to change is inept management” (pp.91-92), however, change-agents and managers have at their avail a choice of strategies to address employees’ resistance to change (Kotter & Schlesinger, 1979). The communication strategy and employee opportunity to participate in the change have been identified as the most effective methods of allaying resistance to change and increasing readiness (Ford et al., 2008; Frahm & Brown, 2007; Jimmieson et al., 2008; Van Dam et al., 2008).

## THEORETICAL FRAMEWORK AND CONCEPTUAL MODEL

The theoretical framework of this study is based on the research of Holt et al. (2007) who classified the antecedents of readiness for change into four categories namely, individual, process, context and content factors (Figure 1).

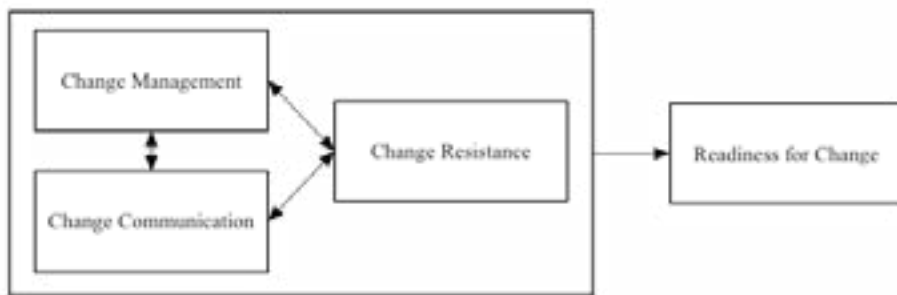
**FIGURE 1:** *Theoretical Framework: Relationship between Content, Process, Context and Individual Attributes with Change Readiness*



Source: Holt et al. (2007)

The conceptual model applied to this research depicts the relationship between three antecedents for readiness for change, which are linked to the successful implementation of organisational reform. These three factors (as discussed in the literature review section) are change communication, change management and change resistance (Figure 2).

**FIGURE 2:** Conceptual Model for this research: Relationship between Change Management, Change Communication, and Change Resistance with Change Readiness



## BACKGROUND

### PUBLIC SECTOR REFORM IN DEVELOPING COUNTRIES, THE SOUTH PACIFIC AND FIJI

Many developing countries gained independence in the 1970's, including the majority of the Pacific Island Countries and Territories (PICT) (Knapman & Saldanha, 1999). During the next decade government expenditure as a percentage of GDP grew to unsustainable levels, facilitated by exceptional high influxes of aid funding and economic mismanagement, and drove many governments to fiscal crisis (Duncan et al., 1999). "Many developing countries also established a heavy reliance on State Owned Enterprises (SOEs) that placed a heavy financial burden on governments" (Karan, 2010, p.26). Donors questioned the developing country SOE model, and offered funding contingent on reduction in the public sector. Since the 1990's there has been a turnaround, and public sector development has been promoted and has emerged (Schacter, 2000).

PICT governments' reform agendas are focused on mitigation of demand on their limited resources (Reddy, 1997) and improvement in efficiency, effectiveness and performance (Pollitt et al., 2007); however, this has been a slow process (Asian Development outlook, 2004). "Fiji, like other Pacific post-colonial developing nations, relied heavily on its public sector for socio-economic development and nation building" (Sharma & Lawrence, 2009, p.268). The Department of Public Enterprises was established in Fiji under the Public Enterprise Act (1996). This Act provided a markedly different governance structure for SOEs whereby government retained ownership, however, strategic direction and commercial performance was provided by a government appointed board (Sharma & Lawrence, 2009).

### REFORM LEADING TO THE MARITIME SAFETY AUTHORITY OF FIJI (MSAF)

In 1998, under the Public Enterprise Act (1996), the Marine Department was declared a 'Reorganization Enterprise' resulting in the establishment of the Shipping Corporation Fiji Limited (SCFL). SCFL was wound up in 1999. The Marine Fleet was renamed Government Shipping Services (GSS), and the Marine Department became the Fiji Islands Maritime Safety Administration (FIMSA). In spite of the name changes, and minimal structural and organisational

reform, no tangible service delivery improvement resulted. In 2005, the reorganisation of Fiji Ports (Ports Terminal Ltd. and Maritime Ports Authority of Fiji) resulted in the establishment of the Fiji Ports Corporation Limited (FPCL) and in the transfer of all regulatory functions to FIMSA. Considering FIMSA administered only a minimal portion of the Fiji government's international and national maritime safety obligations, and failed to adopt a customer focused and business oriented structure and philosophy, in 2006 FIMSA was declared a Reorganisation Enterprise (Secretariat of the Pacific Community, 2008). In 2011 FIMSA was wound up, and the Maritime Safety Authority of Fiji (MSAF) was established, with a much wider set of responsibilities, and a customer-centric mandate.

## **RESEARCH PROBLEM, JUSTIFICATION, AND HYPOTHESIS OF THE STUDY**

The main research problem is that change readiness is critically important to the success of change programmes; however, it is quite difficult to determine whether an enterprise is ready for a change effort; limited 'immature' assessment instruments exist to determine readiness, that typically focus on employee readiness and not organisational readiness for change (Combe, 2014; Weiner et al., 2008); and readiness for change lacks empirical studies (Weiner, 2009). The main research problem and history showed that since 1998 efforts at public sector reform of the predecessor organisations leading up to the MSAF failed to deliver the required change management outcomes, and the ongoing public sector reform in Fiji, set the stimulus for this research. This research provides insight into readiness for change from the perspective of four dimensions, namely, change management, change communication, change resistance, and readiness for change; determines associations between these four dimensions; and establishes a prediction model for readiness for change.

One hypothesis is tested in this research relating to the dependent (predicted) variable, readiness for change at MSAF. The null hypothesis is simply a default position that there is no relationship or no difference existing between the variables.

$H_0$ : (No linear relationship exists)

$H_1$ : (Linear relationship exists)

$H_0$ : There is no statistically significant correlation at all; i.e. none of the variables (Change Management, Change Communication, and Change Resistance) belongs in the prediction model for Readiness for Change.

$H_1$ : There is a statistically significant correlation; and at least one of the variables (Change Management, Change Communication, and Change Resistance) belongs in the prediction model for Readiness for Change.

## **RESEARCH METHODOLOGY**

The survey instrument for this research is a structured survey questionnaire. This was administered



as a self-completion, written survey, face-to-face, in focus groups. The surveys were personally administered to the population of MSAF employees, dispersed across eight maritime locations of Fiji, namely, Labasa, Savusavu, Taveuni, Levuka, Rakiraki, Nadi/Denarau, and Kadavu. The MSAF employee database identified the employee population. All employees were invited to participate in the survey, and the sample size totaled 66. The questionnaire was pretested in Suva on a sample size of 10 respondents, after which minor changes were made. Justification for the use of a self-completion, written, face-to-face, in focus groups questionnaire as a survey instrument in this research was that this proved to be quicker and cheaper to administer, as many respondents were able to complete the questionnaire simultaneously (Bryman & Bell, 2007), and it was reasonable to expect that response rates would be high, completion rates high, and response bias mitigated (Daniel & Berinyuy, 2010). Completion of the questionnaire took approximately 15-20 minutes. The questionnaire constitutes 73 questions and statements. Section A consists of a demographic section of 12 questions; and Sections B-E consists of 61 statements/questions, based on a 5-point Likert scale. The research assistant was present in administering the questionnaire and this allowed for a greater response rate. The descriptive and inferential statistical analysis (the stepwise (backward) method of building the multiple linear regression model) was performed using the Statistical Package for Social Sciences. The stepwise (backward) method has an advantage over normal stepwise regression, because “it is possible for a set of variables to have considerable predictive capability, even though any subset of them does not. Forward selection and stepwise regression will fail to identify them. Because the variables do not predict well individually, they will never get to enter the model to have their joint behavior noticed” (Dattalo, 2013, p.89). The stepwise (backward) method commences with all variables in the model, and enables their cumulative predictive capability to be seen (Dallal, 2012).

## **RESULTS AND DISCUSSION**

### **DEMOGRAPHICS**

The employee respondents’ response rate was 95% (63 questionnaires completed, with 3 employees opting not to participate), and the completion rate was one hundred percent.

These responses were statistically analyzed using the Statistical Package for Social Sciences. Table 1 shows the demographic characteristics of the respondents in this study included forty-seven (47) males while there were only sixteen (16) females. Indigenous Fijians were numbered forty-seven (47) while there were only sixteen (16) Fijians of Indian origin. The sample mostly consisted of employees aged 31-40 years (18), 21-30 years (17), and 41-50 years (16). In terms of employee length of service with MSAF, a greater proportion of respondents had less than 1 year’s service (24), followed by 1-5 years (19). Technical roles dominated (42) over non-technical roles (21). Dominant maritime qualifications held by employees included no qualification (24) followed by boat master license (10). Gross income per annum of respondents (Fiji Dollars) predominantly was in the range of 11,000 to 20,000 (39) followed by 21,000 to 30,000 (10).

**TABLE 1:** Demographic profile of the sample

<i>Age (Years)</i>	<i>21-30</i>	<i>31- 40</i>	<i>41-50</i>	<i>51 - 60</i>	<i>Above 60</i>									
Frequency	17	21	16	8	1									
Percent	27	33.3	25.4	12.7	1.6									
<i>Gender</i>	<i>Male</i>		<i>Female</i>											
Frequency	47		16											
Percent	74.6		25.4											
<i>Marital Status</i>	<i>Single</i>		<i>Married</i>		<i>Separated</i>									
Frequency	11		51		1									
Percent	17.4		81.0		1.6									
<i>Ethnicity</i>	<i>Fijian</i>		<i>Indo-Fijian</i>											
Frequency	47		16											
Percent	74.6		25.4											
<i>Academic Education</i>	<i>Masters</i>		<i>Degree</i>		<i>Diploma</i>		<i>Certificate</i>		<i>No Formal Education</i>					
Frequency	4		8		16		28		7					
Percent	6.3		12.8		25.4		44.4		11.1					
<i>Maritime Education</i>	<i>Class 2 Master / Engineer</i>		<i>Watchkeeper &amp; Class 3 Master / Engineer</i>		<i>Class 4 &amp; 5 Master / Engineer</i>		<i>Class 6 Master / Engineer</i>		<i>Boat Master</i>		<i>No Class Education</i>			
Frequency	3		13		7		6		10		24			
Percent	4.8		20.7		11.2		9.5		15.9		38.1			
<i>Length of Service (Years)</i>	<i>&lt;1</i>		<i>1 - 5</i>		<i>6 - 10</i>		<i>11 - 15</i>		<i>16 - 20</i>		<i>21 - 25</i>		<i>&gt;25</i>	
Frequency	24		19		5		5		4		1		5	
Percent	38.1		30.2		7.9		7.9		6.3		1.6		7.9	
<i>Current Job Status</i>	<i>Executive</i>		<i>Senior Management</i>		<i>Middle Management</i>		<i>Professional Staff</i>		<i>Other</i>					
Frequency	2		4		9		44		4					
Percent	3.2		6.3		14.3		69.8		6.3					
<i>Department</i>	<i>Qualifications &amp; Licensing</i>		<i>Standards &amp; Compliance</i>		<i>Enforcement &amp; Compliance</i>		<i>Port Regulatory</i>		<i>Administration</i>					
Frequency	8		9		22		3		21					
Percent	12.7		14.3		34.9		4.8		33.4					
<i>Employment Status</i>	<i>Permanent</i>		<i>Contract</i>		<i>Temporary</i>									
Frequency	17		44		2									
Percent	27.0		69.8		3.2									
<i>Length of Service as a Civil Servant (Years)</i>	<i>&lt; 1</i>		<i>1-5</i>		<i>6-10</i>		<i>11-15</i>		<i>16-20</i>		<i>21-25</i>		<i>&gt;25</i>	
Frequency	17		21		8		6		5		1		5	
Percent	27.0		33.3		12.7		9.5		7.9		1.6		7.9	
<i>Gross Income (FJD) per annum</i>	<i>≤\$10K</i>		<i>\$11K-\$20K</i>		<i>\$21K-\$30K</i>		<i>\$31K-\$40K</i>		<i>\$41K-\$50K</i>					
Frequency	3		39		10		7		4					
Percent	4.8		61.9		15.9		11.1		6.3					

## RELIABILITY

Table 2 shows the results of the Cronbach's Alpha Coefficient for Internal Efficiency for this survey instrument. Cronbach's alpha values were used to test the reliability of the survey instrument and the result was .860. Individually, Sections B, C, D & E were also considered reliable, with alpha values of .941, .711, .912, and .874 respectively. Based on the Cronbach's alpha values calculated for this survey instrument, the instrument was considered reliable, with a high degree of internal consistency, thereby adding validity and accuracy to the interpretation of this research's data.

**TABLE 2:** *Coefficients of Internal Consistency*

Change Dimension	Cronbach's Alpha Values
Change Management	.941
Change Communication	.711
Change Resistance	.912
Readiness for Change	.874
Overall	.860

## BIVARIATE CORRELATIONS

Considering the variables in this data were normally distributed, Pearson Product-Moment Correlation Coefficient was utilized to determine whether bivariate correlations existed, and the strength of the correlations, between the four dimensions Change Management, Change Communication, Change Resistance, and Readiness for Change.

Table 3 shows that the correlation between Change Management and Change Communication ( $r = .752$ ) represented a high positive correlation at the .01 level, and was statistically significant. The  $p$ -value for the correlation ( $p = .000$ ) was  $< .05$ , which suggested the correlation was statistically significant at the 0.05 level. These results are in accordance with change management literature that suggests a relationship between organisational change management success and communication (Elving, 2005). Effective change communication is fundamental to change management success (Donaldson et al., 2005; Papantos, 2015). Organisational researchers acknowledge the criticality of change communication in successful organisational change and organisational change management (Lewis & Seibold, 1996; Rogers, 1995). The correlation between change management and change communication can aid organisations, change agents, customers, management and staff to cope with change and its effects (Malek & Yazdanifard, 2012b). Notwithstanding, Lewis (2000) contends that methodical research into the effectiveness of communication strategies in change is scant.

**TABLE 3:** Parametric Correlations – By Dimension

			Readiness for Change	Change Management	Change Communication	Change Resistance
Pearson Correlation	Readiness for Change	Correlation Coefficient	1	.668**	.666**	-.347**
		Sig. (1- tailed)	.	.000	.000	.003
	Change Management	N	63	63	63	63
		Correlation Coefficient	.668**	1	.752**	-.244
		Sig. (1- tailed)	.000	.	.000	.027
	Change Communication	N	63	63	63	63
		Correlation Coefficient	.666**	.752**	1	-.128
		Sig. (1- tailed)	.000	.000	.	.159
	Change Resistance	N	63	63	63	63
		Correlation Coefficient	-.347**	-.244	-.128	1
		Sig. (1- tailed)	.003	.027	.159	.
		N	63	63	63	63

\*\* Correlation is significant at the 0.01 level (2-tailed) 0.05 level.

Table 3 shows that the correlation between Change Communication and Readiness for Change ( $r = .666$ ) represented a moderate positive correlation at the .01 level, and was statistically significant. The  $p$ -value for the correlation ( $p = .000$ ) was  $< .05$ , which suggested the correlation was statistically significant at the 0.05 level. These results are in accordance with previous research that change communication was associated with participants' readiness for change (Eby et al., 2000; Wanberg & Banas, 2000, Weber & Weber, 2001); that when employees receive practical and timely information about a change, they are more inclined to assess the change more positively and display enhanced readiness for change (Miller et al., 1994; Wanberg & Banas, 2000); and that suggests strong support for the association of communication with readiness for change (McKay et al., 2013).

Table 3 shows that the correlation between Change Management and Readiness for Change ( $r = .668$ ) represented a moderate positive correlation at the .01 level, and was statistically significant. The  $p$ -value for the correlation ( $p = .000$ ) was  $< .05$ , which suggested the correlation was statistically significant at the 0.05 level. These results are in accordance with previous research. Change management experts prescribe various change management strategies to create readiness for change (Weiner, 2009; Armenakis et al., 1993; Kotter, 1996), including “disconfirming organisational members' conceptions of the current situation, stimulating their dissatisfaction with the status quo, creating an appealing vision of a future state of affairs, and fostering a sense of confidence that this future state can be realized” (Armenakis et al., 1993; Kotter, 1996). Change management conditions likely to create readiness for change include, uniform leadership messages and actions, information sharing, and shared experience (Klein & Kozlowski, 2000). Conversely, employees are unlikely to perceive readiness for change when leaders communicate inconsistent messages or act in inconsistent ways, when limited opportunity to interact and share information, or when employees do not have a common basis of experience. Variability in readiness perceptions indicates lower organisational readiness for change and could signal

problems in implementation efforts that demand coordinated action among interdependent actors (Weiner, 2009).

Table 3 shows that the correlation between Readiness for Change and Change Resistance ( $r = -.347$ ) represented a low negative correlation at the .01 level. The  $p$ -value for the correlation ( $p = .003$ ) was  $< .05$ , which suggested the correlation was statistically significant at the 0.05 level. These results are in accordance with previous research which suggests that readiness for change is a precursor to resistance to change (Armenakis et al., 1993); change resistance and readiness have often been situated at opposing extremes of the same spectrum (Armenakis et al., 1993); and, when readiness for change is high, employees are more likely to be part of the change process (Armenakis & Harris, 2002; Madsen et al., 2005), however, when readiness for change is low, employees are likely to resist the change (Weiner et al., 2008). Strategies for tackling resistance to change (such as communication and participation) are reported as literally generating readiness (Armenakis et al., 1993).

Table 3 shows that the correlation between Change Communication and Change Resistance ( $r = -.128$ ) represented a low negative correlation at the .01 level. The  $p$ -value for the correlation ( $p = .159$ ) was  $> .05$ , which suggested the correlation was not statistically significant at the 0.05 level. These results show a negative correlation (in line with previous research), however, the correlation between Change Communication and Change Resistance was not statistically significant (not in line with previous research). A negative correlation between change communication and resistance to change has been extolled in research literature (McKay et al., 2013); appropriate change communication resulted in lower intent to resist change (McKay et al., 2013; Wanberg & Banas, 2000); and change communication is deemed an effective way to restrain resistance to change (Ford et al., 2008; Van Dam et al., 2008). The findings in this research could hold important implications suggesting that other factors may affect the change communication/change resistance correlation. It is recommended that further research be undertaken to investigate this finding.

Table 3 shows that the correlation between Change Management and Change Resistance ( $r = -.244$ ) represented a negligible negative correlation at the .01 level. The  $p$ -value for the correlation ( $p = .027$ ) was  $< .05$ , which suggested the correlation was statistically significant at the 0.05 level. These results are in accordance with previous research. Literature highlights that resistance to change exists, and is a major concern for organizations (Maurer, 1996; Waddell & Sohal, 1998). While some resistance to change is inevitable, inept change management strategies can often cause more severe problems (Baker, 1989). Change-agents and management have a range of change management strategies to address resistance to change, that are dependent on the type of change, time frame, and resources available (Kotter & Schlesinger, 1979).

#### MULTIPLE LINEAR REGRESSION

Considering that readiness for change is critically important to the success of change programmes (Combe, 2014), and the publicized significance of the impact of Change Management, Change Communication, and Change Resistance, on Readiness for Change (DiFonzo et al., 1994; Elving, 2005); a multiple linear regression analysis was conducted to evaluate whether Change

Management, Change Communication, and Change Resistance (independent variables) predicted Readiness for Change (dependent variable). One hypothesis is tested in this research:

$H_0$ : There is no statistically significant correlation at all; i.e. none of the variables (Change Management, Change Communication, and Change Resistance) belongs in the prediction model for Readiness for Change.

$H_1$ : There is a statistically significant correlation; and at least one of the variables (Change Management, Change Communication, and Change Resistance) belongs in the prediction model for Readiness for Change.

The researcher tested the data against a series of multiple regression assumptions, the assumptions were met, and thus the researcher was confident about any inference/predictions gained from the model – 1. Normality: skewness and kurtosis (ranged between -2 and +2); histograms, Q-Q plots and boxplots reinforced these results; Shapiro-Wilk test (Sig. values > .05) showed no statistically significant difference from a normal distribution could be demonstrated at the .05 level; and scatterplots of standardized residuals showed that the data met the variance and linearity assumptions. 2. Outliers: standardized residuals lay between  $\pm 2$  to 3 standard deviations of zero, indicative of no outliers. 3. Autocorrelation: Durbin-Watson value of 1.440 shows that the residuals were not correlated. 4. Multicollinearity: Tolerance values ranged from .412 to .934 and VIF values ranged from 2.429 to 1.071 and show that multicollinearity was not a concern.

Table 4 shows that the 'R' (Multiple Regression Coefficient) value (.743) indicated a moderate level of prediction of the dependent (predicted) variable. The R Square value (.553) indicated that the independent variables explain 55.3% of the variability of the dependent (predicted) variable, Readiness for Change. The Adjusted R Square value (.530) indicated that the model explained 53.0% of the variability of the response data around its mean; hence the model appeared not to fit the data well. However, it is difficult to predict human perceptions, hence lower R Square values and Adjusted R Square values were expected (Onditi, 2013).

**TABLE 4:** *Model Summary Table*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.743 <sup>a</sup>	.553	.530	.608	1.550

a. Predictors: (Constant), Change Management, Change Resistance, Change Communication.

b. Dependent Variable: Readiness for Change

Table 5 shows that at least one of the independent variables statistically significantly predicted the dependent variable:  $F(3, 59) = 24.289, p < .0005, R^2 = .553$

**TABLE 5:** Anova Table

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	26.958	3	8.986	24.289	.000 <sup>b</sup>
Residual	21.828	59	.370		
Total	48.787	62			

a. Dependent Variable: Readiness for Change

b. Predictors:(Constant), Change Management, Change Resistance, Change Communication.

Table 6 shows that Change Communication ( $p = .003$ ), Change Resistance ( $p = .018$ ), and Change Management ( $p = .026$ ), with  $p$ -values  $< .05$  contributed to the model.

**TABLE 6:** Coefficients Table

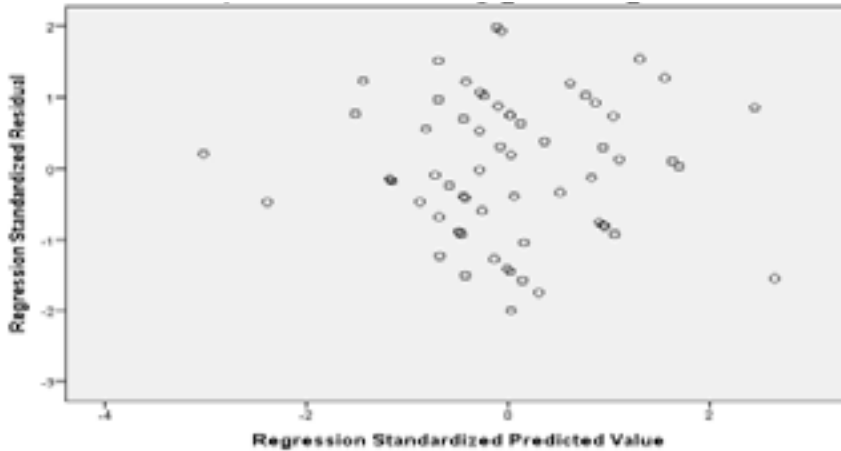
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant) Change Communication	.678	.745		0.91	.367	-.813	2.168	.431	2.322
	.695	.228	.405	3.050	.003	.239	1.15		
Change Resistance	-.378	.155	-.220	-2.440	.018	-.688	-.068	.934	1.071
Change Management	.358	.157	.310	2.282	.026	.044	.671	.412	2.429

Table 7 shows that the means of the residuals are zero, as is expected. A Scatterplot was prepared and showed that the data was randomly distributed – Figure 3.

**TABLE 7:** Residual Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.875	4.6101	2.868	.659	63
Residual	-1.220	1.206	.000	.593	63
Std. Predicted Value	-3.022	2.644	.000	1.000	63
Std. Residual	-2.005	1.983	.000	.976	63

a. Dependent Variable: Readiness for Change

**FIGURE 3:** Scatterplot – Dependent Variable – Readiness for Change

In summary, a stepwise (backward) multiple regression was conducted to evaluate whether three independent variables, namely, Change Management, Change Communication, and Change Resistance were necessary to predict Readiness for Change (dependent variable). At step 1 of the analysis the three independent variables were entered into the regression equation. Change Communication ( $p = .003$ ), Change Resistance ( $p = .018$ ), and Change Management ( $p = .026$ ), with  $p$ -values  $< .05$  contributed to the model:  $F(3,59) = 24.289$ ,  $p < .0005$ ,  $R^2 = .553$ .

All of the three variables added statistically significantly to the prediction,  $p < .05$ .

The multiple correlation coefficient ( $R = .753$ ) indicated approximately 55.3% of the variance of Readiness for Change could be accounted for by Change Communication, Change Resistance, and Change Management. Thus, the regression equation for predicting Readiness for Change was:

$$Y_{\text{predicted}} = b_0 + b_1 \cdot x_1 + b_2 \cdot x_2 + b_3 \cdot x_3$$

( $Y_{\text{predicted}}$  was the dependent variable Change Readiness)

$$\text{Readiness for Change} = (.678) + (.358 \cdot \text{Change Management}) + (.695 \cdot \text{Change Communication}) - (.378 \cdot \text{Change Resistance})$$

For this model, Change Management,  $t(59) = 2.2820$ ,  $p < .05$ ; Change Communication,  $t(59) = 3.0500$ ,  $p < .05$ ; and Change Resistance,  $t(59) = -2.4400$ ,  $p < .05$ ; were significant predictors of Readiness for Change. Thus, the null hypothesis is rejected. There is a statistically significant correlation; and at least one of the variables (Change Management, Change Communication, and Change Resistance) belongs in the model.



## **CONCLUSIONS AND RESEARCH IMPLICATIONS**

The main objective of this research was to provide insight into public sector readiness for change; to determine associations between change management, change communication, change resistance, and readiness for change; and to establish a prediction model for readiness for change. The research findings suggest that statistically significant positive correlations exist between three change variables, namely, change management, change communication, and readiness for change; and, negative correlations exist between change resistance and the other 3 variables. These findings were typically in line with previous research. While a negative correlation was shown between Change Communication and Change Resistance, the correlation was not statistically significant (not in line with previous research). This finding could hold important implications suggesting that other factors may affect the Change Communication/Change Resistance correlation. It is recommended that further research be undertaken to investigate this finding. The multiple linear regression findings show that change management, change communication, and change resistance added statistically significantly to the prediction of readiness for change.

Readiness for change is critically important to the success of public sector reform. However, it is quite difficult to determine whether a public enterprise and its employees are ready for a change effort; limited 'immature' assessment instruments exist to determine readiness; and there exists a dearth of studies that incorporate a practitioner viewpoint (Pettigrew et al. 2001). This study undertaken by practitioners/researchers makes its theoretical contribution primarily to the scarce theoretical strands relating to change efforts of public enterprises and assessment instruments, and practical contribution towards prediction of readiness for change, policymaking, and strategic planning at government levels.

This study has several limitations. First, the sample size is small due to only one public sector undertaking being part of this research. The second limitation of this study relates to the fact that our findings are not generalisable, and the small country (and small public sector undertaking) focus meant that we had to be careful in protecting the confidentiality of our participants. Lastly, we recognize that our research study covers an analysis of three independent variables (Change Management, Change Communication, and Change Resistance) in the prediction model for Readiness for Change, whilst other independent variables exist that could account for variability of the dependent (predicted) variable, Readiness for Change.

It is important that future research focus on more in-depth, empirical studies (Kuipers, 2014), and longitudinal studies (Pettigrew et al. 2001), of the reform process and readiness for change in various public contexts (Kuipers, 2014), practical directions for success (Kuipers, 2014), and the prediction of readiness for change. This research contributes to knowledge by providing a statistically significant model for prediction of readiness for change in support of such future research.

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## **Regulations, Costs and Informality: The Case of Fiji**

*Dibyendu Maiti, Devendra Narain & Sunil Kumar*

### **ABSTRACT**

*Informal sector is considered to be a 'cushion' for the majority of workers in the developing world, where the formal sector jobs are limited and social securities for the unemployed do not exist. While the size of the sector is quite large in the developing world, it appears to be relatively low in Fiji even when the economic growth of the country has been abysmally low during the last three decades. This is because the entry requirement to the informal sector has been quite stringent and time consuming, and may have led individuals to either remain unemployed or concentrate on subsistence production. Relative flexibility for entry and running businesses in the informal sector would not only improve the economic condition of the workers, but also overall economic growth. Separate and flexible legislations are, therefore, needed for the informal sector to grow and contribute to the economy.*

**Keywords:** *Informal sector, starting business, governance, regulation*

## **INTRODUCTION**

An individual who does not find any engagement in the formal setting with a clear set of rules and regulations often goes outside the sector to find employment for survival. This sector is known as the 'informal sector' and the size of the sector happens to be substantially large in the developing world (See ILO 2012). While the size and level of informality, as defined in the literature, is associated with unpleasant images of developing countries often draped in poverty reflecting social insecurity, low productivity, and non-compliance with laws and regulations, no doubt it addresses to a large extent the unemployment problems and social security. Despite many associated ills of the sector, it has the huge potential to absorb workers, and played a very important role at various stages of development and transition in the past in several parts of the world (Lewis, 1954). Such employment has increased in recent years and appears to be an integral part of the developing economies around the world. In some respects, the expansion of the informal sector precludes the establishment and expansion of the formal sectors (Chen, 2007; ILO-WTO, 2009; Maiti and Sen, 2010). In recent years, many developing countries have espoused the importance of the informal sector towards national employment and overall development. The most important challenge for the development practitioners is to find out suitable strategies to graduate more and more workers from the informal to the formal sector. On the one hand, a lot of attention is now being given to understand the contribution of informal sectors and design flexible strategies to promote the sector so that they could raise earnings and productivity and eventually shift to the formal sector. On the other hand, various countries bring rigidity to discourage such activities in the informal sector. But, it is often argued that regulations tend to impose constraints and distort the markets where the fundamentals are not strong. In such circumstances, incentives for factor reallocation, capital accumulation, competition, and innovation remain subdued (De Soto, 1989; Loyaza et al., 2005). A developing economy always has a dilemma to choose which one should be adopted, particularly when unemployed workers cannot be compensated for social benefits. This is the vital question for sustainable growth and development of Fiji as well, when it has been able to lift up the economic growth in recent years after a couple of decades. This paper attempts to investigate the size of the informal sector in Fiji and offer some explanations for this.

Conventionally, it is considered that the level of informality tends to be a bit higher in the presence of greater regulation (Loyaza, 1994; Schneider and Enste, 2000; Besley and Burgess, 2004; Williams and Round, 2007 & 2008). The obvious conclusion is that the relative size of informality is likely to be high if the cost of entry into the formal sector is high. Whether this is always true remains a question. It can be argued that if the level of rigidity in rules and regulations for organising activities in the informal sectors is high, the semi-skilled and unskilled workers who can find employment in the formal sector would prefer to remain unemployed or rely on 'subsistence'. With greater freedom and flexibility nascent entrepreneurship located in the small scale enterprises could flourish. The study attempts to investigate this issue for Fiji.

Fiji is a small island economy with limited economic activities and has shown poor growth during the last three decades. It belongs to lower middle income group with a little higher than \$4000 USD per capita annual income. The informal sector is estimated to be contributing

around 17.1 percent of GDP on average from 2008 to 2010. With regards to the size of informal employment, around 42.3 percent of all employed persons on average were employed in the sector during this period, while around 12.9 percent were considered to be subsistence workers. According to the joint report produced by ILO and World Trade Organisation in 2009, the size of informal economy as a percentage of GDP<sup>1</sup> was 30.4%, 26.8% and 21.2% respectively in North Africa, Asia and the Caribbean region. The informality as a percentage of employment was 52.2 percent in Latin America, 78.2 percent in Asia and 55.7 percent in Africa.<sup>2</sup> It appears that the size of informality in Fiji is slightly lower than that of comparable developing countries. This is an important observation when the Fijian economy has not even grown more than 1.5 percent (annually) during the last three decades and the industrial sector has not demonstrated any significant growth. As a result of the low growth, a significant section of the population still lives under subsistence. This paper looks at the conceptual issue of the informal sector and its size for Fiji. The rest of the sections are organised as follows: Section 2 explores the definitional issues in the backdrop of international definitions and statistical standards; Section 3 provides an account of labour market conditions and the size of informality. The Section 4 of the paper provides some analyses and Section 5 provides some concluding remarks.

## **INFORMAL SECTOR: CONCEPT AND BACKGROUND**

Generally speaking, the 'informalisation' of the economy represents impoverishment of the economy. Due to lack of development combined with unmatched industrial and labour regulations, such economies cannot provide decent employment to a large proportion of the working population. In a less regulated environment, workers who do not find employment in the formal sector often engage in productive activities in the informal sector. Where the labour laws are broadly binding and strictly complied, employment in the informal sector may become prohibitive.

On the other hand, in a more relaxed industrial environment, the existence of informal sectors and subsectors provide an avenue for alternative to formal employment. Estimating the size of this informal sector is difficult, because the characteristic features of defining informality are wide and heterogeneous across regions and countries. The measurement difficulties are seen in the existing literature. Broadly speaking, the informal sector refers to the units involved in production of goods and services, with the aim of providing income and employment to the persons who neither have jobs in the formal sector nor receive any benefits such as social security, medical, or unemployment benefits. *Secondly*, since the rules and regulations are not strictly applied, the workers engaged in these activities are often not paid according to their marginal productivity. Moreover, they could be engaged in very small production units at a low scale and with extremely low returns. Mostly, it is observed that a large part of their activities involve production at the household level. Hence, production units of the informal sectors have the characteristic features of household enterprises and do not separate the assets required for business purposes from household items used for consumption. *Thirdly*, the individuals are usually engaged in such activities parallel to other household works and, therefore, it is often difficult to differentiate their marginal contribution from other domicile activities. *Fourthly*, the units engaged in informal transactions or contracts from other units bear full liabilities on their own. The owners

have to raise the necessary finance at their own risk against any debts or obligations incurred in the production process. Expenditure for production is often indistinguishable from household expenditures. Similarly, capital goods such as buildings or vehicles may be used indistinguishably for business and household purposes. Sometimes, the fixed and other assets used in production units do not belong to them, but are supplied by the master enterprises or contractors, where the sole responsibility for any damages lies with them. As a result, it is problematic to maintain their account accurately. Moreover, most of these activities meet seasonal and local demands. They are unable to run throughout the year either due to lack of capital or insufficient demand. So, the size of the informal sectors should account for an extent of underdevelopment, exploitation, uncertainty and insecurity within the working population and their contribution to the GDP.

There is another side of the argument. Informalisation does not necessarily mean impoverishment and exploitation. According to Hart (2006), the label 'informal' could have both positive and negative connotation. Henley et al. (2006) revealed that informal employment is basically the result of displacement of workers into the insecure labour market as it is the only alternative to unemployment (ILO 2012). This was later refuted by many scholars (e.g., Marjit and Kar, 2011). In a dual economy framework, it is argued that workers can work either in the formal or informal sector and can freely move from one to another and the sector can expand. There are also views that the choice of working in the informal sector is voluntary. This is because workers prefer not to be restricted by tight labour regulations such as working hours, superannuation payments and tax laws. As a result, the accurate measurement of informality has become more problematic but important to promote the informal sector as a development strategy. From both perspectives it is important to understand and estimate the contribution of the informal sector.

## **LABOUR MARKET DYNAMICS IN FIJI**

Fiji has passed through various transitions in economic policies and political order and these have resulted into various episodes of growth and development stories during the last 40 years after Independence. The long-term average annual growth rate for Fiji during the last three decades has been around 1.5 percent. In the last decade, the registered growth rate of the economy has not been encouraging, particularly while it is compared with emerging countries in Asia and similar economies in other parts of the world. However, in comparison to other small Pacific Island countries, Fiji is relatively more resource rich. Even though a vast proportion of land area is mountainous and not suitable for cultivation, the coastal regions are considered fertile with vast potential for agriculture.

Most recently, the Fijian economy has grown by more than 4% in 2014 (UNESCAP, 2013), largely due to the government expansionary policies and expansion of some service sectors. Tourism and sugar are the backbone of Fiji's economy which draws directly from the geographical location and natural beauty. The interior land areas in Fiji are rich in forest and mineral resources which require proper management policies in a way that both the resources and the resulting revenues are used in a sustainable way. The exports of fish, gold and other minerals account for a significant contribution to the growth, and remittances from overseas Fijians also play an important role. Despite this geographical advantage, the economic performance of the agricultural

sector has been dismal and has continued to decline for long (Prasad et al., 2012). According to the government source (Fiji Bureau of Statistics (FBOS)), agriculture contribution was 14% to Fiji's GDP in 1989, which declined to around 8% in 2012. The performance of these sectors largely dictates the level of employment in the economy.

The relatively poor economic growth during the last three decades has limited the opportunities for productive employment in the economy. The 2007 Census of Housing and Employment report provides the labor market picture and how it has changed from 1996 to 2007. The labor force or the economically active number of people has grown from 1996 to 2007 by 9.8% (see Table 1). As seen in Table 2, however, the labor force participation rate went down from 59.4% in 1996 to 55% in 2007. This is when population growth of the country has been less than one percent. More importantly, the employment dropped by 6.9 percent points from 57.2% in 1996 to 50.3% in 2007. Poor economic growth, largely explained by substantial drop in agriculture and manufacturing, must at least be partly responsible for this.

While the lack of economic opportunities could explain a drop in employment rate, other social transformations taking place slowly might also be contributing to the process now visible. Fiji has a highly traditional form of living with deep-seated cultural values. The communities live in rural areas and their dependence on subsistence played a very important role of survival for the common people and to keep the severity of poverty in Fiji at the lower level. However, the extent of subsistence living has declined in recent years due to the availability of market goods. This decline is reflected in the 2008/09 HIES data. It shows that subsistence income declined between 2002 and 2009 in all quintiles except for the bottom quintile.<sup>3</sup> The drop of subsistence employment could be the result of gradual decline in agriculture and traditional communal living.



**TABLE 1:** Labor force status of population ages 15 and over, 1996 and 2007

	2007	1996	Difference (in %)
<b>Population aged 15 and over</b>	594,150	500,913	18.6%
I. Economically active (or in Labor Force)	326,988	297,770	9.8%
A. Employed	298,974	286,646	4.3%
Money Income	252,399	219,314	15.1%
No money income (subsistence)	46,575	67,332	-30.8%
B. Unemployed	28,014	11,214	149.8%
II. Not economically active	267,162	203,143	31.5%
A. Fulltime home Worker	131,957	106,686	23.7%
B. Fulltime Student	63,262	56,051	12.9%
C. Retired	19,815	9,695	104.4%
D. Disabled	5,888	3,117	88.9%
E. Not Looking	25,707	5,473	369.7%
F. Others	20,533	22,121	-7.2%

*Source:* Author's calculations and the 2007 Census of Population and Housing using the ICLS definition of employment and unemployment

Under the categorization used by ISIC, it is assumed that those who engaged in subsistence types of work are already classified as 'employed'. In the pool of employed, there are those that engage in both paid and subsistence work. On the other hand, those that are not economically active or are outside the labor force increased by 31.5% in the period 1996 to 2007. Its share to total population likewise grew by 4.4%. Interestingly, the number of people who are not looking for work or have given up has risen dramatically by 369.7%.<sup>4</sup> This reflects findings of the ADB report (2012) regarding weak linkages between education and the labor market. Apart from this group, the number of retirees has increased more than a hundred percent (104.4%). These forces definitely put pressure on unemployment and the informal sector.

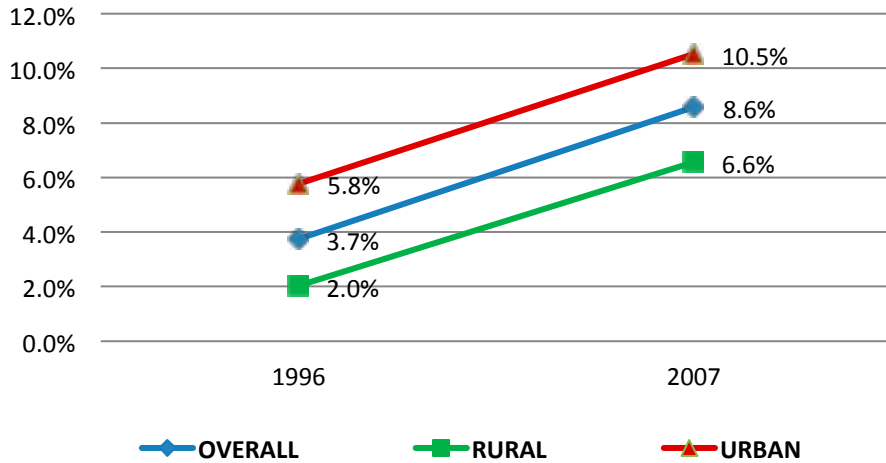
**TABLE 2:** *Percentage to total population aged 15 & over*

	2007	1996	diff (% point)
<b>Population aged 15 and over</b>	100.0%	100%	-
<b>I. Economically active (or in Labour Force)</b>	55.0%	59.4%	(4.4)
A. Employed	50.3%	57.2%	(6.9)
Money Income	42.5%	43.8%	(1.3)
No money income (subsistence)	7.8%	13.4%	(5.6)
B. Unemployed	4.7%	2.2%	2.5
			-
<b>II. Not economically active</b>	45.0%	40.6%	4.4
A. Fulltime home Worker	22.2%	21.3%	0.9
B. Fulltime Student	10.6%	11.2%	(0.5)
C. Retired	3.3%	1.9%	1.4
D. Disabled	1.0%	0.6%	0.4
E. Not Looking	4.3%	1.1%	3.2
F. Others	3.5%	4.4%	(1.0)

*Source:* Author's calculations and the 2007 Census of Population and Housing using the ICLS definition of employment and unemployment

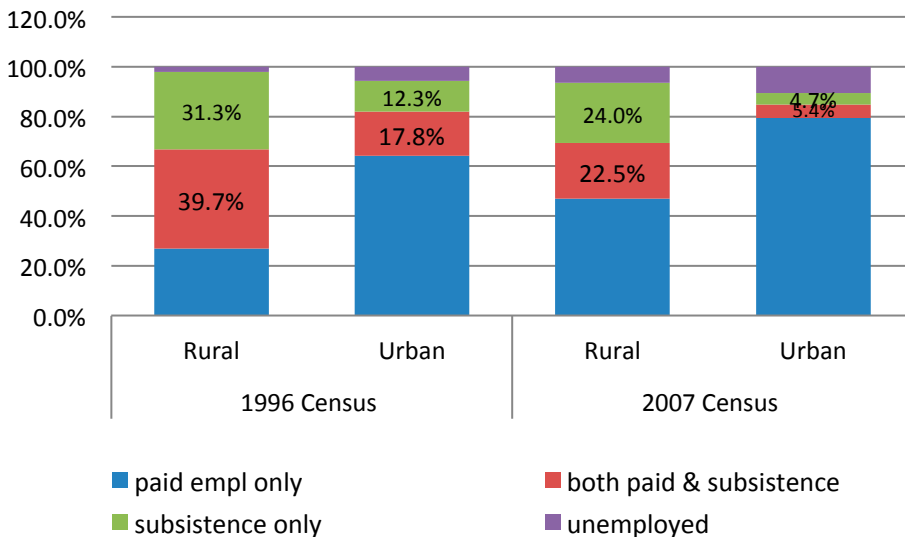
The unemployment rate is further broken down by location to have a glimpse of the disparities between the two areas (see Figure 1). It can be seen that urban unemployment is consistently greater than overall unemployment which has gone up in 2007 to 10.5% from 5.8% in 1996. The rural areas, meanwhile, have relatively lower unemployment rates, although the rates show the similar upward trend from 2% to 6.6% between 1996 and 2007. According to the definition, the unemployed people were without work, available for work, and had been actively looking for work or in other words had taken steps to seek employment. Moreover, Figure 2 shows that the number of people on subsistence only (rural and urban areas alike) had decreased in the period 1996 to 2007. The same is observed for those relying on both sources of income. For the urban areas this category of earners declined from 17.8% in 1996 to 5.4% in 2007, which is still substantially a high rate. It is interesting to note that there are also people engaged in subsistence activities but are actively looking for paid employment – a more secure alternative. The 2007 Census report provided another set of unemployment estimates by adding subsistence workers that want to earn cash income from the ranks of employed (see Figure 3).

**FIGURE 1:** Unemployment rate by Location, 1996 and 2007

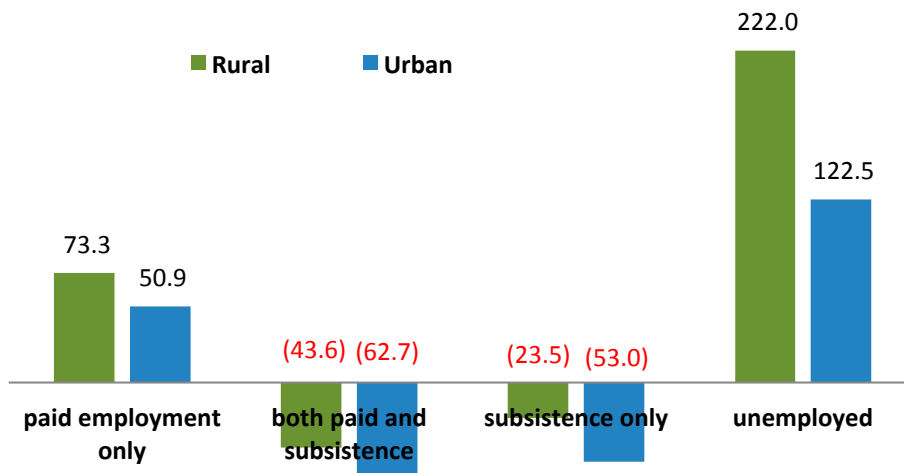


Source: 2007 Census of Population and Housing

**FIGURE 2:** Employment and unemployment rate (in %), by geographic location



Source: 2007 Census of Population and Housing

**FIGURE 3:** Percent change in employed and unemployed from 1996 to 2007

Source: 2007 Census of Population and Housing

**TABLE 3:** Labour supply and demand in Fiji 2002 – 2007

LABOUR SUPPLY AND DEMAND		CATEGORY	AVERAGE ANNUAL (2002-2007)	
			2002	2002-2007
Supply	New Entrants	School Leavers	14,500	75,500
		Belated Entrants	600	3,000
		Laid off workers	2,400	12,000
		Never attended school	200	1,000
		Total supply	17,700	88,500
Demand	Employment opportunities (formal sector)	Replacements for emigrants	2,070	11,350
		Replacements for attrition	2,900	14,500
	Employment requirements (informal sector)	New jobs created (@2.6% GDP per annum)	4,000	20,000
		Total Demand	8,970	44,950
		Total required	8,730	43,650

Source: Ministry of Education

As per the estimated unemployment rate has been on the rise during the last decade or so. While on the one hand, the rate of labour inflow into the formal sector job market is rising because of decline in the subsistence living, the demand for such jobs has not grown at the same rate. It is noted that over the past few years, overall employment (formal employment) has not been expanding. From 2002 to 2007, total new entrants to the labour market were 88,500, of which, only 50.7 percent (i.e., 44,950 individuals) could find employment in the formal sectors. This leaves 49.3 percent (i.e., 43,650 individuals) to be seeking jobs in the informal sector. Since employment in the formal sector has not been growing, the only way to create jobs or to absorb

labour is to expand the informal sector. This indirectly suggests that the unemployment rate could have been brought down, had the informal sector grown. But, it has gone up in reality because the informal sector could not absorb them. In the next section we examine the level of informal employment and the factors that influence them.

## SIZE OF INFORMALITY IN FIJI

If one is interested to know the size of the informal sector, there is a need to re-estimate its contribution. Fiji Bureau of Statistics (FBOS), the compiler of national accounts, uses the general definition as in SNA 1993 to measure the informal sectors in Fiji. The GDP (2005 as base year) has been compiled based on SNA 1993. FBOS uses labour-input method to compute the informal sector contribution for the following: 1) manufacturing; 2) construction; 3) wholesale & retail trade; 4) hotels & restaurants; 5) transport, storage & communication; 6) real estate & business services and other community, and 7) social & personal service activities. The main data used is the informal employment, drawn from Employment and Unemployment Survey (EUS) for the period 2004-2005. The current definition of informality, however, cannot capture the actual size (see for instance ILO 2012 for definitions of informality). The individuals who did not contribute to the Fiji National Provident Fund (FNPF), were not registered as a business venture or did not pay a license to operate their business would come under the informal sector in the country.<sup>5</sup> This does not capture the full size of informal sector as per the international definition. There are a couple of problems with this definition. *First*, the workers that are contributing to the FNPF could be hired on temporary and casual basis and they should come under the informal sector. *Second*, any establishment which is registered or pays license fees can be informal as well. *Third*, a larger section of agriculture and farming takes place for self-consumption and is undertaken by the informal labour. Even if, farmers produce for the market, they do not maintain accounts, pay taxes or contribute to the FNPF funds. Therefore, they should be part of informal sector. FBOS calculates the macro aggregates for the relevant sectors (gross output, intermediate consumption, value added) per employee for employment size group 1-4. This is then multiplied by the informal labour for the sector concerned to obtain the informal value addition for the sectors. The employment size with the group 1-4 refers to registered establishments having less than five workers. The choice of employment size 1-4 for their contribution in the informal sector has been arbitrary and does not distinguish between household and hired labour. This would be a problem especially if units with 5 or more workers are largely employing household workers, then the workers should be classified as informal workers. It should be based on either industrial laws or number of hired labour. Moreover, any worker hired by an establishment should be paid according to their minimum wage. But, usually it is seen that the establishments with less than five hired workers cannot pay the minimum wage throughout a single year because the units are so small to carry out production on a continuous basis. Then, such establishments should come under the informal sector. This is not clear from the existing method of calculation. In the case of Fiji, the residual methods of adjustment are practised, as suggested by ILO (2012).

The problem with the above-mentioned measurement is that it does not account for other measures of informality - employment and social securities. There could be also establishments that are registered and contributing to the FNPF funds, but do hold other characteristics of informality -

such as non-accounts maintenance, multiple activities of employees, non-tax payees or even non-registered for tax purposes and non-fulfilment of the minimum labour requirements. However, Fiji's tax laws have been made stringent, which makes non-compliance nearly impossible, particularly in urban areas. In the economy, FNPF is compulsory now for all employees after the removal of the 12 day rule and there is a voluntary membership scheme.<sup>6</sup> All major businesses need to be registered with the business licenses obtained from the respective municipalities. Simply using business registration and FNPF as measures to decide informality cannot provide a correct estimate, and thus may lead to the understated informal sector size. Hence, there is a need for an alternative and a more accurate estimation method to ascertain the changes in this sector. However, a logical argument would obviously lead to a conclusion that the informal economy in Fiji has declined significantly.

#### ALTERNATIVE METHODS SUGGESTED

Given the dearth of data, it is not an easy task to re-estimate the contribution of the informal sector as raw statistics particularly on employment, wages and productivity are required. Statistics on productivity per worker across employment size in Fiji are not available. The only statistics available for estimates were the labour force data (from employment and unemployment survey) and mean wages and salaries.

It is noted that the terms 'unorganised' or 'informal' are often used interchangeably, although there is a minor conceptual difference. The current definition of informal sector emerged from the conceptual framework developed by the International Conference of Labour Statisticians (ICLS) guided by the International Labour Office (ILO). The term informal sector was first coined by the ILO in 1972, to denote a wide range of small and unregistered economic activities. Since then, the interest has been mounted to determine what should be universally acceptable.

According to the definitions and classifications provided in the United Nations System of National Accounts (Rev.4) for statistical purposes, the informal sector is regarded as a group of production units which are a part of the household sector as household business establishments or equivalently as unincorporated business entities owned by households. Hence, there is a need to clearly distinguish between household business entities and normal business establishments. Household businesses are production units that do not have separate legal status from their owners and do not keep accounts to differentiate the production activities of the enterprise from that of the owners and separate out the flows of income and capital between the business entities and the owners. It simply means that whatever production or income is generated basically belongs to the owners and the risks associated with the business are also borne by the owners. These business entities may employ family workers and/or other employees on an occasional or casual basis. No one is employed on a continuous basis as workers would ideally be hired on a needs basis. The final output from these businesses could either be consumed or sold to other formal businesses as input in the production process.

Businesses in Fiji need to have licences to operate from their respective municipalities. Additionally, businesses also need to be registered with the tax authority and obtain a tax identification number for value added tax (VAT) and the company taxes. These businesses may

range from large businesses to self-employed persons such as street vendors. So, to distinguish between formal establishment and informal establishment, the nature of business needs to be known. Usually, establishments with lower employment do not operate throughout the year and quite often are not always visible. Such establishments should be treated as informal enterprises, but this characteristic may not be obvious. With regards to this, the ILO defines informal employment as consisting of self-employed or own-account workers (excluding administrative workers, professionals, and technicians), unpaid family workers, and employees working in establishments with less than the critical number of hired workers, excluding paid domestic workers.<sup>7</sup> Thus for calculating informality in Fiji, the criterion based on the number of employees working in the establishment, while not quite clear, seems to be establishments with less than 5 workers. Fiji Bureau of Statistics classifies such establishments as informal. So to re-estimate Fiji's informal sector contribution, subsistence activity is excluded. This is because of many complex issues surrounding the calculation of subsistence activities.

**TABLE 4:** *Re-estimation of Informality*

	2005	2006	2007	2008	2009	2010	2011
<b>Informal sector contributions as released by FBOS</b>							
Subsistence value addition (\$000s)	145945.0	146763.1	147420.5	148142.9	148907.6	149730.4	150509.9
Informal value addition (\$000s)	585554.8	573413.5	589183.0	601369.5	593933.3	604318.3	608164.4
Total Informal Sector Contribution - Value (\$000s)	731499.8	720176.6	736603.5	749512.5	742840.9	754048.7	758674.4
<b>Total Informal Sector Contribution as % of GDP</b>	<b>16.9%</b>	<b>16.3%</b>	<b>16.9%</b>	<b>17.0%</b>	<b>17.0%</b>	<b>17.3%</b>	<b>17.1%</b>
<b>Re-estimated Informal Sector Contribution</b>							
Subsistence value addition (\$000s)	145945.0	146763.1	147420.5	148142.9	148907.6	149730.4	150509.9
Informal value addition based on informal labor criterion (\$000s)	702823.1	650391.3	829289.8	825571.6	853251.7	824952.6	803954.9
Informal value addition in formal sector based on number of hours worked criterion (\$000s)	51073.4	50788.0	59542.8	58204.0	58678.0	56207.8	54099.7
Total Informal Sector Contribution - Value (\$000s)	899841.5	847942.4	1036253.1	1031918.5	1060837.2	1030890.8	1008564.6
<b>Total Informal Sector Contribution as % of GDP</b>	<b>20.8%</b>	<b>19.2%</b>	<b>23.7%</b>	<b>23.4%</b>	<b>24.3%</b>	<b>23.6%</b>	<b>22.7%</b>

*Source: Author's calculation*

The informal sector value addition using the labour criterion was calculated by multiplying the informal labour with the daily mean wages of workers, because informal workers are deemed to be wage earners or self-employed. All industries' daily mean wages were obtained from Fiji Bureau of Statistics. Minimum wages/daily mean wages are used to calculate value addition by sectors or categories. Minimum and daily wages are used for simplicity. The estimation could

have been made using productivity data, but it requires more disaggregated level of information. It is also important to account for informality from the formal sector to calculate the true value of informal sector contribution. In terms of the number of hours worked, those who work for less than 50 percent of the official hours are generally deemed to be working on an informal basis. To calculate the informality in the formal sector, we took the number of wage earners who worked for less than 150 days based on EUS conducted in 2005, which was assumed to have remained the same from 2006 to 2011. This was multiplied with the estimated daily mean wages rate to compute informal value addition in the formal sectors. The final step was to add the subsistence sector value addition given by Fiji Bureau of Statistics with informal value addition based on labour criterion and informal value addition in the formal sector. Then, the informal sector value addition will be as follows:

**Informal sector value addition** = *Own accounts establishments + establishments hiring 1-4 workers + value addition of casual workers in formal units*

**Workers** = *regular (formal) + casual workers (informal)*

**Casual workers** = *workers not contributing FNPF + workers who receive wages less than minimum wages and no formal contract letter + whose employment are not compliance with labour relations + who do not work more 150 days.*

Table 4 shows that the contribution of the informal sector based on suggested methods are higher than that Fiji Bureau of Statistics (FBOS) has calculated (shown in Figure 4). From 2005 to 2011, the informal sector is re-estimated to be around 22.5 percent compared to 16.9 percent reported by FBOS. The highest contribution was in 2009 at 24.3 percent of GDP. Additionally, the informal labour workforce has been on an average around 37.8 percent of total labour force from 2005 to 2011 (Figure 4). This is quite low compared to many countries in Asia, Africa and Latin America (see informality reported in WIEGO 2014). It is important to note that the share has not increased, though these figures are rough estimates.

## REGULATION AND INFORMALITY

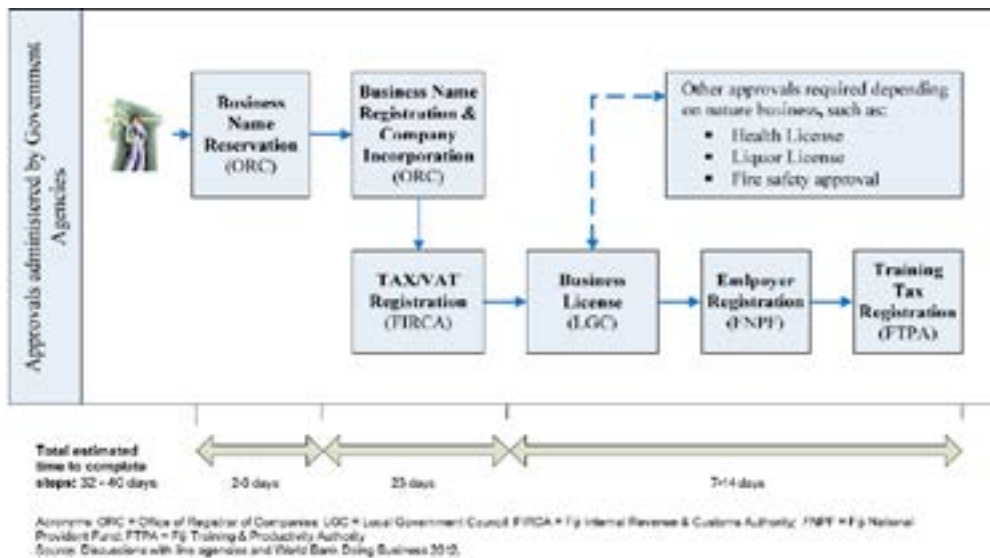
Now the questions that arise are: 1) why cannot the informal sector expand when the unemployment rate has increased and workers have been leaving the subsistence sector and entering into the formal job markets; and 2) why would the unemployment rate be high when there is no unemployment benefit available in Fiji? The obvious answer lies in the extent of rigidities (legal constraints) associated with entering into informal business. We investigate this issue to verify the answer.

At the outset, it should be mentioned that there is no separate legislation for the informal sector and the regulations followed for them are not different from those applied for formal establishments.



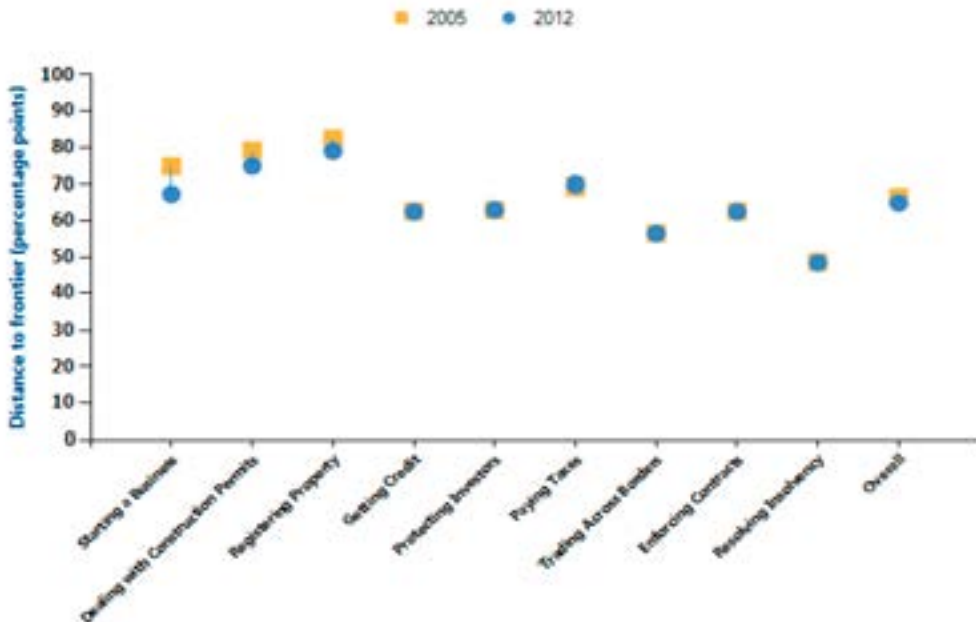
It is quite evident that when regulations governing business start-ups are ‘transparent’ and ‘flexible’, investments increase since costs and requirement processes become clear to follow. Many of Fiji’s regulatory requirements remain difficult for business to comply with, particularly micro and small businesses who have fewer resources to draw on. This is considered to be a critical constraint for private investors in Fiji. The process of entering and registering a business is quite difficult and time consuming (see Figure 5). First, the businesses intending to start operations need to reserve a business name and formally register the business with various government departments such as tax authorities, Registrar of Titles, Lands Department, Fire Authority, Fiji National Provident Fund, Local government (City or Town Councils) or Rural Authority (if the business is not in an urban area) and the Ministry of Labour. Apart from these, businesses have to secure clearance from the Departments of Environment and Health. All of these processes take a long time, ranging from a few days to a few months (World Bank 2014).<sup>8</sup> All these agencies have their own requirements which the registering business needs to comply with, some of which are extremely difficult for small businesses to fulfil. There are no exceptions or flexibility for small businesses or for those operating as informal entities. These are reflected by how Fiji’s position on ‘Ease of Doing Business’ has declined over the years.

FIGURE 5: Business Entry Process in Fiji



Source: Discussions with line agencies and World Bank Doing Business 2012

**FIGURE 6:** How far has Fiji come in the areas measured by Doing Business?



*NOTE:* The distance to frontier measure shows how far on average an economy is from the best performance achieved by any economy on each **Doing Business** indicator since 2005. The measure is normalized to range between 0 and 100, with 100 representing the best performance (the frontier). The overall distance to frontier is the average of the distance to frontier in the 9 indicator sets shown in the figure. See the data notes on the original reports for more details on the distance to frontier measure.

*Source:* Ease of doing business database, World Bank (2013).

**Figure 7:** How Fiji ranks on Doing Business Indicators



*Source:* Ease of doing business database, World Bank (2013).

## DETERIORATING BUSINESS CONDITIONS

*Doing Business database* provides an aggregate ranking on the ease of doing business based on indicator sets that measure and benchmark regulations applying to domestic small to medium size businesses through their life cycle. As per the overall ranking<sup>9</sup>, Fiji is situated at 60 out of 185 countries in the world and seems to have deteriorated from 2005 to 2013 (see Figure 6). The rank of starting business is 138 in 2013 and deteriorated from 120 in 2012. According to the report, starting a business in Fiji requires 11 procedures, takes 58 days and costs 24.0% of income per capita. Cumbersome processes and high transaction costs raises the risk to access to credit as well as hinders their ability to settle contract disputes through the legal system. The existing regulations currently require physical visits to more than five different agencies and takes between one to two months to complete – well above international best practice of one day (ADB, 2012; World Bank, 2014).

A brief review of a couple of licenses, conducted by ADB (2012) suggests that there are duplications and inconsistency with good practice principles. The general business license which applies to all businesses appears to be particularly problematic in this regard. There has also been a recent trend to introduce new licenses with limited consultation. Fiji made starting a business more difficult in 2012 by adding a requirement to obtain a tax identification number when registering a new company which is a precondition for obtaining a National Fire Authority certificate and a letter of compliance from the Ministry of Labor in 2013. Now an additional process (as of 2014) requires real estate owners (prospective business sites) to seek permission for any letting agreements, where applications of restrictions are fairly arbitrary opening up room for more corruption (costs) and bureaucratic delays.

Now complying with building regulations is excessively costly in time and money causing many builders to opt out, particularly smaller ones. Applicants may even pay bribes to obtain certificates of inspections or simply build illegally leading to hazardous construction that put public safety at risk. Globally, Fiji stands at 82 on the ease of dealing with construction permits in 2013 which has deteriorated from 71 in 2012. In 2009, the City Council adopted new regulations that added three new pre-approval procedures related to health, fire safety, and water and sewage connections. Obtaining a construction permit became more expensive from 2013 adding a fee for the Fire Department clearance.

Producers intending to produce at small-scale cannot easily absorb such costs. Moreover, getting electricity requires 4 procedures that may take 81 days and incur significant cost. Globally, Fiji stands at 75 in the ranking on the ease of getting electricity, while Samoa stands on 20 in 2014. Though Fiji has reliable sources of electricity, it is not easy to access as compared to regional best practices.

In Fiji property transfer (including land) is too costly or complicated. There are four complicated, costly and time-consuming procedures that Banks require clients to follow before loans could be transacted. It takes 69 days and costs 2.0% of the property value. Fiji stood at 58 in the ranking of 185 economies on the ease of registering property in 2013 while Samoa at 23. The rank of Fiji has deteriorated from 52 in 2012, because Fiji made transferring property more difficult recently

by requiring parties to a property transaction to obtain capital gains tax clearance certificate from the Fiji Revenue and Customs Authority. While registering property has become more complicated, only 10-15% of total land is left for commercial and freehold transactions and the rest is reserved.

Credit information systems enable lenders to understand a potential borrower's financial history (positive or negative) and such valuable information to consider when assessing risks. Fiji ranks at 70 and has deteriorated recently. On property rights and investor protection Fiji stood at 49 in the ranking in 2013 and which dropped from 46 in 2012.

On average, firms in Fiji make 34 tax payments per year, spend 163 hours per year filing, preparing and engaging in paying taxes, where the total taxes amount to 37.6% of profit as per 2013 data. The regional average shows 34.5% among East and Pacific economies. Fiji now stands at 85 on the ease of paying taxes as against 78 in 2012. While tax rates were reduced from 31% to 18% in 2012, new taxes and duties were introduced. Fiji introduced capital gains tax of 10% and increased stamp duty on transfers from 1.5% to 3% (Ministry of Finance 2012). The value-added tax (VAT) was also been increased from 12.5% to 15% in 2012 (see World Bank 2013 and 2014).

In today's globalized world, making trade between economies easier is increasingly important for businesses. According to data, exporting a standard container of goods requires 10 documentations that take 22 days to complete and costs \$655. Importing the same container of goods requires 10 documentations which takes 23 days and costs \$635. Fiji stands at 111 in the ranking of 185 economies on the ease of trading across borders while Samoa is at 66. Although Fiji made trading easier by opening customer care service centers and improving customs operations in 2011, it still appears to be costly and tends to discourage potential trade.

According to 2013 data, enforcing a contract in Fiji takes 397 days and costs 38.9% of the value of the claim. It requires 34 procedures to be completed. Fiji stands at 67 in the ranking of 185 and has deteriorated from 65 in 2012.

In terms of economic freedom index of The Heritage Foundation, Fiji stands at 99<sup>th</sup> position with an overall score of around 58.7 out of 100 points (see Table 5). When looking at the indexes for business separately, Fiji is no better than its comparators such as Jamaica and Mauritius, but slightly better than its neighbors like PNG and Tonga. The Employment Relations Promulgation (ERP) introduced in 2007 repealed and replaced six prominent labor laws in Fiji. It is largely compliant with international labor standards, although a number of subsequent decrees have eroded the rights of workers and unions. In addition, some of the labor laws, regulations and procedures, particularly those related to social security payments and the employment terms and conditions including minimum wages and workplace standards are beyond most small businesses in Fiji (ADB, 2012).

**TABLE 5:** *Economic Freedom Index of Fiji with respect to comparators*

Country Name	World Rank	2014 Score	Change in Yearly Score from 2013	Business Freedom	Labor Freedom	Investment Freedom
Fiji	99	58.7	1.5	64.9	73.1	50
Jamaica	56	66.7	-0.1	84.6	75.6	85
Mauritius	8	76.5	-0.4	74.4	78	85
Papua New Guinea	132	53.9	0.3	57	73.7	35
Samoa	84	61.1	4	73.7	80.3	55
Tonga	104	58.2	2.2	74.6	91.2	35
Trinidad and Tobago	73	62.7	0.4	59.4	76.4	60
Vanuatu	93	59.5	2.9	54.8	56.8	60

Source: *Index of Economic Freedom*, <http://www.heritage.org>

All this information suggests that the existing rules and regulations have not been conducive for the expansion of nascent enterprise on a small scale. If a small economy like Fiji surrounded by huge swaths of ocean wants to deal with its unemployment problems and expand its industrial activities, the focus should strategically shift towards establishment of more small, medium and micro enterprises. This is only possible through providing the right incentives, greater flexibility and separate legislation for the informal sectors.

## CONCLUDING REMARKS

Recognition of the informal sector's contribution towards overall economic performance is fast becoming a focus of many economies around the world. According to the official estimate, the informal sector contribution to GDP is around 17% and captures a little less than 39% of total labour forces. While it is understood that estimation problems exist in Fiji as shown by our re-estimated figures, the importance of the informal sector in generating employment should not be underestimated. The calculations indicate that the share of the informal sector contribution as percent of GDP is 5-6 percent higher. It may be recommendable that the Fiji Bureau of Statistics adjust its HIES questionnaire to capture informal activities more accurately. Including worker characteristics such as the number of days worked per year and the types of firm (by size and sector - FSIC) may be needed to improve the estimates. Currently, the survey forms do not capture whether the employees are household workers or hired workers and the size of the firms.

Whatever would be the case, the size of the informal sector has not grown, while the employment rate has declined and the unemployment rate has gone up in the recent years. In order to deal with the unemployment problem and encourage private investment, the informal sector deserves separate attention. More specifically, Fiji needs separate and flexible legislation to accommodate the informal sector and incentive supports to small and informal businesses to reduce their cost of production. This is important in an economy where there is no unemployment benefits and where a weak entrepreneurial culture exists. Incentives need to be provided for promoting entrepreneurship, innovation and healthy competition to integrate the underprivileged with the formal world of business.

## ENDNOTES

- <sup>1</sup> Informal sector (excluding agriculture) in % of total GDP
- <sup>2</sup> Country groupings: (i) Latin America: Argentina, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, Uruguay, Venezuela, (ii) Asia: China, India, Indonesia, Pakistan, Sri Lanka, Thailand, (iii) Africa: Botswana, Cameroon, Egypt, Ethiopia, Ghana, Kenya, Malawi, South Africa, Tanzania, Zambia, Zimbabwe.
- <sup>3</sup> Narsey (2012) points out that subsistence income “rarely gets the attention it deserves from government’s assistance programs”
- <sup>4</sup> The 2007 Census of Population and Housing defines those that fall under “Not Looking” as respondents that have given up looking for work since they believe that work suitable for them is not available.
- <sup>5</sup> Fiji National Provident Fund is the only superannuation scheme in Fiji where both the employees and employers contribute 8 percent and 10% respectively.
- <sup>6</sup> FNPF has introduced a voluntary scheme for self-employed persons. Workers engaged in production for their own use with surplus being sold in the markets can join and contribute towards FNPF. The removal of 12 day rule means that even if workers are employed for one day (i.e. on casual basis) the employer must deduct FNPF contribution of 8.0 percent and contribute another 8.0 percent from their side into the workers FNPF account. It should be noted that even though FNPF is compulsory, many businesses including registered formal business do not comply with this regulation and do not contribute their share of FNPF for their employees.
- <sup>7</sup> For example 5 hired workers in the case of Indian subcontinent.
- <sup>8</sup> Ease of Doing Business index has worsened in the last 12 months. Many of these indicators are at levels worse than those of countries such as Nigeria.
- <sup>9</sup> The rank is given by looking at the ease of doing business index - starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and resolving insolvency (Doing Business database, 2013).

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## **The effectiveness of the destination websites in promoting linkages between visitors and the community in Tonga**

*Nick Towner*

### **ABSTRACT**

*Whilst tourism has brought Tonga potentially significant prospects for job creation and local business ownership, many tourists lack knowledge about the cultural experiences on offer at their holiday destination. This signifies a lost opportunity to form linkages between foreign tourists and the Tongan community. This study analysed the content of 40 Tongan websites to see how effectively they promoted linkages to community based tourism industries. It found the majority of websites had very weak content on local handicrafts, food and cultural events and were ineffective at promoting linkages between tourists and the community, thereby reducing the potential for local community participation in the tourism industry.*

**Keywords:** *Tonga, community participation, internet, linkages, websites*

## **INTRODUCTION**

The Kingdom of Tonga is referred to as “the friendly isles,” with over 170 islands to explore and plenty of world-class activities and attractions to choose from. Tonga remains one of the Pacific’s most attractive holiday destinations (Tonga Visitors Bureau, 2014). Studies have shown that visitors to Tonga have the ability to improve the quality of life for residents and provide significant opportunities for employment and local involvement in business ownership (Hopkins, 2008; Milne, 2009; Milne and Bui, 2005). Tourism has been identified by the Tongan government and NZAID as a priority for the economic development of the country, highlighting the importance of increasing community participation through linkages between tourism and the local community (Ministry of Tourism, 2006; NZAID, 2008).

A lengthy history of research has shown that tourism can have a positive impact on job and income generation in Tonga through both direct and indirect linkages to the community (Connelly-Kirch, 1982; Milne, 1988; Orams, 2002). The positive economic impact on local Tongan communities from indirect participation in the tourism industry appears to be high, and further opportunities exist to facilitate both greater direct participation and to strengthen existing linkages with the industry (Hopkins, 2008; Milne & Bui, 2005). Community based tourism could potentially help alleviate poverty in Tonga, but one of the constraints is the lack of on-line marketing information available (Milne, 2009).

Today, the internet is the major tool tourists use for researching places of interest, planning journeys and booking accommodation and services (Fernández-Cavia, Rovira, Díaz-Luque & Cavaller, 2014). Destination websites attract potential tourists through branding, alluring imagery and quality information (Luna-Nevarez & Hyman, 2012), while articles published on travel blogs are consulted because of their usefulness, reputation and trustworthiness (Ting, Ting & Hsiao, 2014). The content and imagery contained in destination websites and travel blogs has the ability to represent features of a local community in an enticing way to potential travellers, creating vital linkages with community based tourism products, increasing community participation in the industry.

Travel information found on the Internet, which depicts the destination image in a certain light has numerous managerial implications (Ting, Ting & Hsiao, 2014). Tourism websites and blogs that generate a positive perception of the Tongan community and its culture have the ability to connect foreign tourists with the host population and the tourism products and services they offer.

## **LITERATURE REVIEW**

### **COMMUNITY PARTICIPATION IN TOURISM**

Community participation is a key component of sustainable tourism development (Okazaki, 2008). Arnstein (1969) notes that the goal of participation is power redistribution between stakeholders and to share costs and benefits equally amongst relevant groups. In practice community participation is difficult to achieve, for several reasons, including residents’ lack of tourism knowledge, confidence, time and interest (Cole, 2006, p. 631). Scheyvens (2003)

notes limited ownership, resources and capital constrain a community's ability to participate in tourism. Iorio and Corsale (2014) add that this situation is more evident in small communities "off the beaten track" who often do not have the ability to acquire the necessary capital needed to attract tourists.

Cole (2006, p. 633) maintains that remote areas of developing nations face additional challenges, such as developers consider local community not to have understanding to be adequately involved in tourism, and limited experience in tourism development. Other obstacles to community participation in developing nations include lack of training of state tourism agency officials, and a need for improved government coordination and education and training for tourism operators (Saufi, O'Brien & Wilkins, 2014). Tourism policy implemented in developing countries is inherently a government-led development exercise, designed to meet their own objectives and large reflect top down decision-making; policies that reduce the prospects for community participation (Wang & Wall, 2007, p. 78). Similarity Dadvar-Khani's (2012, p. 259) study in isolated rural areas of Northwest Iran into host population attitudes towards development, found that tourism was not equipped to facilitate the participation of rural communities in tourism projects, which lead to limited involvement by the local community.

Empowerment is the "top rung" on Arnstein's (1969) "ladder of citizen participation"; at this initial stage the members of the community are active in producing change, have problem solving capacity, make decisions, implement plans and evaluate management (Cole, 2006). Scheyvens (2003), outlines four dimensions of empowerment: economic, psychological, political and social. The financial profits of tourism are evidence of economic empowerment; psychological empowerment results from cultural pride assisted by tourism; and social empowerment comes from improved community cohesion when people group together through tourism enterprises. The concept political empowerment is extended by Sofield (2003), stating that it is a transference of power between the powerful and the powerless. However, often in developing countries communities are subject to internal power struggles (Simpson, 2008) and are not regarded by government or key stakeholders as equal partners, which keeps the power in their hands (Iorio & Wall, 2014).

Knowledge is a key element of empowerment. It is necessary for local communities to have access to a range of quality tourism information resources to fully participate in tourism (Tosun & Timothy, 2003). Local communities effected by tourism that embrace community informatics have increased access to communication and information technologies, which in results in greater empowerment (Milne, Speidel, Goodman & Clark, 2005). Cole (2006, p. 631) notes that the initial phase of empowerment is understanding the tourism industry, which then permits local communities to make knowledgeable decisions concerning tourism development. In poorer regions of developing nations, people often lack the knowledge and capital that are needed for them to produce quality tourism products enabling them to establish their own businesses (Truong, Hall, Garry, 2014).

Communities in developing countries often need to first identify the characteristics of foreign travellers, allowing them to offer services and products that are desired thereby increasing their participation in the industry. Unless external inputs are available to the local communities, it can

be difficult to start tourism initiatives. External exposure plays a key role in acting as a catalyst for community based tourism projects and increasing local participation (Iorio & Wall, 2012).

#### INTERNET TOURISM RESEARCH

As tourists embrace the internet and other different types of digital technology, their tourism decision-making and motivations have become increasingly influenced by destination marketing websites and informal word-of-mouth travel blogs (Fernández-Cavia, Rovira, Díaz-Luque & Cavaller, 2014; Pai, Xia, Wang, 2014; Ting, Ting, Hsiao, 2014; Wan, 2002). The internet has had a large impact on the tourism market, allowing travellers to access vast amounts of information instantly from the comfort of their own homes. Therefore, the internet has become an increasingly significant and important instrument for destination marketers to promote their products (Brey, So, Kim & Morrison, 2007; Lee, Cai & O'Leary, 2006). The internet allows the promotion of smaller, less accessible tourism sectors, due to its ability to reach audiences around the globe and the relatively low costs involved (Horng & Tsai, 2010).

The main role of a tourism website is to promote a destination by supporting an indirect experience of the tourism product (Bastida & Huan, 2014). The image presented is integral to the traveller's decision-making process as well as bookings and service purchases (Fernández-Cavia, Rovira, Díaz-Luque & Cavaller, 2014). A destination website must be informative and supply potential tourists with accurate information. It must provide a comprehensive picture of the destination, which is ultimately one of the most significant factors in the destination selection process (Choi, Lehto & Morrison, 2007). Horng and Tsai (2010) conclude that effective tourism websites: have user-friendly architecture so travellers can seek information and navigate between pages without problems; have regularly updated content as travellers demand both the latest and most accurate information; must be attractive and eye catching. Research by Bastida and Huan (2014) found that the more attractive and useful destination websites are, the greater likelihood there is to turn a potential tourist into an actual tourist.

Online word-of-mouth communication is commonly referred to as a "blog", (abbreviated from the term "web log") and plays an important role in the decisions of travellers (Ting, Ting & Hsiao, 2014). The emergence of travel blogs has caused a shift in how tourists go about conducting research for their holiday. Travel blogs are often very specific in expressing the experiences of a tourist at a particular destination, and therefore consumers can easily access very up to date and subjective information on their chosen holiday destination (Pan, Mac Laurin & Crotts, 2007). Malleus and Slattery (2014) argue that personal travel blogs are important for studying intercultural interactions which are one the main of objectives of community based tourism.

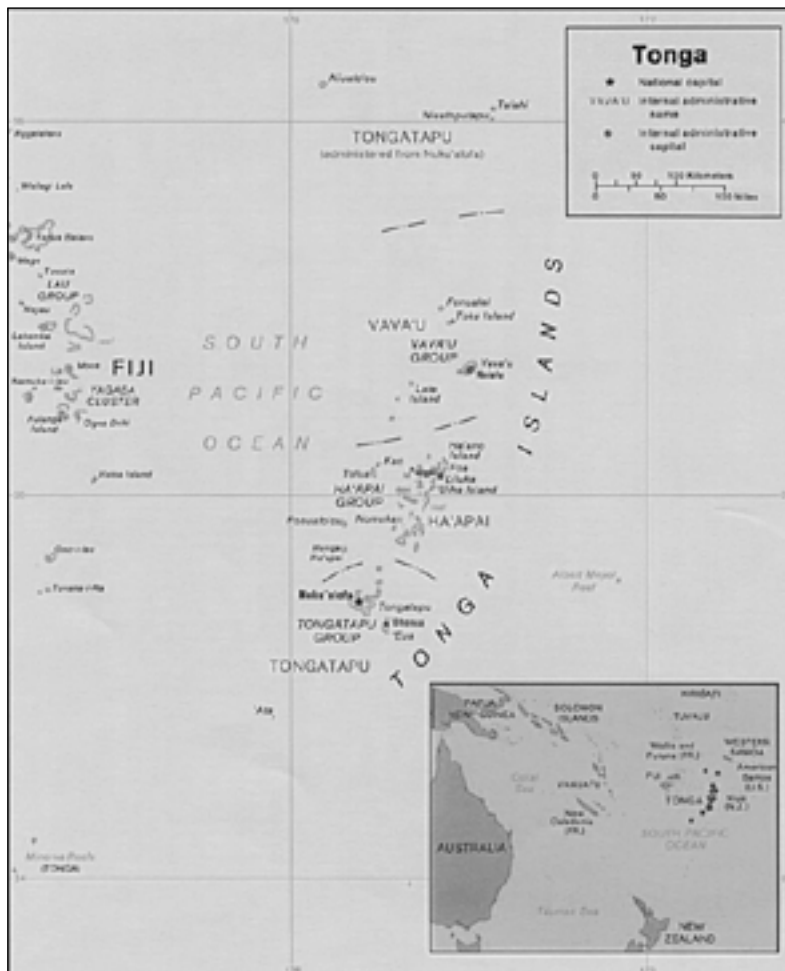
Web based tourism research has increased dramatically over the last decade along with the ability of the world wide web to greatly influence decisions about visiting destinations (Dion & Woodside, 2010). A large number of more recent studies have investigated the effectiveness of various destination websites, evaluating their different attributes (Bastida & Huan, 2014; Fernández-Cavia, et al. 2013; Fernández-Cavia, Rovira, Díaz-Luque & Cavaller, 2014; Fryc, 2010; Gupta & Utkarsh, 2014; Li, 2011; Pai, Xia & Wang, 2014; Woolsey, 2011). For example Fernández-Cavia, et al., (2014) study on web quality indexes investigated the technical aspects

such as usability and positioning, communicative aspects such as the quality of content, relational aspects such as interactivity and persuasive aspects such as branding. Current research focused on web quality has overlooked the internet's ability to shape positive perceptions towards various features of the host destination's tourism products and the implications this might have in terms of community based tourism and local participation.

#### CASE STUDY: TONGA

The Kingdom of Tonga is located in the South Pacific Ocean, south of Western Samoa and roughly two-thirds of the way from Hawaii to New Zealand (Figure 1). Its 176 islands many of which are uninhabited, attract tourists for its uncrowded beautiful natural environment and relaxed atmosphere, where visitors can enjoy an authentic mix of centuries-old culture, history and unique wildlife. The tourism industry is Tonga's largest foreign exchange earner, higher than any other productive sector, with an estimated high of T\$58 million in 2010 (Reserve Bank of Tonga, 2011). Tourism has also become the largest contributor to GDP, increasing from 6% in 2001 to about 27% in 2011 (Ministry of Finance, 2011).

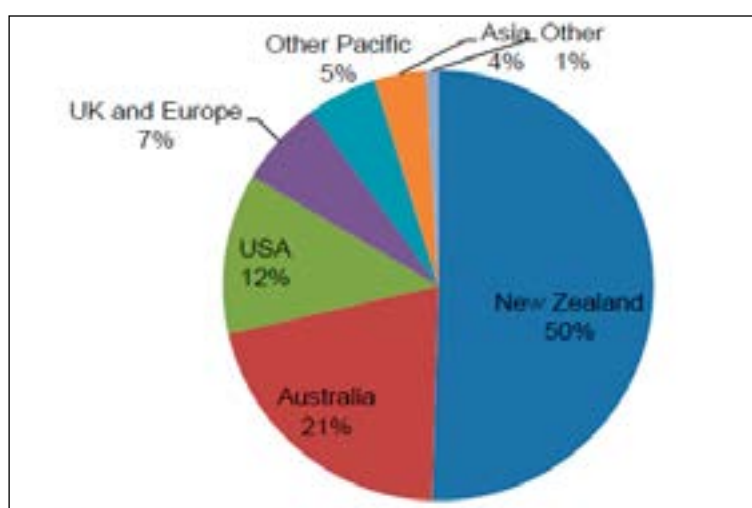
FIGURE 1: Map of Tonga.



Source: (CIA, 2014)

Approximately two-thirds of Tonga's total international travel market (visitors plus residents) is accounted for by travel to and from Australia and New Zealand. During 2013 Australian and New Zealand residents travelling to Tonga as visitors accounted for around 71% of arriving and departing passengers at Fua'amotu Airport. The remaining 29% of arriving and departing passengers were North American (12%), UK and Europe (7%), other Pacific (5%) and Asia (4%) (Figure 2) (Ministry of Commerce, Tourism and Labour, 2013a). The New Zealand and Australian markets have grown strongly, while the North American market has suffered most from the effects of the Global Financial Crisis. The most recent international visitor survey indicated that 44 percent of visitors spend between seven to ten days in Tonga and that the median age of visitors was 42 years old (Ministry of Commerce, Tourism and Labour, 2013b).

**FIGURE 2:** Air visitors by country of residence.



Source: (Ministry of Commerce, Tourism and Labour, 2013)

Australians and New Zealanders take advantage of the warm weather in Tonga and escape the colder southern hemisphere winter (Tonga Tourism Association, 2013). These visitors typically travel to Tonga on holiday packages which are generally restricted to the main island of Tongatapu and its capital city of Nuku'alofa. Other significant niche tourist markets include whale-watching, cruise ships and cruising yachts which provide vital economic benefits for the more isolated island groups of Vava'u and Ha'apai (Orams, 2002). The distribution and patterns of holiday visitors are changing within Tonga. Visitation to Eua Island, for example, has increased from only a few hundred 10 years ago, to around two thousand in 2011. A major obstacle to tourism in Tonga is that visitation is highly seasonal, with two major periods for holiday visitors. The busiest months are June through to October, reflecting the whale watching season and December and January which are the New Zealand and Australian school holidays (Ministry of Commerce, Tourism and Labour, 2013b).

Despite its attractiveness as a tourist destination, Tonga's tourism industry is relatively undeveloped compared to its South Pacific neighbours of Samoa and the Cook Islands, who

each received roughly around two and a halftimes more visitors per year than Tonga (Tonga Tourism Association, 2013). Tonga's international tourist arrivals only increased by 3,000 visitors between the years of 2009 and 2012 (Table 1), however, this growth is comparable to Samoa who experienced a similarly insignificant increase over the same time period (The World Bank, 2014).

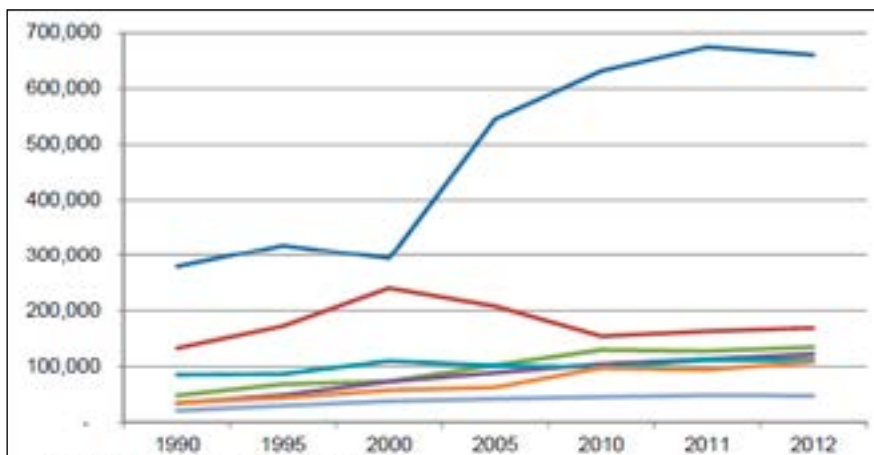
**TABLE 1:** *International Visitor Arrivals 2009-2012*

Country	2009	2010	2011	2012
<b>Tonga</b>	46,000	47,000	46,000	49,000
<b>Samoa</b>	122,000	122,000	121,000	126,000
<b>Fiji</b>	542,000	632,000	675,000	661,000

Source: World Bank, 2014

The international tourist demand for Tonga as a holiday destination has slowed down during the past couple of years, mainly caused by the recent global recession which seems to affect the island economies more than their larger Pacific neighbours like Australia and New Zealand (Ministry of Commerce, Tourism and Labour, 2013a). The overall number of air arrivals remains stagnant at the 50,000 level during the past 3 years (Figure 3).

**FIGURE 3:** *Visitors trends to Pacific nations from 1990-2012.*



Source: (Ministry of Commerce, Tourism and Labour, 2013)

In 2008, the Tongan government's Strategic Development Plan highlighted the tourism sector as a priority for the economic development of the country and identified the importance of linkages



between tourism and the community (Ministry of Tourism, 2008). Despite these findings there have been few attempts by academic researchers to investigate how these linkages could be enhanced with the objective of increasing local community participation in the tourism industry. Recent studies related to tourism in Tonga have centred on the economic significance (Orams, 2013), managerial implications (Kessler & Harcourt, 2012) and the sustainability (Kessler, Harcourt & Heller, 2013) of the whale watching industry.

#### METHODOLOGY

In order to examine the effectiveness of destination websites in promoting the linkages between tourism and local communities in Tonga, content analysis was employed. Content analysis is a “research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use” (Krippendorff, 2006, p. 18). Cusick, McClure and Cox (2009, p.26) add that content analysis can be applied to written text, images or symbols that communicate meanings of “something to someone.” When using content analysis as a data analysis tool, all researchers should come to the same conclusions and inferences must be drawn in the context of the original text (Volkens, 2009).

The first phase of the study was to analyse the content of Tongan tourism websites from both government and non-government sources. Content analysis is commonly used in tourism research (Wan, 2002; Echtner & Prasad, 2003; Kemp & Dywer, 2003), including several studies on tourism and the internet (Wang, Chou, Su & Tsai, 2007; Xiang, Wöber & Fesenmaier, 2008; Xiang & Gretzel, 2010). Analysing the content of tourism websites gives a holistic picture of how both the industry and tourists are promoting linkages between tourism and communities in Tonga.

The sample of Tongan tourism websites was selected through an extensive audit of websites using various Google searches on 11 November 2009. The websites were found using the following keyword searches in order of: 1. Tonga Tourism; 2. Tonga; 3. Tonga Holiday; 4. Tonga accommodation; 5. Tonga Hotels; 6. Tonga Resorts; 7. Tonga Activities; 8. Tonga Attractions; 9. Tonga Whale watching; 10. Tonga Cruise; and 11. Tonga Sailing. Google’s Page Rank algorithm lists websites based on popularity (Brin & Page, 1998). The most relevant websites were selected from the first 40 search results. The selected websites were then categorised by their general characteristics into four main categories: General Information; Accommodation; Whale watching/Sailing and Cruises (Table 2).

TABLE 2: Tongan tourism websites.

General Information
<a href="http://www.tongaholiday.com/">http://www.tongaholiday.com/</a>
<a href="http://www.pacific-travel-guides.com/tonga-islands/tourist-information/index.html">http://www.pacific-travel-guides.com/tonga-islands/tourist-information/index.html</a>
<a href="http://www.tonga.islands-travel.com">http://www.tonga.islands-travel.com</a>
<a href="http://www.tourism.net.nz/international/south-pacific/tonga/tonga-attractions.html">http://www.tourism.net.nz/international/south-pacific/tonga/tonga-attractions.html</a>
<a href="http://www.tongatourism.to/">http://www.tongatourism.to/</a>
<a href="http://www.infohub.com/travel/sit/sit_pages/tonga.html">http://www.infohub.com/travel/sit/sit_pages/tonga.html</a>
<a href="http://www.jasons.com/Tonga/">http://www.jasons.com/Tonga/</a>
<a href="http://www.lonelyplanet.com/tonga">http://www.lonelyplanet.com/tonga</a>
<a href="http://www.whl.travel/tonga-hotels">http://www.whl.travel/tonga-hotels</a>
<a href="http://www.iexplore.com/dmap/Tonga/Activities">http://www.iexplore.com/dmap/Tonga/Activities</a>
<a href="http://gohawaii.about.com/od/tongasites/Tonga_Activities_and_Sightseeing.htm">http://gohawaii.about.com/od/tongasites/Tonga_Activities_and_Sightseeing.htm</a>
<a href="http://www.iexplore.com/dmap/Tonga/Activities">http://www.iexplore.com/dmap/Tonga/Activities</a>
<a href="http://www.beautifultonga.com">www.beautifultonga.com</a>
<a href="http://www.hideawayholidays.com.au/ASP/Tonga.asp">http://www.hideawayholidays.com.au/ASP/Tonga.asp</a>
<a href="http://www.tongadeals.com/">http://www.tongadeals.com/</a>
<a href="http://www.spto.org/spto/export/sites/spto/destinations/tonga/activities.shtml">http://www.spto.org/spto/export/sites/spto/destinations/tonga/activities.shtml</a>
<a href="http://www.1uptravel.com/international/oceaniapacific/tonga/sightseeing.html">http://www.1uptravel.com/international/oceaniapacific/tonga/sightseeing.html</a>
<a href="http://www.geckogo.com/Guide/Tonga/Explore/Sights-Attractions/">http://www.geckogo.com/Guide/Tonga/Explore/Sights-Attractions/</a>
<a href="http://www.colonialvoyage.com/oceania/eng/tonga/index.html">http://www.colonialvoyage.com/oceania/eng/tonga/index.html</a>
Accommodation
<a href="http://www.tonga.islands-resorts.com/">http://www.tonga.islands-resorts.com/</a>
<a href="http://www.eua-island-tonga.com/accommodationeua.html">http://www.eua-island-tonga.com/accommodationeua.html</a>
<a href="http://www.tongavilla.com/">www.tongavilla.com/</a>
<a href="http://www.wheretostay.com.au/?qr=to">http://www.wheretostay.com.au/?qr=to</a>
<a href="http://www.southtravels.com/pacific/tonga/index.html">http://www.southtravels.com/pacific/tonga/index.html</a>
<a href="http://www.oceansidegaesthouse.com/activities.html">http://www.oceansidegaesthouse.com/activities.html</a>
<a href="http://www.webtourist.net/tonga/">http://www.webtourist.net/tonga/</a>
<a href="http://www.smoothhound.co.uk/tonga/">http://www.smoothhound.co.uk/tonga/</a>
<a href="http://www.all-hotels.com/oceania/tonga/home.htm">http://www.all-hotels.com/oceania/tonga/home.htm</a>
<a href="http://www.travbuddy.com/Tonga-hotels-list-c256">http://www.travbuddy.com/Tonga-hotels-list-c256</a>
<a href="http://www.mounuisland.com/">http://www.mounuisland.com/</a>
<a href="http://www.south-seas-adventures.com/Tonga/Tonga-Resorts-Tonga-Hotels.php">http://www.south-seas-adventures.com/Tonga/Tonga-Resorts-Tonga-Hotels.php</a>
<a href="http://www.datelinehotel.com/attractions.html">http://www.datelinehotel.com/attractions.html</a>
Whale watching/Sailing
<a href="http://www.whales-in-the-wild.com/accommodation.cfm">http://www.whales-in-the-wild.com/accommodation.cfm</a>
<a href="http://www.sailingsafaris.com/">http://www.sailingsafaris.com/</a>
<a href="http://www.whalewatchvavau.com/">http://www.whalewatchvavau.com/</a>
<a href="http://www.whalediscoveries.com/index.htm">http://www.whalediscoveries.com/index.htm</a>
<a href="http://www.whaleswim.com/">http://www.whaleswim.com/</a>
<a href="http://www.naia.com.fj/tonga/index.html">http://www.naia.com.fj/tonga/index.html</a>
<a href="http://www.whalestonga.com/">http://www.whalestonga.com/</a>
<a href="http://www.tonga-dive.com/">http://www.tonga-dive.com/</a>
<a href="http://www.blue-pacific-whale-watching.com.au/r8/whale-watching-in-tonga.html">http://www.blue-pacific-whale-watching.com.au/r8/whale-watching-in-tonga.html</a>
<a href="http://www.sailingsafaris.com/whale_about.html">http://www.sailingsafaris.com/whale_about.html</a>
<a href="http://www.fikco.com/whalewatch.htm">http://www.fikco.com/whalewatch.htm</a>
<a href="http://www.finsnflakes.com/whalewatching.htm">http://www.finsnflakes.com/whalewatching.htm</a>
<a href="http://www.tours.com/tours_vacations/tonga/whale_watching.htm">http://www.tours.com/tours_vacations/tonga/whale_watching.htm</a>
<a href="http://www.tongasailing.com/activities_in_tonga.htm">http://www.tongasailing.com/activities_in_tonga.htm</a>
Cruise
<a href="http://www.paradiseadventures.com.au/ASP/tonga.asp">http://www.paradiseadventures.com.au/ASP/tonga.asp</a>
<a href="http://www.pocruises.co.nz/FindACruise/Destinations/Pages/PacificIslands.aspx">http://www.pocruises.co.nz/FindACruise/Destinations/Pages/PacificIslands.aspx</a>
<a href="http://www.pacificislandtravel.com/tonga/cruises/oleanda.html">http://www.pacificislandtravel.com/tonga/cruises/oleanda.html</a>
<a href="http://www.sailingtonga.com/">http://www.sailingtonga.com/</a>
<a href="http://www.pgcruises.com/destinations/tonga/default.aspx">http://www.pgcruises.com/destinations/tonga/default.aspx</a>
<a href="http://www.cruiseline.co.uk/q-id/pacific-islands-cruises/tonga-cruises/">http://www.cruiseline.co.uk/q-id/pacific-islands-cruises/tonga-cruises/</a>
<a href="http://sailing-vacations.gordonsguide.com/tonga.cfm">http://sailing-vacations.gordonsguide.com/tonga.cfm</a>
<a href="http://www.princess.com/learn/ports/australia/ports/VAV.html">http://www.princess.com/learn/ports/australia/ports/VAV.html</a>

The websites were then evaluated according to their role in linking tourism with different community dimensions: Tongan Culture; Tongan Handicrafts and Tongan Food. Codes were allocated to significant statements central to community dimensions, with the objective being to produce a large collection of codes. These codes were then assembled into theoretical value clusters, permitting related occurrences of phenomena to be compared and contrasted. Codes that were found to be similar were rechecked to ensure they been coded accurately (Douglas, 2003, p. 47). The constant comparison of codes permitted greater assurance and confidence in the earlier produced codes (Glaser & Strauss, 1967, p. 24).

Various sub dimensions of Tongan culture, Tongan handicrafts and Tongan food identified during the coding process were then assessed. Each website was evaluated as to whether the website contained an introduction to the community dimension, followed by a detail of the dimension. The imagery displayed on each website was also assessed, as well as the opportunity for tourists to experience the various community dimensions (see Table 3). The Tonga Visitors Bureau and Eua Island websites were separated and assessed individually as they were the two highest performing websites.

**TABLE 3:** *Dimensions of Tongan culture and tourism website categories.*

Dimensions	Tonga Visitors Bureau (n=1)	Eua Island Website (n=1)	Websites			
			General Information % (n=19)	Accommodation % (n=14)	Whale Watching / Sailing % (n=14)	Cruises % (n=8)
Tongan Culture						
• Introduction to Tongan culture	*	*	53	31	43	38
• Detailed history of Tongan culture	*	*	18	8	21	13
• Cultural Events	*	*	18	8	14	13
• Images	*	*	35	15	36	38
• Diversity of images		*	18	8	21	13
• Cultural tourism experience- Village visit		*	6	15	14	13
Tongan Handicrafts						
• Introduction to Tongan Handicrafts	*	*	6	15	7	25
• Detail on Tongan Handicrafts	*	*	6	15	7	13
• Images	*	*	6	15	14	0
• Diversity of images	*	*	6	15	0	0
• Cultural tourism experience- Handicrafts		*	0	8	0	13
Tongan Food						
• Introduction to Tongan Food		*	0	15	7	25
• Detail on Tongan Food		*	6	8	14	13
• Images		*	0	8	7	13
• Diversity of images		*	0	8	7	13
• Cultural tourism experience- Island Night	*	*	0	8	7	13

The text data from the tourism websites was analysed by word frequency using NVivo (NVivo, 2012), a qualitative data analysis software package. To ensure interpretable results from the word frequency analysis, several grammatical operations were performed: All words commonly used in constructing sentences or stop words such as *is, a, the, of*, were excluded; the spelling of Tongan names such as Tongatapu and Nuku'alofa were made consistent; plural and singular words were combined such as *Tonga* and *Tongan*; and non-travel related text were further excluded from the analysis as they would not add significant information to the results.

## RESULTS

Tongan culture was moderately well covered by all sites, with just over 40% of sites giving a brief introduction. The sites providing detailed cultural history and information on cultural events were few. Well under half the sites provided images of Tongan culture, while very few sites displayed a diverse range of imagery. Whale watching/sailing and general information sites were the most informative, while accommodation sites were very weak. Both handicrafts and food were covered poorly across all Tonga travel sites. Cruise sites performed the best with 25% giving brief introductions to handicrafts and food. All sites displayed few images of Tongan food and handicrafts. The number of sites offering tourists the opportunity to participate in Tongan handicraft and food experiences such as Island nights was also very low. General information sites did not offer any opportunities, while only one site in each of whale watching, accommodation and cruises categories offered those opportunities.

[www.eua-island-tonga.com](http://www.eua-island-tonga.com) is a community based site run by a small group of volunteers on Eua Island. The Eua Island site was the most comprehensive and informative site of all Tongan travel sites, fulfilling all requirements of linking tourism with the community. The site has extensive sections on Tongan culture and details obscure topics such as legends and kava making. As well as informative text, there is a range of brilliant images that are well chosen for the site. The site provides travellers with plenty of opportunities to get involved with Tongan culture as it offers weaving classes, tapa cloth making, dance classes and kava nights.

[www.tongaholiday.com](http://www.tongaholiday.com) is the official website of the Tongan Government run by the Tongan Visitors Bureau. Due to its status, visitors may believe that this is the most comprehensive and informative of all Tonga travel sites. Overall, the site performed only moderately well and lacked several key components. The site had a strong and concise section on Tongan culture, however, it lacked a variety of images and disappointingly, there was no link to a Tongan cultural tourism experience. Handicrafts were covered comprehensively with great images and good detail; however, again, there was no link to a handicraft tourist experience. Tongan food received no attention on the site, which was surprising. There was a link to a Tongan feast, but this was hard to find, as it was located under the tours and guides section.

Table 4 displays the 25 most frequently used words as well as the top 4 cultural words used on the websites. The word *Tonga* was the most frequently used word closely followed by *Island*. Predictably, the majority of the most frequently used words such as *water*, *fish*, *beach*, and *boat* are commonly found in the promotional materials of Pacific Island Holiday Destinations (Connell, 2006 and 2007). Interestingly, there are only positive words in the top 25 most frequently used words: *good*; *great*; *friendly*; *beautiful* and *pretty* all featured and no negative words were recorded. *Church* and *Sunday* were both frequently mentioned reflecting the widespread practice of the Christian faith observed on this day, with the result being that most tourism activities shut down on Sunday (Orams, 2002). Linkages formed between community and tourism via websites was poor, as evidenced by the very low frequency of words such as *crafts*, *kava* and *culture*. However *dance* and *food* both featured in the 25 most frequently used words, again these words being commonly associated with Pacific Island holidays.

**TABLE 4:** 25 most frequently used words.

Keyword	Frequency
Tonga*	447
island	363
people	125
water	123
boat	117
good	114
fish	97
great	95
beach	87
local	84
church	83
town	73
trip	71
food	68
cave	67
beautiful	65
pretty	60
Tongatapu	60
flight	55
Sunday	53
dance*	53
Nuku'alofa	52
friendly	49
dinner	46
culture*	18
kava	24
crafts	4
handicrafts	0

## DISCUSSION

The aim of this study was to assess the extent to which current web content features promote and enhance the tourism linkages to handicrafts, food and local cultural activities in Tonga. It was found that the majority of Tongan tourism websites had very weak content on local handicrafts, food and local cultural events, and no single tourism sector stood out as performing better than another. Some websites did however offer good information on one particular community dimension. For example, [www.tongaholiday.com](http://www.tongaholiday.com), the official website of the Tongan Government, provided great insights into local handicrafts but did not mention Tongan food. Only [www.eua-island-tonga.com](http://www.eua-island-tonga.com), a community based website, stood out as being a model website that linked tourism with all three of the community dimensions.

Many small nations such as Tonga have government-run tourism websites in the hope that their websites will attract prospective tourists through attractive imagery and credible information (Horng & Tsai, 2010). Dion and Woodside (2010) propose that the government run destination websites have greater levels of detailed information in comparison to privately created websites. [www.tongaholiday.com](http://www.tongaholiday.com) was the second highest performing website, however, it still lacked the key component of Tongan food and did not have high quality images. This was very surprising, as government websites have become prominent advertisers of the local culture and cuisines of a tourist destination (du Rand Heath & Alberts, 2003). Boyne, Hall and Williams (2003) found that the official tourism websites of several countries needed to be improved in relation to their information content.

It must also be noted that the two highest performing websites were government ([www.tongaholiday.com](http://www.tongaholiday.com)) and community-based ([www.eua-island-tonga.com](http://www.eua-island-tonga.com)) and not tourism operators' websites. The fact that not all websites were run by tourism businesses did introduce bias into the study, as it is not always in the best interests of tourism operators to promote local community as it might lead to tourists spending their money elsewhere and not at the resort, hotel or cruise-ship being advertised (Meyer, 2007; Macpherson, 2008). Tourism operators need to be shown how their websites can easily promote linkages to the local community. This could be

facilitated by the Tongan government providing incentives or subsidies to operators in order to stimulate increased local community participation in tourism.

Many websites had quality information about the Tongan community dimensions but failed to back it up with decent imagery. For example, two whale watching /sailing websites had good introductions to handicrafts but did not have any imagery. Studies by Diaper and Wealend (2000) and Wang, Chou, Su and Tsai (2007) have shown that one of the keys to attracting online tourists and enhancing the marketing opportunities of websites is to provide a large variety of images to reinforce the written text. Horng and Tsai, (2010) add that websites containing only written text fail to build a sense of real presence and do not motivate tourists in the same way photos do. Imagery needs to be truly eye catching and of high quality. Poor quality photos can often leave a negative impression.

The majority of websites wrote that Tonga was an idyllic island holiday destination. The keyword analysis revealed that bloggers associated Tonga with words common to other Pacific Island holiday destinations (Connell, 2006 and 2007), and there was no mention of anything negative. This is a very positive sign for Tongan tourism and corresponds well with the marketing material on the Tonga Visitors Bureau website, which promotes Tonga as the “The Happy Isles” and displays great imagery of all things Pacific (Tourism Visitors Bureau, 2009). One key point arising from the keyword analysis is that websites frequently commented on the Christian faith being observed on Sunday as a day of rest. This is interesting, as it seems that Tonga shuts down on Sundays, and there are very limited opportunities for travellers to participate in tourism activities. This could be a great opportunity to link tourism with community; for example, local communities could offer tourism activities that observe a local church’s ceremonies, followed by the afternoon feast.

The keyword analysis clearly identified that Tongan websites had very little to say about local culture. This was most obvious from the lack of Tongan cultural words contained in the websites; for example, the word *handicrafts* was not mentioned in any of the websites. Another indication that had limited connections between travellers and local community was the limited range and use of local terminology used to describe certain objects. For example, the word *food* was commonly used, however, the names of local dishes such as *taro* or the traditional feast of an *umu* were not mentioned.

## **FUTURE RESEARCH AGENDA**

Future research could examine websites from other Pacific Island nations, not only a single country such as Tonga. This would provide a more comprehensive analysis of the internet’s role in promoting the links between tourism and the community in the Pacific region. It would also provide a contrast for the findings of this study, determining if the results found in this study were typical of all Pacific nations or if Tonga is an individual case. It is suggested that future studies also investigate travel blogs and word of mouth sources used by tourists visiting Tonga. Travel blogs and forums such as TripAdvisor, Facebook, ThornTree (Lonely Planet) could potentially provide a more direct link between local Tongan communities and tourists. The method of content analysis is not the only research instrument available, and other techniques

such as focus groups, consumer surveys, Delphi methodology, and interviews with travellers who have browsed Tongan tourism websites may provide deeper understanding.

The findings in this study are subject to inherent bias imbedded in data collection methods. Future research needs to take into consideration the method of sampling; in this study the tourism websites were not collected from a random sample of all internet sites. Using Google as the search engine to find the most popular and relevant Tongan tourism websites and travel blog sites subjects the sample to the Google ranking system. This sampling technique should be replaced with a larger sample size and an automated random sampling method.

## CONCLUSION

Tonga's tourism industry is still in its infancy and current indications show that the local community is not receiving many benefits, highlighted by the small number of community members actively participating in the tourism industry and the very limited information available on the internet regarding local community dimensions (Hopkins, 2008 and Milne, 2009). This study highlighted that Tongan destination websites are currently ineffective in promoting linkages between travellers and local community tourism products and services. The information gathered by this study can be used to shape and develop Tongan website content in a way that can stimulate tourism's links to the community dimensions of food, handicrafts and local cultural experiences.

This paper contributes to the growing body of knowledge associated with community participation in developing nations (Cole, 2006; Okazaki, 2008; Saufi, O'Brien & Wilkins, 2014; Scheyvens, 2003; Wang & Wall, 2007) and specifically, the challenges of being geographically isolated (Dadvar-Khani, 2012; Iorio & Corsale, 2014). The research highlighted that the local community participation in the tourism industry can be negatively influenced when internet exposure of the host population is not promoted on destination websites. In the absence of quality internet content and alluring imagery, local communities face a major obstacle in attracting international tourists to participate in community based tourism.

This paper builds on current tourism destination website assessment (Bastida & Huan, 2014; Fernández-Cavia, et al. 2013; Fernández-Cavia, Rovira, Díaz-Luque & Cavaller, 2014; Fryc, 2010; Gupta & Utkarsh, 2014; Li, 2011; Pai, Xia & Wang, 2014 Woolsey, 2011) by exploring the effectiveness of linking travellers to community based tourism. Extending on previous research, this study highlights that tourism destination websites play a more significant role than just pure promotion. This paper calls for future destination website assessments to look beyond only aesthetic aspects and move towards incorporating community dimensions. It is hoped that this study is the stimulus for future research to examine how destination websites can more effectively promote linkages with tourism and the community.

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## Hayden White and the Burden of History

*Anurag Subramani*

### ABSTRACT

*In his essays “The Burden of History” (1966), “Interpretation in History” (1972), “The Historical Text as Literary Artefact” (1974), “The Value of Narrativity in the Representation of Reality” (1980) and “Getting Out of History” (1982), Hayden White discusses the main tenets of his theory of historiography, narrativity and, inevitably, the relationship between the history and literature. In the essays, White argues for a common constructivist character of history and fiction, and rejects the Rankean notion of a ‘science of history’. Drawing support from the historiographical and literary theories of Claude Lévi-Strauss, R. G. Collingwood and Northrop Frye, White suggests historians must acknowledge history’s basis in the literary arts and treat the historical text as a literary artefact in order for the discipline to regain the prestige that it enjoyed in the early nineteenth century. The kind of eclectic history that White advocates is found in Klaus Neumann’s *Not the Way it Really Was*, a text that itself rejects a positivist view of history.*

**Keywords:** *History, literature, narrativity, positivism, Hayden White, Klaus Neumann*

## INTRODUCTION

[...] a significant number of philosophers seem to have decided that history is either a third-order form of science [...] or that it is a second-order form of art, the epistemological value of which is questionable, the aesthetic worth of which is uncertain. These philosophers seem to have concluded that, if there is any such thing as a hierarchy of the sciences, history falls somewhere between Aristotelian physics and Linnaean biology - which is to say that it may have a certain interest for collectors of exotic world-views and debased mythologies, but not very much to contribute to the establishment of that “common world” spoken of by Cassirer as finding its daily confirmation in science (White, 1978a, p. 30).

In his essay “The Burden of History” (1978), Hayden White speaks of a crisis in the discipline of history that began in the nineteenth century with the historian’s specious claim to occupy the hallowed middle ground that supposedly exists between the arts and sciences, claiming privileges arising from the association with both, conforming to the critical standards of neither. The trajectory of the crisis can be charted as follows: the loss of the historian’s power of prescience, that is, his/her inability to move beyond the studying of the past for its own sake in order to provide that visionary aspect that has generally been seen as the *raison d’être* of the discipline; the methodological naiveté of the historian in his/her unwillingness to use techniques from the arts and sciences; the consequent general revolt against the discipline by artists and scientists following the pattern set by Friedrich Nietzsche in *The Birth of Tragedy* (1872); the opposition to the so-called ‘historical consciousness’ by writers from the turn of the century till the 1960s; and the continued claim by contemporary historians of history as a science.

## THE PERILS OF ANTIQUARIANISM

The historian, writes White, for more than a century has been making the extravagant claim that the discipline of history is a site where the arts and sciences come together in a harmonious synthesis. While the claim gave the historian the license, on the one hand, to adhere to the critical standards of neither discipline, it also provided him/her with an excuse to avoid the criticism of artists and scientists. White adds,

[...] when criticised by social scientists for the softness of his method, the crudity of his organising metaphors, or the ambiguity of his sociological and psychological presuppositions, the historian responds that history has never claimed the status of a pure science, that it depends as much upon intuitive as upon analytical methods, and that historical judgments should not therefore be evaluated by critical standards properly applied only in the mathematical and experimental disciplines ...when reproached by literary artists for his failure [...] and his unwillingness to utilize contemporary modes of literary representation, the historian falls back upon the view that history is after all a *semi-science*, that historical data do not lend themselves to ‘free’ artistic manipulation [...] (ibid, p. 27).

With the refutation of the nineteenth-century belief that art and science were different ways of making sense of the world, the claim of the historian as a mediator between the arts and sciences no longer held sway. “Everywhere,” says White, “there [was] resentment over what [appeared]

to be the historian's bad faith in claiming the privileges of both the artist and the scientist while refusing to submit to the critical standards [...] obtaining in either art or science" (ibid, p. 28). The re-evaluation of history as the "irredeemable enemy" (ibid) of both the arts and sciences was significant for the development of historiography in the twentieth century. The attainment to the position of hegemony of the sciences sharpened the social scientists' hostility towards history. But, White writes, what was unnerving about the ostracism of history from the first rank of the sciences [in the early twentieth century] was that it was accompanied by a similar hostility of history by artists, in particular writers of fiction. The hostility of the artist towards history arose not only from history's claim to be a science or the unwillingness of the historian to open his mind to the techniques of imaginative writing, but also from what artists perceived to be the loss of the prophetic element in history. White writes that "the charge levelled against the historian by modern writers [was] also a moral one; but whereas the scientist [accused] him only of a failure of method or intellect, the artist indicts him for a failure of sensibility or will" (ibid, p. 31).

Although the tone for the revolt against history was set by Nietzsche in *The Birth of Tragedy* and "The Use and Abuse of History" (1874), where he warned that "wherever the 'eunuchs' in the 'harem of history' flourished, art must necessarily perish" (ibid, p. 32), his indictment against history and the historical imagination was taken up by writers of fiction such as George Eliot who warned of the "perils of antiquarianism" (ibid) and André Gide who in *The Immoralist* (1902) celebrated art's "response to the living present" and revolted against "history's worship of the dead past" (ibid, p. 34). The First World War, writes White, confirmed Nietzsche's revolt against history generations earlier. He says everywhere there was the feeling that history had failed to prepare men for the war, adding, the new anti-historicist attitude was best expressed by Paul Valéry, who wrote, "history is the most dangerous product evolved from the chemistry of the intellect" (ibid, p. 36). The anti-historicist attitude continued in the decades after World War Two, exemplified in the works of writers such as Albert Camus and Jean-Paul Sartre. These and other writers suggested only by "disenthraling human intelligence from the sense of history that men will be able to confront creatively the problems of the present" (ibid, p. 40). To realise this new inspired and vibrant historiography, White suggests historians must regain the visionary aspect of their work because "the disinterested study of the past" is neither "ennobling [nor] even illuminative of our humanity" (ibid). He points out that the revolt against history is from all fronts and that,

*the burden of the historian* in our time is to re-establish the dignity of historical studies on a basis that will make them consonant with the aims and purposes of the intellectual community at large (ibid).

## **HISTORY - A SCIENCE, NO LESS AND NO MORE**

One of the factors that led to the crisis within the discipline in the late nineteenth century was the attempt by historians to make the discipline a science modelled around the methods of the physical sciences. The philosophy that emerged in the nineteenth century that came to view the idea that historical knowledge could only be acquired by observation and experimentation in the manner of the natural sciences is positivism, and much of Hayden White's writing is a

resistance to the positivistic view of history. White's *Metahistory*, (1973) tries to deconstruct the mythology of the so-called science of history. Ewa Domanska suggests *Metahistory*, "seemed to dissolve the difference between fact and fiction and between real and imaginary events, violating the principles established by Aristotle and confirmed in the nineteenth century by Leopold von Ranke's constitution of history as a 'scientific' discipline" (2001, p. 324). She explains White's views in *Metahistory* and his other writings "stems from a revolt against the positivistic approach to history, whose naively realistic understanding of historiography, thinking in terms of binary oppositions (fact versus fiction), advocacy of a correspondence theory of truth and objectivism, and separation of axiology from epistemology, still make history an exceptionally well-protected enclave among the human and social sciences" (ibid, p. 322).

In articulating his alternative vision, White has been influenced by a wide range of theorists. Domanska suggests what links all these individuals – including White himself – is the fact that they were 'rebels' and 'heretics' "changing the legitimate (in their times) ways of thinking about the world and modes of its representation" (1998, p. 174). White's main influences have been Robin George Collingwood, Northrop Frye and Claude Lévi-Strauss. Of particular influence of the individuals has been on White's reading of history as 'constructivist'/'interpretive', and hence closer to the arts than the sciences. It is an idea that finds resonance in the tropes used by Collingwood, Frye and Levi-Strauss – 'constructive imagination', '*mythos*' and 'fraudulent outlines' respectively – to similarly argue for a constructivist view of history. Before I discuss the ideas of these theorists, it is imperative to look at the context in which a positivistic view of history arose.

In 1903, the English historian, John Bagnell Bury, delivered his inaugural address as Regius Professor at Cambridge entitled "The Science of History." In the address, he "celebrated the scientific character of the German critical school, affirmed the positivist call for generalization in history, and condemned history as a literary genre and moral teacher" (Breisach, 1994, p. 285). He ended by uttering the following words, which captures the essence of empirical history: "[history was] simply a science, no less and no more" (ibid). But Bury was not the first historian to make the claim that history was a science; it is, the German historian, Leopold von Ranke, who is widely celebrated as the 'father of historical science.' Ernst Breisach in *Historiography: Ancient, Medieval, and Modern* (1983) states, "rarely has a phrase been so often and approvingly quoted as Ranke's declaration that he wanted not to pass judgment on the past, but simply to report '*wie es eigentlich gewesen*' (how it actually was)" (ibid, p. 233). The scientific view of history held by Ranke and his epigoni is the result of the attainment to hegemony of the sciences among the intellectual disciplines as well as the advances made by science's off-spring, technology. It has also been deeply influenced by the publication in 1859, of Charles Darwin's *The Origin of Species*, in which he outlines his theory of evolution in nature – a parallel theory of evolution of societies forms the basis of the teleological view of History in general, and of Auguste Comte's philosophy of positivism in particular.

Ernst Breisach suggests that by 1880 the sciences had enjoyed such immense prestige, that scholars were "enthusiastic about the image of a nonmysterious world without essences and spiritual entities and about the scientific method as a way to certain and timeless truth" (ibid,

p. 268-269). He adds “scholars in all fields, including history, felt compelled to emulate so successful an endeavour and transfer its views and methods from the inquiry into nature to the inquiry into human phenomena” (ibid, p. 269). But there were also those like George M. Trevelyan, who “considered the idea of history becoming a science harmful if not grotesque” (ibid). Hence, in the six decades prior to 1914, a battle raged between those who were ready to accept history as a science - Auguste Comte, Henry Buckle, John Bagnell Bury, Hippolyte Taine, Karl Lamprecht - and those who insisted that an objective, ‘colourless’ view of history was not possible and even less desirable - Wilhelm Dilthey, Johann Gustav Droysen, Benedetto Croce and R. G. Collingwood. If Ranke is considered the father of ‘scientific history’, then Comte is the ‘father of positivism’. It was Comte who laid out the methodology to turn history into the science of history.

According to Collingwood, Comte’s point of departure was the idea that every natural scientist “began by ascertaining facts and then went on to discover their causal connexions” (Collingwood, 1946, p. 128). He adds, “accepting this assertion, Comte proposed that there should be a new science called sociology, which was to begin by discovering the facts about human life (this being the work of the historians) and then go on to discover the causal connexions between these facts” (ibid). Of the first task of ascertaining facts, Collingwood says that according to the positivist philosophy, the historian had to eliminate all subjective elements in his point of view. The second task, he says, would be carried out by sociologists – the ‘super-historians’ – “raising history to the rank of a science by thinking scientifically about the same facts about which the historian thought only empirically” (ibid). He adds, Comte’s programme was similar to the Kantian call for a philosophy of history with the difference that, while the latter conceived of historical processes as something different from natural processes, the positivist project of Comte saw historical processes identical with natural processes and “that was why the methods of natural science were applicable to the interpretation of history” (ibid). Drawing their inspiration from the likes of Ranke, Comte and Darwin, other positivist historians carried on with their individual visions of a scientific history.

One of these historians, Henry Thomas Buckle, called on historians to give up the search for metaphysical essences and forces shaping human action and emulating the natural scientists, and strive to find fixed laws governing human life. In France, Hippolyte Taine argued the past could be explained, “If one ascertained empirically, first, facts and more facts and then established the precise relationship between these facts or group of facts” (ibid). In researching and writing about the historical past, Taine borrowed a lot of his models and concepts from zoology, physiology and psychology. In England, Bury became for some “a prophet of positivism in historiography” (Breisach, 1994, p. 285). In the United States, historians had become ‘awed’ by science by the end of the nineteenth century, and this fascination led to the founding in 1884 of the American Historical Association. Among the founders were many German-educated historians, including Herbert Baxter Adams, who were “full of enthusiasm for a ‘scientific history’ in the German manner” (ibid, p. 287).



## FRAUDULENT OUTLINES: THE ART OF HISTORIOGRAPHY

In the nineteenth century, at a time when the positivistic view of history was taking shape, a counter-movement grew that argued for the idea that “interpretation was the very soul of historiography” (White, 1978d, p. 52). In that era, the four major theorists of historiography – Georg Wilhelm Friedrich Hegel, Johann Gustav Droysen, Friedrich Nietzsche and Benedetto Croce – rejected the “Rankean conception of the ‘innocent eye’ of the historian and the notion that the elements of the historical narrative, the ‘facts,’ were apodictically provided rather than constituted by the historian’s own agency” (ibid, p. 53). White says, “all of them stressed the active, inventive aspect of the historian’s putative ‘inquiry’ into ‘what had really happened’ in the past” and that all four theorists considered history not a science but a literary art, arguing that like all forms of literary arts, historical reality “was as much a ‘making’ (an *inventio*) as it was a ‘finding’ of the facts” (ibid, p. 53-54). The central tropes in Collingwood, Frye and Levi-Strauss’s - ‘constructivist imagination,’ *mythos*,’ and ‘fraudulent outlines’ respectively – theory of history, locate the discipline firmly in the realm of myth or fantasy. White discusses his own ideas for a constructivist view of history in “Interpretation in History” and “The Historical Text as Literary Artefact.”

In the first essay, White argues that all history contains an element of interpretation, and that it is this aspect that immediately calls into question whether the explanation of events by historians can qualify as objective and scientific. White’s view is “often defined as rhetorical constructivism based on the conviction that historical facts are ‘not given’ but ‘made by’ the historian” (Domanska, 1998, p. 322). The central argument in White’s theory of historiography is that in reconstructing the past, historians need to firstly exclude from their account those ‘facts’ which are seen as irrelevant to their narrative purpose and secondly, they must include in their narratives “an account of some events or complex of events for which the facts that would permit a plausible explanation of its occurrence are lacking” (White, 1978d, p. 51). This, he argues, is essentially an exercise in interpretation as it entails the filling in of gaps in the information on “inferential or speculative grounds” (ibid). It is this, that leads White to conclude that historical narratives are “verbal fictions, the contents of which are as much *invented as found* and the forms of which have more in common with their counterparts in literature than they have with those in the sciences” (White, 1978b, p. 82). White laments that the discipline of history is in a state of crisis because historians have eschewed the interpretive element in history and have lost sight of the discipline’s origins in the literary imagination.

As stated earlier, in arriving at his own philosophy of history, White was influenced by the ideas of a wide range of thinkers, including R. G. Collingwood. In *The Idea of History*, Collingwood calls positivism “philosophy acting in the service of natural science” (Collingwood, 1946, p. 126). He is especially critical of two aspects of the positivist view of history: firstly, the idea that historians should not taint the facts with their own views; and secondly, he points to a fundamental error in the positivistic philosophy arising, he says, from its misunderstanding of what a ‘fact’ constitutes. He explains that the natural sciences see a fact as something that is observed by sensory perception, adding that if there is any doubt about the facts, it can be repeated by experimentation. Thus, he says, “for the scientist, the question whether the facts

really are what they are said to be is never a vital question, because he can always reproduce the facts under his own eyes” (ibid, p. 133). Historical facts, however, “being now gone beyond recall or repetition, cannot be ... objects of perception” (ibid). He seriously questions whether the programme of the positivists to ascertain the facts by emulating the methods of the natural sciences is even possible, and this leads him naturally to ask whether a ‘science of history’ is possible. Collingwood insists, “the historian was above all a story teller suggesting historical sensibility was manifested in the capacity to make a plausible story out of a congeries of ‘facts’” (White, 1978b, p. 84). The making of a story out of the historical record – Collingwood points out that the historical record is always fragmentary and incomplete – requires what Collingwood calls the ‘constructive imagination’, a tool also used by writers of fiction.

Although White shares Collingwood’s belief that historical narratives are constructed using the faculty of the imagination, he is critical of his idea that the historical events themselves contain the story or complex of stories. He argues instead that the events only contain the story elements. It is the historian who spins the story elements into a narrative by suppressing some of them and highlighting others. In short, he says the historian uses all of the techniques a novelist or playwright would use in the ‘emplotment’ of a novel or a play. White believes that historical events are ‘value-neutral’ and that the type of story the events are finally composed into depends upon the historian – “What one historian may emplot as a tragedy, another may emplot as a comedy or romance” (White, 1978d, p. 58). This idea of ‘emplotment’ of the story elements into a story of a particular kind – tragic, comic, romantic, or ironic – aligns White’s theory of history with the ideas of the literary theorist Northrop Frye.

In *Anatomy of Criticism* (1957) Frye argues, “when a historian’s scheme gets to a certain point of comprehensiveness it becomes mythical in shape, and so approaches the poetic in structure” (ibid, p. 57). He speaks of different historical myths: romantic myths based on a quest or pilgrimage; tragic myths of ‘decline and fall’; comic myths of progress through evolution or revolution; and ironic myths of ‘recurrence and catastrophe’. He explains that “the fundamental meanings of all fictions, their thematic content, consist ... of the ‘pre-generic plot-structures’ or *mythoi* derived from the corpora of Classical and Judaeo-Christian religious literature” (White, 1978b, p. 83). White explains in Frye’s theory “we understand why a particular story has ‘turned out’ as it has when we have identified the archetypal myth, or pregeneric plot structure, of which the story is an exemplification” (White, 1978d, p. 83). He says “interpretation in history consists of the provisions of a plot structure for a sequence of events so that their nature as a comprehensible process is revealed by their figuration as a *story of a particular kind*” (White, 1978b, p. 58). A specific event from the historical past, says White, can be emplotted in different ways to provide different interpretations of, or to tell different stories about, the same historical event.

Claude Levi-Strauss calls the same process of imposing a story upon historical events as giving it a ‘fraudulent outline’. In *The Savage Mind* (1966), he argues, “the formal coherency of any historical narrative consists solely of a ‘fraudulent outline’ imposed by the historian upon a body of materials which could be called ‘data’ only in the most extended sense of the term” (White, 1978d, p. 55). Like White, Levi-Strauss argues historical ‘facts’ are not ‘found’ or ‘given’ but ‘constituted’ by the historian himself. He adds historical facts are not only constituted, but also

selected by the historian: “confronted with a chaos of ‘facts,’ the historian must ‘choose, sever and carve them up’ for the narrative purposes” (ibid). A narrative or story is finally fashioned from the congeries of facts by the imposition of a ‘fraudulent outline’. Hence, Levi-Strauss’s explanation of history brings it in the realm of the mythical. White writes “this conflation of mythic and historical consciousness will offend some historians and disturb those literary theorists whose conception of literature presupposes a radical opposition of history to fiction or of fact to fancy” (White, 1978b, p. 82). Northrop Frye similarly says “to tell the historian that what gives shape to his book is a myth would sound to him vaguely insulting” (ibid). But the element of myth is evident most clearly in those grand narratives of the West – History, Marxism and Christianity – that are driven by a teleological impetus and which purport to tell a single narrative truth about the past. Arguing for the mythical element in history, White writes,

In my view, history as a discipline is in bad shape today because it has lost sight of its origins in the literary imagination. In the interest of appearing scientific and objective, it has repressed and denied to itself its own greatest source of strength and renewal. By drawing historiography back once more to an intimate connection with its literary basis, we should not only be putting ourselves on guard against merely ideological distortions; we should be by way of arriving at that ‘theory’ of history without which it cannot pass for a ‘discipline’ at all (ibid, p. 99).

## **PALINGENESIS - THE REBIRTH OF HISTORY**

How does White propose the historian relieve contemporary society from the burden of history? The project for the historian as envisaged by White is two-fold: firstly, he must put that sense of purpose back into history, that is, history not an end in itself but history with a vision - “philosophy teaching by examples” (ibid, p. 36); and secondly, history must shed the parochialism that has been the most salient feature of the discipline from the mid nineteenth century onwards, and embrace the eclecticism, which was its defining feature in the early nineteenth century.

Much of the revolt against history from the mid-nineteenth century onwards had to do with the fact that the discipline had lost much of the visionary aspect that both intellectuals and the laity expected from it. White, in “Getting out of History”, discusses similar crisis in contemporary Marxism. He says that many modern Marxists have tended to play down the prophetic aspect of Marxism in an attempt to appear more scientific, but that the result has been the loss of the ability of Marxism to inspire visionary politics. A similar loss of moral coloration has been obvious in the discipline of history from the mid-nineteenth century. The discipline of history, White argues, needs to “establish the value of the study of the past, not as an end in itself but as a way of providing perspectives on the present that contribute to the solution of the problems peculiar to our time” (ibid, p. 41). He says, “anyone who studies the past as an end in itself must appear to be either an antiquarian, fleeing from the problems of the present” or a ‘cultural necrophile’ “who finds in the dead and dying a value he can never find in the living” (ibid). In “Hayden White: Beyond Irony”, Ewa Domanska suggests White is “one of those thinkers who see historical knowledge as a problem of consciousness, and not merely as one of methodology” (Domanska, 1998, p. 176). She adds like Georg Wilhelm Friedrich Hegel, Karl Marx, Friedrich Nietzsche, Jules Michelet and Alexis de Tocqueville, “White is conscious that the way one thinks about

the past has serious implications about the way one thinks about one's own present and future" (ibid). White explains the great reflective historians like Huizinga inspired him because they not only studied the past, but also reflected on how the past was to be studied. He says:

I think that, all of the great historians do both history and philosophy of history. They always asked the question how do you do history, what is the best way of doing it, what are the grounds for thinking that one way is better than another, what are the purposes, the social purposes of studying the past? (Domanska, 1993, p. 8).

Of the second project for the historian - being more receptive to the techniques of inquiry and representation of other disciplines - White writes of the importance of a 'palingenesis' or rebirth for the discipline of history after its decline in the nineteenth century. He says historians need to seriously consider the methods and perspective of artists and scientists about how the historical past ought to be brought to life. White draws our attention to the nature of the exchange that characterized the relationship between the various disciplines in the early nineteenth century:

Romantic artists went to history for their themes and appealed to "historical consciousness" as a justification for their attempts at cultural palingenesis, their attempts to make the past a living presence to their contemporaries. And certain sciences - geology and biology in particular - availed themselves of ideas and concepts which had been commonly used only in history up to that time (White, 1978b, p. 41).

He writes that what was impressive about that era was the "willingness of intellectuals in all fields to cross the boundaries that divided one discipline from another and to open themselves up to the use of illuminating metaphors for reality, whatever their origins in particular disciplines or world-views" (ibid, p. 42).

White points out the crisis of history in the middle of the nineteenth century coincided with the discipline's refusal to entertain the techniques of inquiry and representation that the arts and sciences had to offer. During this period historians also somehow became attached to antiquated notions of what art and science were. Both art and science were undergoing drastic changes in terms of outlook and methodology, but the historian somehow clung to antiquated views. Hence, when historians claimed the discipline of history was a combination of science and art, they were oblivious to the fact that their notions of art and science had become anachronistic. What in fact historians were talking about, states White, was history as a combination of 'romantic art' and 'positivistic science', adding when historians spoke of the 'art of history' they "[seemed] to have in mind a conception of art that would admit little more than the nineteenth-century novel as a paradigm" (ibid). He explains,

... when [historians] say they are artists, they seem to mean that they are artists in the way that Scott or Thackeray were artists. They certainly do not mean to identify themselves with action painters, kinetic sculptors, existentialist novelists, imagist poets, or *nouvelle vague* cinematographers ... Thus, for example H. Stuart Hughes argues in a recent work on the relation of history to science and art that 'the historian's supreme technical virtuosity lies in fusing the new method of social and psychological analysis with his traditional storytelling function' (ibid).

White dismisses the idea of history as advocated by people like Hughes saying that while bringing the past to life in a linear chronological story may serve the historian's purpose, it is, however, only one of many modes of representation open to them. In an interview with Ewa Domanska (1993), White maintains that in the representation of the historical past the historian must use different techniques available to him. He writes that such eclecticism would liberate the historian from methodological narrow-mindedness and "force [them] ... to recognise that there is no such thing as a *single* correct view of any object under study but that there are *many* correct views, each requiring its own style of representation" (White, 1978a, p. 47). He believes that such recognition would allow the historian to "entertain seriously those creative distortions offered by minds capable of looking at the past with the same seriousness ... but with different affective and intellectual orientations" (ibid).

Historians, writes White, do not have to represent the past in narrative form, adding "they may choose other, non-narrative, even anti-narrative, modes of representation, such as the meditation, the anatomy, or the epitome" (White, 1980, p. 3). He points out that historians like Tocqueville, Burckhardt, Huizinga and Braudel refused the narrative form because it wasn't the most suitable form for the kind of history they wished to write. Unfortunately, writes White, when historians speak of history as an art, what they have in mind is history that emulates the English novel as it developed in the late nineteenth century, a history that "[eschews] the techniques of literary representation which Joyce, Yeats, and Ibsen have contributed to modern culture" (White, 1978a, p. 43). The nineteenth century novel form, he argues, has itself become something of an anachronism, unable to capture the fragmented and ambivalent nature of our existence. It has been superseded by other forms, which are more pertinent to the age like the *nouvelle roman*. White laments that historians do recognize the need to write history using newer literary forms:

There have been no significant attempts at surrealist, expressionistic, or existential historiography in this century [...] for all the vaunted 'artistry' of the historians of modern times. It is as if the historians believed that the *sole possible form* of historical narration was that used in the English novel as it had developed in the late nineteenth century. And the result of this has been the progressive antiquation of the 'art' of historiography itself (White, 1980, p. 43-44).

White points out some historians have shown a remarkable ability to innovate by utilising econometrics, game theory, theory of conflict resolution, role analysis and other types of innovations, but that the examples have been too few and far in between, and that it has been done only when the historian sensed "their conventional historiographical purposes can be served in doing so" (ibid, 45). The two examples he cites of the historians' willingness to go beyond the conventional modes of historical representation are the works of the Jacob Burckhardt and Norman O. Brown. Of O. Brown's experiment in *Life against Death* (1959), he says that Brown offers the historiographical equivalent of the anti-novel. In White's analysis of Burckhardt's *The Civilization of the Renaissance in Italy* (1860), we can see clearly the type of innovation he requires at work in historical discourse:

[He] was willing to experiment with the most advanced artistic techniques of *his* time. His *Civilization of the Renaissance* can be regarded as an exercise in impressionistic historiography, constituting, in its own way, as radical a departure from the conventional historiography of the

nineteenth century as that of the impressionistic painters, or that of Baudelaire in poetry. Beginning students in history - and not a few professionals - have trouble with Burckhardt because he broke with the dogma that an historical account has to 'tell a story,' at least in the usual, chronologically ordered way ... And once he was freed from the limitations of the 'storytelling' technique, he was liberated from the necessity of constructing a 'plot' with heroes, villains, and chorus, as a conventional historian is always driven to do. Since he possessed the courage to use a metaphor constructed out of his own immediate experience, Burckhardt was able to see things in the life of the fifteenth century that no one had seen with a similar clarity before him (ibid, 44).

What White advocates then, is a historiography that is innovative and uses techniques and methodologies from other disciplines. After all, argues White, historians have themselves at one point stated that the study of history does not require a specific methodology nor any special intellectual equipment. He says that only a willingness to innovate and continuously reinvent the discipline and to engage in the project of palingenesis would allow history to avoid the kind of crisis experienced in the discipline in the late nineteenth century. He says, "The methodological ambiguity of history offers opportunities for creative comment on the past and present that no other discipline enjoys" (White, 1978a, p. 47-48).

### **KLAUS NEUMANN AND THE WAY IT REALLY SHOULD BE**

The kind of history White advocates, one that innovates, is self-reflexive and understands that the historical text is a literary artefact, is found in Klaus Neumann's *Not the Way it Really Was* (1992). Robert Kiste in the "Editor's Note" to the text refers to it as an example of a positive trend in Pacific history where young historians are breaking out of the traditional boundaries of their discipline and embracing more eclectic approaches in writing about the past. He compares Neumann's work with David Hanlon's *Upon a Stone Altar: A History of the Island of Pohnpei to 1890* (1988), pointing out both authors "employ a mixture of conceptual frameworks and research methods from social and cultural anthropology, folklore, historical linguistics, oral history, and archival research" (Neumann, 1992, p. vii), as a way of conceptualising a new kind of history. The very title of Neumann's text expresses a spirit that is anti-positivist, being an uncrowning of Ranke's outrageous assertion that he wanted to write history 'as it really was'. In the spirit of White, the text proposes instead, history that articulates the past in a polyphony (in the Bakhtinian sense) of voices and one that is nonlinear and experimental in form and subjective in nature. It is interesting to note that Neumann says much of what he proposed, the stylistic and methodological choices he made, stood "outside the parameters of the discourses that predominate in the discipline at the Australian National University and in its periodical, the *Journal of Pacific History*" (ibid). It is to his credit then, though working in an institution renowned for its conservative approach to history writing, he was able break free of methodological and stylistic constraints, and produce a text that is stylistically innovative and an exceptional work of scholarship.

One of the great strengths of Neumann's text is that it achieves Hayden White's call for a history that muses on the processes of its own creation, history that also contains a philosophy of history. Neumann says, "I do not always neatly distinguish between writing a history and writing

about histories, and I often make the second undertaking become part of the first” (ibid, p. 4). Neumann uses the study of the historical past of the Tolai as an occasion to express his thoughts on the complexities of the history writing process as well as to reveal unsettling truths about the past. Neumann is able to merge history and metahistory by the choice of his organisational style. Phyllis Herda, in a review of *Not the Way it Really Was*, makes the point that Neumann’s “organizational style is reminiscent of Greg Denning’s *Islands and Beaches*” (1994, p. 231), a work that itself undermines traditional historical practices and one in which Denning establishes a rapprochement between history and poetics that an empirical historian would dismiss as a folly of an individual imbibing freely on the theories of postmodernism and post-structuralism. In Neumann’s text there is harmony between content and form and he says as he was writing the book he consciously “wondered how to avoid a separation of the content and the nature of the research from the form in which the results would be presented” (1992, p. 42). Francois Lyotard’s well-known definition of postmodernism, “incredulity towards metanarratives” (1984, p. xxiv) is quite appropriate for Neumann’s work because what he constructs is “a series of ‘mininarratives’, which are provisional, contingent [and] temporary” (Barry, 2002, p. 87).

If one examines the structure of the text, one would find a history that is non-linear and which clearly violates conventional practices of history writing – and conventional literature - by not having a clearly discernable beginning, middle and an end. Even within the chapters Neumann chooses not to continuously propel the story forward in a linear fashion, but moves back and forth, sometimes giving an account by participants or eyewitnesses of the events, for instance, those surrounding the murder of German planter Rudolf Wolff, sometimes engaging in a discussion of his own methodology, sometimes discussing aspects of the Tolai historical past and sometimes engaging in a discussion of the influences upon his approach to history writing. The odd-numbered chapters of the book are concerned with the colonial past of the Tolai, especially the central event of the murder of Wolff. The even-numbered chapters “establish the contexts in which this history has been produced and in which Tolai produce their histories” (Neumann, 1992, p. 48-49). It is a forum where Neumann considers his own methods, discusses the influences behind his approach to history writing, and the impulses that drove him to research the historical past of the Tolai and the way he did his investigation. Herda correctly points out it is not the Tolai who are the main subject of the book, but history itself ((Herda, 1994, p. 231). Kiste expresses a similar view when he says “the Tolai history (or histories) is but a vehicle for addressing a larger set of issues about the nature of history and the work of its practitioners” (Neumann, 1992, p. vii).

The style of Neumann’s text clearly demonstrates two influences at work: postmodernist philosophy, which rejects the notion of objectivity in discourse of any kind and which emphasises and celebrates the disjointed nature of existence; and cinematic and dramatic technique. Firstly, one can see the influence of cinema on Neumann in his mention of the name of German film director Alexander Kluges, whose approach to doing history, he says, fascinated him. I will discuss the ideas of Kluges later, but here I want to compare Neumann’s work with some cinematic offerings with which his work shares many points in common. The template for most films is Aristotle’s three-act plot. In fact, the great teachers of screenwriting such as Robert McKee and Syd Field warn students of transgressing this time-honoured template. However, sometimes certain filmmakers opt for an experimental technique, breaking-free of the linear framework

and three-act plot development. One film that comes to mind is Akira Kurosawa's *Rashomon* (1950) in which four different witnesses give their account of one incident. The accounts of the four witnesses are mutually contradictory and the film makes a commentary on the nature of truth and objectivity. Two recent examples have been Quentin Tarantino's *Reservoir Dogs* (1992) and Christopher Nolan's *Memento* (2001). Both films previously mentioned depend on a disjointed narrative and temporal shifts back and forth in the narrative to gradually reveal the story. Time itself becomes a subject in these films. In both films the experimentation with narrative techniques adds significantly to the development of the plot. Neumann's text can be seen as a textual equivalent of these cinematic offerings.

The text opens with an account in first person by an indigenous Tolai who relates the incident of the murder of a German planter. This is followed by Neumann's introduction to the Tolai people and his musing on the subject of history itself. In these musings, speaking of the various events he would examine, Neumann discloses, "for my history I have selected seven clips (my emphasis) from the Tolai past" (ibid, p. 4). After this we have a series of subheadings. He closes the chapter once more with personal musing about history and the type of history he intends to write: "I do not intend to write a history that places a particular sequel to events of the past firmly between a before and an after" (ibid, p. 36). There are times when Neumann, like a filmmaker, cuts to, pans and does a close-up. The stylistic cosmopolitanism one encounters in the text goes hand in hand with another important project Neumann has undertaken in the text – the task of revealing one of the great truths about history, one that orthodox historians know but fail to declare and that is the idea that objectivity is a chimera. All historians grapple with the questions of historical objectivity and historical truth, but Neumann demonstrates its elusive nature by writing a history in which objectivity is difficult to achieve. On the question of objectivity, Neumann writes: "The construction of the Tolai past that I propose is as subjective as other written histories – with the difference that other written histories often vie to be objective reconstructions of the past. I stand by the partiality of my approach" (Neumann, 1992, p. 40). Neumann instead writes history that is polyphonous. In his history, the past speaks to us in many voices. In his history, there is no one 'way it really was'.

Neumann also spends considerable time musing on the many influences on his own philosophy of history. In my discussion of White I mentioned how the philosopher's own work was influenced by and was a synthesis of the positive elements of philosophers before him. Neumann mentions the names of Walter Benjamin and German film director Alexander Kluges as two key influences. Of Benjamin, he says the theorist's two works "Theses on the Philosophy of History" and *Passagenwerk* or *Arcades Project* "represent the most incisive condensation of a truly revolutionary approach to history" (ibid, p. 42). "Theses on the Philosophy of History" Benjamin states that to "articulate the past historically ... means to seize hold of a memory as it flashes up at a moment of danger." Hence Neumann's work is the expression of all the key moments that went into making a historical past. From Kluges, Neumann derives the idea that "there is a real need for ideology", explaining that his "proposal meant that I could use stories as elements for my construction of the past and at the same time subject them to a critique that tries to unravel the conditions" (ibid, p. 43). Speaking of Kluges' influence on him, Neumann writes, "His cinematic rendering of the past provides a vision for producing a history" and calls his



films “literary artefacts” (ibid). Both Benjamin and Kluges provide Neumann with a philosophy behind doing history; however, in search for a philosophy that synthesizes the ideas of the two individuals aforementioned, Neumann does not drown out the voices of the Tolai, rather his personal musings ask questions about the nature of history using the histories of the Tolai as a reference point. The arrangements of the chapters allows for his personal musing as well as the voice of the Tolai to live in harmony - the odd-numbered chapters contain narratives of the Tolai’s historical past, while the even-numbered chapters contain theoretical criticism as well as Neumann’s own reflections on the process of writing history.

So overall, what we have in *Not the Way it Really Was* is a history that has the stylistic cosmopolitanism that Hayden White suggests any good history must have. Neumann actively muses on his methodology, the challenges of reconstructing the historical past, and the various influences on his own worldview and style. For the reconstruction of the history of the Tolai, he also employs archival and oral sources (a source often marginalised in many European histories about the Pacific) and hence, gives agency to the subjects of the history, the Tolai. Most importantly, Neumann’s works makes a contribution to the on-going ‘history as a science’ or ‘science as an art’ debate by subverting Ranke’s proposition to capture the past objectively using the scientific method, by presenting a history that is polyvocal and understands its own status as a constructivist art. Kiste is right when he speaks of Neumann’s work as a healthy new trend in Pacific history and I would add for Neumann to write this kind of history working in an institution renowned for its methodological and stylistic conservatism is great credit to him.

## CONCLUSION

This paper, in critically appraising the works of Hayden White, has tried to show the deep schism in the discipline of history that developed from the nineteenth century onwards, a situation that owed a lot to Leopold Von Ranke’s call for historians to write history ‘the way it really was’ and to Auguste Comte’s positivist plan for a ‘science of history’. In his theories of history and narratology, White suggests historians, in an effort to salvage the reputation of the discipline, need to pay heed to the techniques and methodologies from other disciplines. He also suggests historical texts need to contain a philosophy of history, that is, a historian needs to write about the past, not because he/she is an antiquarian but because he/she sees his/her work as contributing positively to the future of humanity. Most importantly, White suggests historians need to shun the idea of a science of history and acknowledge the historical text as being a constructivist and interpretive form. The kind of history that White proposes is found in the works of Pacific historians Klaus Neumann, David Hanlon, Greg Dening and Robert Nicole. The strength of these historians has also been their ability to enervise the discipline with critical theory, a gesture that has allowed them to present fresh perspectives on the historical past.

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## **A comparative study of stress amongst teachers of the western division in Fiji**

*Mohammad Absan*

### **ABSTRACT**

*Stress is an unavoidable aspect of modern life and can have serious effects on one's health and performance. There is an absence of empirical research and literature regarding stress amongst teachers in Fiji. As such, there is an important need for basic research on teacher stress to be carried out in Fiji. The aim of this study was to investigate stress amongst school teachers. Fifty one teachers from the western division of Fiji were selected for this study. The Teacher Work Stress Inventory of G. J. Boyle et al. was used to measure teacher stress. Data was analysed using the IBM SPSS 21. Percentages, means, standard deviations, and t-test were used to describe the data. On the basis of data analysis, the study revealed that female, married, urban, i-Taukei, and secondary school teachers have more stress than their counter parts. It was also noted that all teachers at some point or the other experience different levels of stress, weather moderate, mild or extreme.*

**Keywords:** *Stress, Gender, Ethnicity, Dependants and School Teachers.*

## **INTRODUCTION**

Stress is a common phenomenon and much has been written about its nature, effects and management. It has been constantly associated with facilitating professions, including teaching. Teaching has traditionally been considered to be one of the most stressful occupations (Kyriacou, 2000). Teacher stress can be defined as experiences in teachers of unpleasant, negative emotions, such as anger, frustration, anxiety, depression and nervousness, resulting from some aspect of their work (Kyriacou 2001). Stress has been further defined as the sum of the physical, mental and emotional strains or tensions in a person. People under large amounts of stress can become tired, sick, and unable to concentrate or think clearly. Sometimes, they even suffer mental breakdowns.

Two types of stress can eventually affect teachers; task-based stress and role based stress. Task based stress such as dealing with distracting students, refers to problems that are associated with a variety of specific tasks that teachers must perform in their teaching role. Role based stress, such as an absence of sufficient resources to execute effectively, refers to how teachers' expectations of their role fit in with the actual work-related responsibilities needed to fulfill their role (Pettegrew & Wolf, 1982). Stress within teaching is driven by the organizational factors related to the way in which teachers are expected to work (Hepburn & Brown, 2001). Organizational factors that contribute to teacher stress can include unreasonable directed time budgets, excessive paperwork, unrealistic deadlines, and intimidating inspection regimes (Hepburn & Brown, 2001). Teachers face various stressors comprising student behaviour complications (Forlin, 1997), poor student behaviour (Friedman, 1995), discipline and handling difficult students (Onafowora, 2004), dealing with uncompromising behaviour of parents (Howard & Johnson, 2004), compact workload (Nagel & Brown, 2003), multiple roles and responsibilities (Hockley & Hemmings, 2001), being evaluated by others (Kyriacou, 2001), role conflict (Pearlin, 1989), attending after school and evening meetings (Romano & Wahlstrom, 2000), inadequate resources (Chaplain, 1995), lack of incentive (Burke & Greenglass, 1993), and high external expectations (Murray-Harvey et al., 2000).

A teacher who does not have a conflict between personal values and those of educational authorities, has a high ambition to succeed professionally, and is not easily upset or excited; tends to experience the least amount of stress (Bachkirova, 2005). Teachers need to identify how much stress they are experiencing and how it is affecting their teaching before they can learn and incorporate positive coping strategies. It is imperative that teachers learn that stress can be diminished with simple strategies which could then lead to a healthier and more fulfilling career.

The research intended to identify level of stress in school teachers, on the basis of their gender, marital status, ethnicity, discipline, location, experience and number of dependants. There is an absence of empirical research and literature regarding stress of school teachers in Fiji. As such, there is an important need for basic research on teacher stress to be carried out in Fiji-where the local circumstances can be taken into account in the design of the study.

## METHODOLOGY

### PARTICIPANTS

The sample size for this study was affected due to a lack of consistency in the return rate of participants' signed consent and questionnaire. For the present study fifty one in-service teachers were randomly selected. The average age of the participants was 29.09 year and the SD 5.38 years. The demographic information is as follows;

**TABLE 1:** *Demographic Information of In-service Teachers*

Items		Number of Participants	Percentage (%)
<b>In-service Teachers</b>	Western	51	100
	Male	23	45.09
<b>Gender</b>	Female	28	54.90
	Single	18	35.29
<b>Marital Status</b>	Married	33	64.70
	Fijian	42	82.35
<b>Ethnicity</b>	I-Taukei	9	17.64
	Primary	42	82.35
<b>Discipline</b>	Secondary	9	17.35
	Rural	30	58.83
<b>Location</b>	Urban	21	41.17
	Low	31	60.78
<b>Experience</b>	Medium	16	31.38
	High	4	07.84
	Few	18	35.30
<b>No. of Dependants</b>	Some	23	45.10
	More	10	19.60

### DESIGN

This study adopted a quantitative approach to investigate stress levels amongst school teachers in Fiji. Stress was selected as an independent variable. The dependents variables were gender, marital status, ethnicity, discipline, location, experience and number of dependants in the family.

### INSTRUMENT

The Teacher Stress Inventory (Boyle et al., 1995) was used to measure teacher stress: The

questionnaire items asked participants to rate the level of stress they experienced in carrying out different teaching tasks. Each item of the inventory had five possible answers, which typically were: No Stress, Mild Stress, Moderate Stress, Much Stress and Extreme Stress. To obtain a conventional score, the Likert-type scale ranging from no stress (0) to extreme stress (4) was used. The inventory consisted of twenty six items.

## PROCEDURE

All the teachers participating in this study were part of the in-service programme offered by the Fiji National University (FNU). They attended classes on Saturdays at Lautoka campus. During these classes, the questionnaires were distributed to the participants. Instructions were delivered beforehand to mark their response. All fifty one teachers voluntarily participated in this study.

## ANALYSIS OF DATA

The data were analysed using the Statistical Package for Social Sciences 21. Percentage, means, standard deviation, and t-test were used to describe the data. The significance level was set at .05 levels.

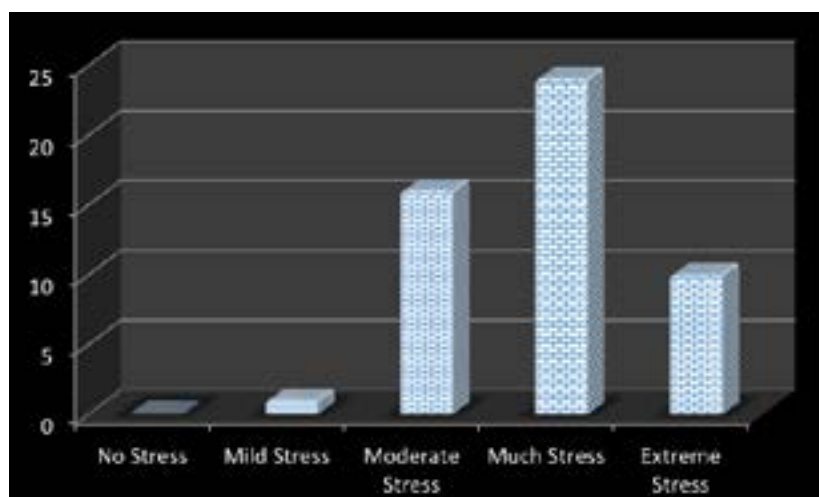
## RESULTS

The data were computed and tabulated in the following manner

The levels of stress amongst school teachers

Sr. No.	Categories of stress	No. of Teachers
1	No Stress	0
2	Mild Stress	1
3	Moderate Stress	16
4	Much Stress	24
5	Extreme Stress	10

*Level of Stress*



The graph shows the responses among a group of in-service teachers about stress. According to the graph, none of the fifty-one teacher had stress, only one teacher had mild stress, sixteen teachers had moderate stress, most of the teachers had much stress, whereas only ten teachers had extreme stress.

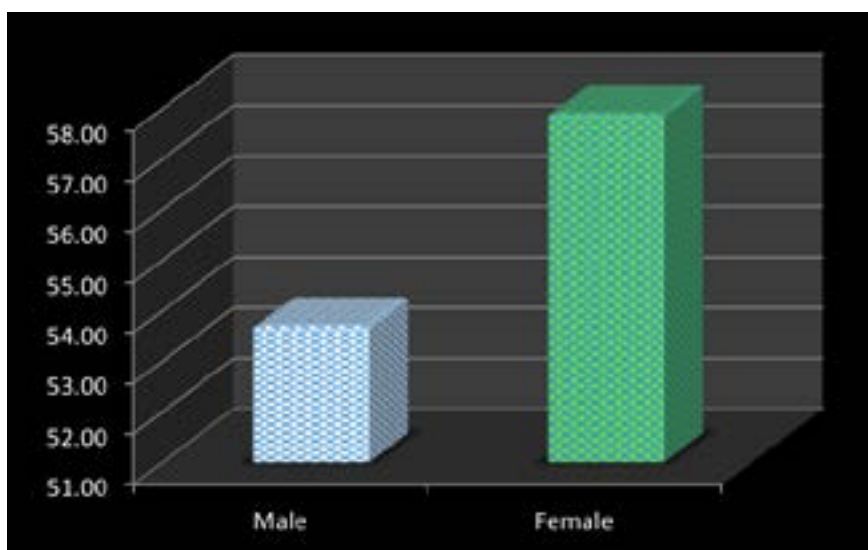
## GENDER

	Mean	SD	df	t-test
Male	53.70	14.92	49	0.35
Female	57.89	17.04		

*\*Significant level at .05 levels*

In order to compare the level of stress between the male and female teachers, the mean and standard deviation were separately calculated. The findings showed that there was no significant difference between the male and female teachers. However, the mean score of female teachers was higher than that of male teachers.

*Level of Stress Based on Gender*



The graph shows the responses for the level of stress of male and female teachers. In comparison, female teachers showed higher stress levels than the male teachers.

## MARITAL STATUS

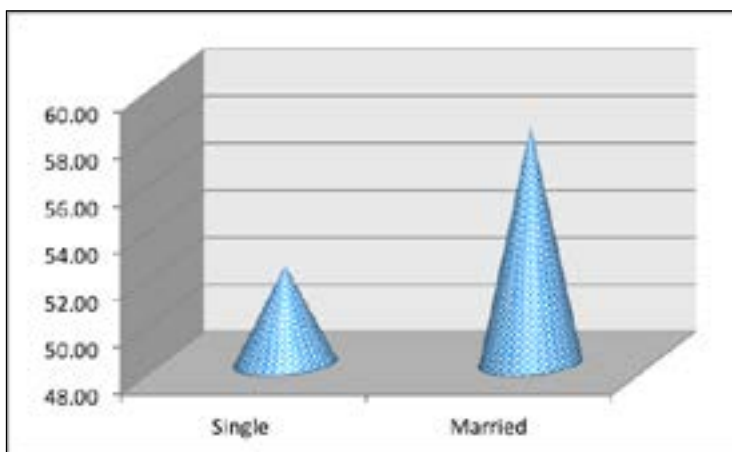
	Mean	SD	Df	t-test
Single	52.17	17.60	49	0.24
Married	58.09	15.08		

*\*Significant level at .05 levels*



In order to compare the level of stress between single and married teachers, the mean and standard deviation were separately calculated. The findings showed that there was no significant difference between single and married teachers. However, the mean score of married teachers was higher than that of the single teachers.

Level of Stress Based on Marital Status



The graph shows the responses for the level of stress of the single and married teachers. Comparatively, married teachers have higher stress levels than the single teachers.

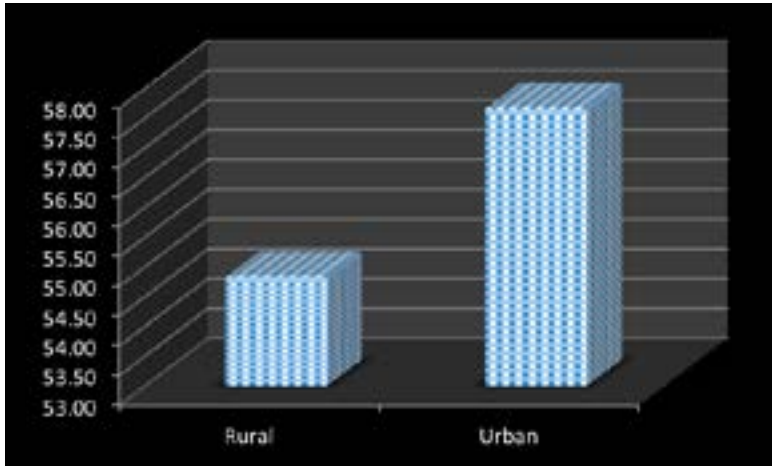
### LOCATION

	Mean	SD	Df	t-test
Rural	54.83	17.84	49	0.52
Urban	57.67	13.47		

\*Significant level at .05 levels

In order to compare the level of stress according to the location, between rural and urban teachers, the mean and standard deviation were separately calculated. The findings showed that there was no significant difference between rural and urban area teachers. However, the mean score of urban teachers was higher than that of the rural teachers.

Level of Stress Based on Location



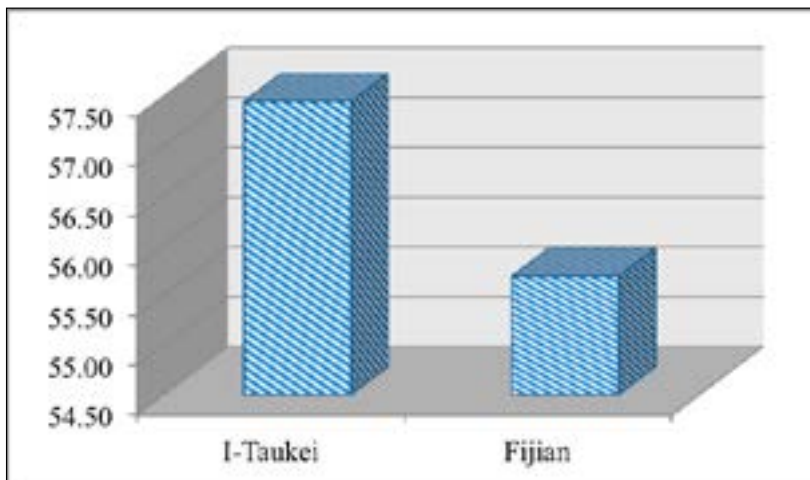
The graph shows the responses for the level of stress of the rural and urban teachers. In comparison the urban teachers had higher stress levels than the rural teachers.

**ETHNICITY**

	Mean	SD	df	t-test
<b>i-Taukei</b>	57.44	17.04	49	0.78
<b>Fijian</b>	55.69	16.09		

In order to compare the level of stress according to the ethnicity, between i-Taukei and Fijian teachers, the means and standard deviation were separately calculated. The findings showed that there was no significant difference between the i-Taukei and Fijian teachers. However, the mean score of i-Taukei teachers was higher than that of the Fijian teachers.

Level of Stress Based on Ethnicity



The graph shows the responses for the level of stress of the i-Taukei and Fijian teachers. Comparatively, the i-Taukei teachers had higher stress levels than the Fijian teachers.

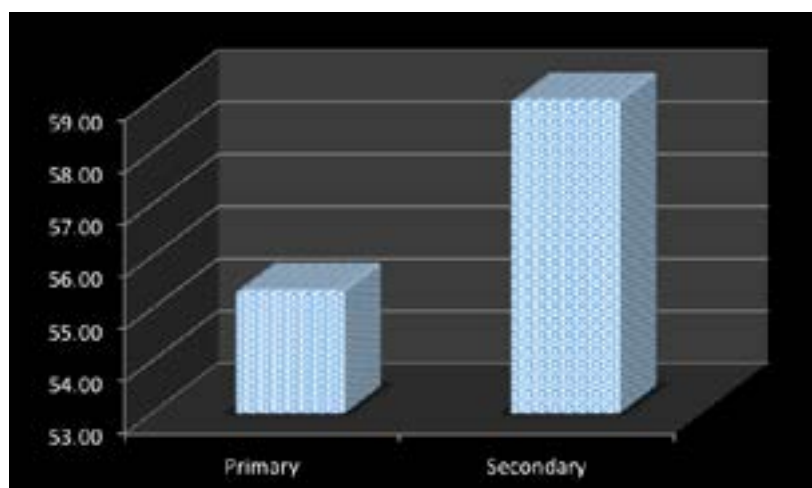
**LEVEL OF STRESS BASED ON AREA OF SERVICES**

	Mean	SD	df	t-test
Primary	55.36	15.07	49	0.63
Secondary	59	21.05		

*\*Significant level at .05 levels*

In order to compare the level of stress between primary and secondary school teachers, the mean and standard deviation were separately calculated. The findings showed that there was no significant difference between primary and secondary school teachers. However, the mean score of secondary school teachers was higher than that of the secondary school’s teachers.

*Level of Stress Based on Area of Services*



The graph shows the responses for the level of stress of the primary and secondary school teachers. Comparatively, secondary school teachers had higher stress than the primary school teachers.

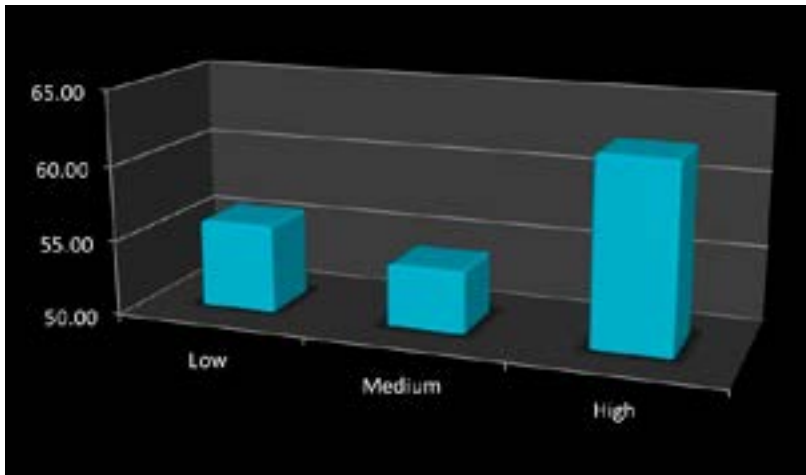
**NUMBER OF YEARS OF TEACHING EXPERIENCE**

	Mean	SD
Low (1-8)	55.87	16.12
Medium (9-15)	54.13	17.87
High (16->)	62.40	10.38

*\*Significant level at .05 levels*

In order to compare the level of stress according to their teaching experience, The teachers who have had 9-15 and year of experience had lesser stress then the teachers who have had 1-8 year of experience, the teachers who have had greater than 16 years of experience had the highest level of stress.

*Level of Stress Based on Years of Teaching Experience*

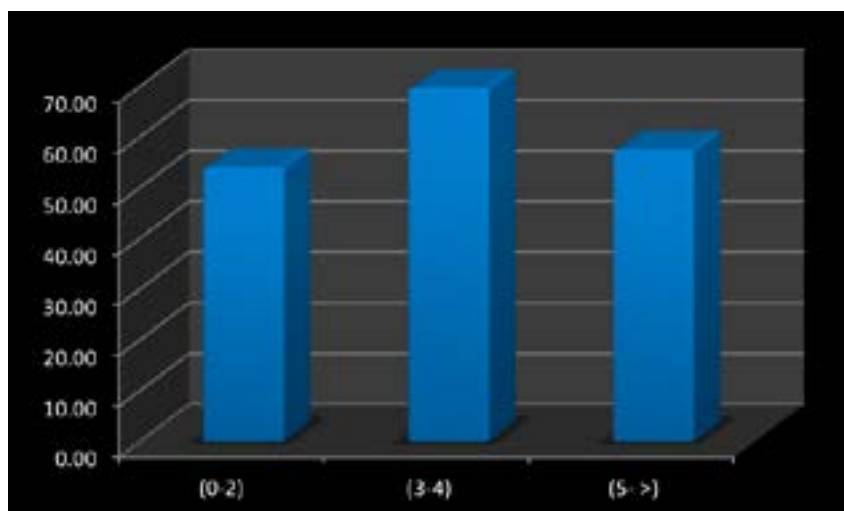


The graph shows the responses for the level of stress of the teachers according to their years of teaching experience. The teachers who have had 1-8 and 9-15 year of experience had almost same levels of stress but, the teachers who have had greater than 16 years of experience had the highest level of stress.

### **NUMBER OF DEPENDANTS**

	<b>Mean</b>	<b>SD</b>
<b>Few (0-2)</b>	53.94	18.05
<b>Some (3-4)</b>	69.58	12.58
<b>More (5 -&gt;)</b>	57.40	20.58

In order to compare the level of stress among school teachers based upon their family dependants; the mean and standard deviation were separately calculated. The findings showed that the teachers who had low number of dependants had less stress while the teachers who had 3-4 dependants had more stress than the teachers who had more than four dependants.

*Level of stress based on number of dependants*

The graph shows the responses for the level of stress based upon the family dependants. When comparing the responses we can see that the graph shows that the teachers who had low number of dependants had less stress, while the teachers who had 3-4 dependants had more stress than the teachers who had more than four dependants.

## CONCLUSION

The results of the data analysis, which have been explained, show that for this sample of fifty one teachers from the western division of Fiji, female teachers had higher stress levels than the male teachers, married teachers had higher stress levels than the single teachers, urban teachers had higher stress levels than the rural teachers, i-Taukei teachers had higher stress than the Fijian teachers, secondary school teachers had higher stress levels than the primary school teachers, teachers who had 9-15 years of teaching experience had lower stress levels than the teacher who had 1-8 year teaching experience, while the teachers who had greater than 16 years of experience had highest stress levels. The findings also showed that the teachers who had less number of dependants had less stress. While the teachers who had 3-4 dependants had more stress than the teachers who had more than four dependants. However, we can say that from this group of teachers there was no teacher who did not have stress, only one teacher had mild stress, sixteen teachers had moderate stress, most of the teachers had much stress, while only ten teachers had extreme stress.

There are certain discrepancies between these findings and those of prior studies; this could be the result of different instruments being utilised, or perhaps due to having different school working environment, contract duration, and so on. The results of the data can be used to guide further development of interventions to mitigate teacher stress and, consequently, improve teacher effectiveness, student behaviour and learning.

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***PAPERS FROM:  
12th Pacific Science Inter-Congress.***

The 12th Pacific Science Inter-Congress (PSIC-12) was held from 8–12 July 2013 at the Laucala campus of the University of the South Pacific in Suva, Fiji. The PSIC-12 was a highly successful meeting with excellent science, and was the third most attended Inter-Congress in PSA’s history, attracting 632 registered participants from 51 countries.

The theme of the 12th Pacific Science Inter-Congress was: “Science for Human Security & Sustainable Development in the Pacific Islands and Rim”. The PSIC-12 included physical, biological, and social sciences and encompassed terrestrial, marine, atmospheric, and social/cultural subjects and approaches in the Pacific Islands and Rim region. Inter-Congress sessions were organized on the PSIC-12’s seven sub-themes:

- Biodiversity, Ecosystem Services, & Resilient Societies
- Information and Communication Technologies (ICT) for Sustainable Development
- Food, Water, Energy & Health
- Society, Culture & Gender
- Governance, Economic Development & Public Policy
- Climate Change & Impacts
- Oceans

*The University of the South Pacific  
Suva, Fiji*

2016





## **Australia – A Hegemonic Power in the Pacific Region**

*Herman Mückler*

### **ABSTRACT**

*“The Australian colonies displayed expansionist tendencies almost from the beginning” is a pointed statement, and there is evidence that Australia exerted its influence on and expanded its spheres of interest to neighbouring territories in Melanesia and in the Pacific region as a whole almost from the beginning of its existence. This article gives an overview about Australia acting as a hegemonic power in the Pacific Islands before World War I, its engagement in the decades afterwards, and its regional political involvement recently, perceived and interpreted from a European viewpoint.*

**Keywords:** *History, colonialism, expansionism, hegemonial influence.*

## **INTRODUCTION**

The newly created state, Commonwealth of Australia, called Australia for short, a product of the European policy of colonial settlement, in its relatively brief modern history had not yet been consolidated to become a single state, when already the autonomous administrative districts or colonies started to exert their influence on and expand their spheres of interest to neighbouring territories in Melanesia and the Pacific region as a whole. To put it in a nutshell: “The Australian colonies displayed expansionist tendencies almost from the beginning” (Kuhn, 2011, p.2). This statement, which originally applied only to the Australian continent trying to put a stop to the attempts by France and Germany to settle this continent, must be re-defined so as to apply to the neighbouring Oceanic region as a whole. Australia, as a rising state, did not shirk from confrontations with other European powers (except Great Britain) to stop them establishing colonies in the Pacific region.

After Australia had been founded, its administration considered it legitimate to exert influence on the Pacific Islands by means of some kind of “sub-imperialism”. The current political relations between Australia and the Pacific Islands must be regarded as a direct consequence of this, with Australia acting both in a benevolent paternalistic and a strategic hegemonial way. Ever since Australia has existed as a state, there has been an understanding about the Pacific region that: “This is our part of the world ... this is our patch”, as Prime Minister John Howard once said in 2003 on the occasion of the military intervention on the Solomon Islands (RAMSI, Regional Assistant Mission to the Solomon Islands) led by Australia (Thornton/Bloodworth, 2003, p.1). History over time until today shows that a number of key-factors ruled Australia’s ambitions to exert an influence in the Pacific region, and they all concerned the safeguarding of their economy and of their security: 1) preventing or impeding Germany and France from acquiring colonies in the region; 2) colonial annexation of New Guinea so as to secure the northern flank of Australia and to control New Guinea’s resources; 3) securing the exploitation of resources in the Pacific Island region for Australian enterprises, 4) reducing Soviet and more recently also Chinese influence in the region; and 5) increasing regional stability by intensely supporting the policy of developing the Pacific Island states. The most important historical aspects of the relations between Australia and selected island states of Oceania are described below in order to show that Australia has been playing an important and evolving role as a “regional player” in the Pacific Island world.

## **THE QUEENSLAND LABOR TRADE AND AUSTRALIAN SUB-IMPERIALISM IN THE PACIFIC**

In the 1870s, Australia still consisted of various colonies which united on January 1<sup>st</sup>, 1901 to become the so-called Commonwealth of Australia. However, although some of the colonies, the future federal states, were still in the constitutive phase, they had already shown an interest in regions beyond the Australian continent. The reasons, first of all, were economic considerations; these were closely linked with the recruitment of labourers from Melanesian islands to Queensland, the so called “blackbirding”. Tracey Banivanua-Mar explained in her influential study about the indentured labour trade to Queensland that in the aftermath of the abolition of slavery, these labourers provided the essential cost-neutral, coercible, and coloured labour that was deemed

essential to the economic viability of white settlement in the tropical belt of Britain's Australian colonies (Banivanua-Mar, 2007, p.1; see also: Wawn, 1973, p.XIX; Graves, 1993, 8pp)

When plantation agriculture was intensified in the middle of the 19th century especially in Queensland, Australia, and simultaneously in Fiji and New Caledonia, the plantation companies investing in those regions had an increased demand for labourers. Since either not enough labourers could be recruited from among the local indigenous populations, or they refused to submit to this kind of dependency model and to the pressures of the money based market economy, the plantation managers had to find other solutions to this problem. The solution seemed to be to hire labourers in those relatively nearby Melanesian islands, which had had only very little contact with western civilization; labourers who were thought could be motivated to do this kind of work for the remuneration offered (often in the form of consumer goods, for which there was a great demand). These practices of recruiting labourers were not confined to Melanesia, and eventually spread to Polynesia with severe consequences for the whole region. One of the darkest chapters in the history of Oceania has to do with this so called 'blackbirding', which was the forcible recruiting or even kidnapping of natives of the Pacific Islands, who then had to labour under extremely difficult conditions for low pay (compared with white man's wages) on the sugar-cane- or cotton plantations, mostly under very questionable conditions. Queensland first imported labourers from the Melanesian islands, in particular from the Solomon Islands and the New Hebrides (Vanuatu today). The potential laborers were lured to the ships with mostly empty promises or with gifts and were talked into signing three-year labour contracts, or were forced to do so. They were conscripted by means of a finger print on the labour contract, as most of the people hired were not able to read. This was practised mainly between 1863 and 1911. Altogether about 62,000 labourers thus came to the Australian colony of Queensland (Queensland South Sea Island Indentures Labourer Records 1863-1908), and only after intensive criticism by human rights activists, and by the so-called 'Pacific Islanders' Protection Act of 1872' could it be controlled at least to some degree. The organized labour trade to Queensland, the so-called 'indentured labour', developed its own dynamics with regard both to the labourers on site as well as their fate after their labour contract had expired. In due course, in the interest of the labourers the regulations were improved step by step. The recruiting practice of sailing to the islands to hire labourers was a profitable business which was boosted by the fast development of the agrarian economy and especially the expansion of the sugar-cane industry in Queensland. The escalation of this business is evident from the number of steamers which left the port of Mackay in Queensland: in 1880 two steamers were involved in the labour trade, in 1890 as many as 30 chartered or locally owned steamers were operating (Andrew/Cook, 2000, p.31). Numerous publications have dealt with this subject in recent decades (see Scarr, 1968 and 1973; Wawn, 1973; Moore, 1979; especially Banivanua-Maar, 2007 and Quanchi, 2009).

The first focus beyond the Australian continent was directed at its south eastern neighbour, New Zealand. Way back in 1791 seal hunters from New South Wales (NSW) had set up a station in New Zealand and under the NSW governor King there existed for a short time the idea of recruiting Maori for sheep rearing in Australia. This would have been the first attempt at labour trade to Australia. At the beginning of the 1830s, there were still Australian ambitions to put New Zealand under the control of New South Wales (see Tapp, 1958). New Zealand had

definitely become a British colony only when a British Resident (corresponds to a diplomatic representative) was installed in 1832 and when a fairly large British contingent of troops was deployed in New Zealand, and subsequently when the Treaty of Waitangi was signed by various Maori chiefs from the North Island in February 1840.

The next Australian ambitions were directed at Fiji. This archipelago bordering on Melanesia and Polynesia, began to interest Australian enterprises, because it was a relatively large island group in the Pacific Ocean and because it provided ideal conditions for cultivating cotton and sugar cane. In 1859 the legislative assembly of New South Wales voted to request the British to annexe Fiji, a wish that Great Britain refused to fulfil at that time. As a consequence of the American Civil War (1861-1865), the cotton production in the USA came to a halt and Fiji gained more and more significance because cotton was already cultivated on the islands and could be sold at a good price. Australian settlers and investors who came to Fiji in large numbers in those days were described as “the great Fiji rush” (Young, 1967, pp.83ff), and together with German businessmen and settlers, they made up the largest segment of white foreigners in Fiji. Some of the reasons for this were six years (1864-1870) of severe economic problems in Australia, the decline of the price of wool, several years of drought and the burst of stock market bubbles in Sydney and Melbourne through dubious enterprises. All these caused many Australians to turn to the Pacific region, with a hope to make their fortune. The Polynesian Company, founded in Melbourne, Victoria, at the end of 1868, was one of the enterprises that became active in Fiji, however, it did not exist for a long time because its business philosophy was to gain quick profits by questionable speculating. In contrast, the Colonial Sugar Refining Company (CSR), which was also founded in Melbourne and is still active today, which also settled in Fiji and intensified the cultivation of sugar cane and promoted the annexation of Fiji, was much more successful. In an article published in the Melbourne newspaper “The Age”, it was speculated that it should be possible to claim colonial status for Fiji even without British support: “...if England refuses to interfere, Austeralia (sic!) will do well to discuss the advantages or disadvantages of stepping into the breach... Since England can rule India, why should not Victoria make the experiment of trying to rule Fiji?” (The Age, August 14<sup>th</sup>, 1869).

Although the fears by some Australians that France might annex Fiji after Tahiti had become a French colony in 1842 and New Caledonia, situated very close to the north coast of Australia had become a French convict colony were indeed unfounded, quite a few powers still had designs on Fiji. Some Americans made claims on the then commanding chief Ratu Seru Cakobau in Fiji, which were based on a fabricated cause, and also Germany might have been expected to show an interest in Fiji on account of its significant economic activities there. The Australian CSR paid the “debts” claimed from Cakobau by a blackmailing US citizen and was in return able to strengthen its commanding position in Fiji. Around 1900 the CSR exported about 88 % of the Fijian sugar (Lowndes, 1956, pp.31-34, pp.299-301). The Polynesia Company tried to motivate the governments of both Victoria and New South Wales to annex Fiji. The British government, which had adopted Fiji as a British colony after all in 1874, immediately and drastically wiped out the then existing German claims and interests in an uncompromising way: the suspension of all land sales to Germans, and none or very little compensation for the expropriation of German farmers who were forced to sell their land. These actions caused an atmosphere of friction

between Britain and Germany. This incident finally caused the German Chancellor, Bismarck, to give up his negative attitude towards creating German colonies in the Pacific region to safeguard German economic interests in the islands. The British authorities in Fiji acted at least partially at the instigation of those representing Australian interests. The Australians can be seen as the direct opposing competitors against the Germans in the Fiji Islands in those times (see Mückler, 2012, p.170). In other words we might say that the British and the Australians themselves triggered German colonial activities in the Pacific region on account of their expansionist policies, and thus laid the foundations for potential confrontations. The decision by Britain to annex Fiji as a colony was not primarily influenced by Australian ambitions, but still at first, as long as a legislative assembly did not yet exist, the laws of New South Wales were applied (Mückler, 2009, p.283).

The next focus of Australian expansionists was on New Guinea. Some people thought they could effectively meet Queensland's need for labourers by importing them from New Guinea. Once more Great Britain was expected to take the initiative, this time to annex all the eastern part of the island of New Guinea that was not yet subject to Dutch administration. Britain, however, was more hesitant after the massive German protests in connection with the handling of Fiji's colonisation. The pressure was increased by Australia's supporters of colonisation, but Great Britain did not want to give cause for more confrontations with the German empire. Because German enterprises had very successfully expanded their activities in the Pacific region, especially the trading companies Hernstein and Godeffroy so that the safeguarding of trading interests had gained major importance, fears were raised in Australia that Germany might try to consolidate its interests in the Pacific region and especially in nearby New Guinea by establishing a protectorate. The Australian proponents of colonial expansion in the Pacific region hailed from Queensland, New South Wales and Victoria. On April 3<sup>rd</sup>, 1883 Queensland on its own authority, without having consulted the British government, and on the instigation of Queensland's Prime Minister, Thomas McIlwraith, annexed the south coast of New Guinea with the help of a group of activists led by a police magistrate who hoisted the Queensland flag in Port Moresby. The strategic considerations why the Queensland Prime Minister acted this way were that many more steamers were now passing the Torres Straits, and he wanted to be able to control this. Great Britain under Prime Minister, William Ewart Gladstone, promptly annulled this annexation and on July 2<sup>nd</sup>, 1883 prohibited Queensland from colonising New Guinea.

It is an interesting irony of fate that Australian ambitions to annex parts of New Guinea were justified by their argument that Germany might set foot in the region, but this very development was actually accelerated by Australia acting in this imperialist fashion. The feelings in Australia ran high when in return Germany hoisted its flag in the north eastern part of New Guinea and placed New Guinea under its protection on November 3<sup>rd</sup>, 1884 in order to protect its own trading interests from the obvious aggressive expansionist Australian policy. Only three days later, on November 6<sup>th</sup>, 1884, Great Britain declared south east New Guinea to be its protectorate and called it the Territory of British New Guinea. Britain had difficulty curbing the excessive hegemonic ambitions of her Australian colony; thus, for example, on June 2<sup>nd</sup>, 1883 the Government of Victoria suggested that all territories of Melanesia not yet occupied by other colonial powers should be annexed (Thompson, 1980, p.66). In 1885 the British and Germans came to an

understanding about the exact course of the border in New Guinea. Many Australians would not forgive the British for a long time as they had allowed a German colony to be established in the north eastern part of New Guinea (Gordon, 1951; Young, 1967). The only part of the population who mostly reacted in a positive way, were those entrepreneurs from New South Wales, who were hoping for an increased trading volume with the Germans – a hope which indeed was fulfilled. Many Australians from the other colonies, however, did not understand why the chance had been forfeited to annex the whole eastern part of New Guinea. But Great Britain had other geopolitical priorities and these concerned Egypt in the first place, which played a decisive role in providing the passage to India. For this reason too, Great Britain was interested in reaching a settlement with Germany. The fact that to the north east of the Australian continent there was New Caledonia in French possession, blocking access to the central Pacific region, did not make things any easier. It was on September 1<sup>st</sup>, 1906 that Great Britain transferred the administration and control of British New Guinea to the dominion of Australia (a dominion was a self-governing territory of the British Empire). The colony in New Guinea now administered by Australia was called (Australian) Territory of Papua. It thus was, as it were, the colony of a colony. But by law the Territory of Papua (after 1914 and 1942: Territory of Papua and New Guinea) remained a British colony until 1975.

Subsequently, the eastern part of New Guinea, which was split up between Germany and Australia, developed in extremely different ways. While Germany set out to develop an infrastructure in the north east by building roads and ports and by gradually developing the yet unknown back country and the highlands, the south eastern part under Australian administration by and large remained undeveloped. Until World War I much more scientific exploration took place and many more research expeditions were undertaken in German New Guinea than in the southern Australian part. (see Mückler, 2012, p.186-200) Only missionaries and dedicated individuals contributed to the development of the infrastructure to any major extent. The reason so little was done was attributed to the limited financial resources which Australia was prepared to invest in this first colony outside the Australian continent. Australian influence in this colony which had changed its name from British New Guinea to Territory of Papua as of 1906, led to a kind of “gold rush” (just as previously in Australia itself ) for the exploitation of resources, with the discovery of gold in effect speeding up this development. When World War I broke out, Australia at long last managed to take possession of German New Guinea and in addition occupied the island of Nauru in Micronesia, which was of importance because of the guano-phosphate deposits there. Australia took great care not to be missed out when the mandates were allocated at the Versailles peace negotiations after the war (see Mackenzie, 1939, p.347-350). Expropriation with or without minimum compensation, displacement and assaults on Germans marked this era of expansion of Australian hegemonic claims in that region after the German colonies had been taken over (see Rowley, 1958).

In the 19<sup>th</sup> century besides New Guinea, Australia wished to possess mainly the New Hebrides, Vanuatu today. The Australians mainly hoped to recruit labourers from there, but they also wanted to cultivate fruits, spices, coconut oil, sugar and other products there. After the initiative by McIlwarith to annex New Guinea had failed in 1883, his supporters immediately called for the annexation of the New Hebrides. This idea was triggered because in 1882 the French

Compagnie Caledonienne des Nouvelles Hebrides was founded with its headquarters in New Caledonia which had begun to buy large areas of land on a number of islands belonging to the New Hebrides, planning to introduce cattle breeding and to grow plantations. In 1889, in order to coordinate the Australian economic activities in the New Hebrides, the Australasian New Hebrides Company with headquarters in Victoria was founded, which even issued its own stamps for the island. This company however did not exist for long and was merged with the Australian Burns Philp & Company in 1897, founded by James Burns and Robert Philp. Mainly the Presbyterian missionaries demanded annexation by Australia, since they wanted to push back the catholic mission which had to come to the island with the French. The Australian colonies, the future federal states, at first acted in coordination and concertedly in favour of annexation. But South Australia and Tasmania soon veered off. Also New South Wales, which profited most from trade with the French and therefore preferred a strategy of free trade among and with the Pacific islands, after a short time did not support the plans for annexations in the Pacific region any more. Victoria, where the powerful Presbyterian Church engaged in missionary work in Oceania had its headquarters, saw things differently: The Presbyters kept a jealous watch on the growing French influence in the west Pacific region because this would lead to an increase in the activities of the Catholic mission. An Australian Presbyterian missionary, Daniel McDonald, had a vision for the New Hebrides: “to become the Australian Indies” (Kuhn, 2011, p.2). Eventually the New Hebrides, without Australian involvement, were split between Great Britain and France and became a Condominium under the joint administration of the two colonial powers until they became independent in 1980 (see Belshaw, 1950; Brookfield, 1972).

The Australians were also focussing on the Solomon Islands as a potential source of labourers for their plantations in Queensland, and as early as 1901 the idea was first created to annex the Solomon Islands, but they became the British Solomon Islands Protectorate (BSIP) under British administration. In spite of this the Solomon Islands, so rich in raw materials, were dominated by the Australian enterprises and interests; the Australian pound was the currency at that time and the transport facilities were primarily in Australian hands (see Bennett, 1987). In principle this situation did not change when the Solomon Islands became independent in 1987: The Solomon Islands’ economy has continued to depend mostly on Australia, always centred on cutting down and exporting tropical timber and this led to mutual dependencies and relations with Australia which eventually enabled RAMSI and which continue to this day.

Australian “foreign relations” were repeatedly dictated by some individuals, often influential opinion leaders. The lack at first of adequate institutions and of exact guidelines for dealing with matters of foreign policy in the years before 1901, were the reasons why in the Australian administration of the colonies and later the federal states, and the personal preferences of each Prime Minister could be the decisive factor influencing political decisions. Private interests, misjudgement of a situation, narrow-mindedness and megalomania were often character traits of the leaders in politics who, as a consequence, did not hesitate to get involved in domestic and international confrontations and were not able to comprehend the international diplomatic and above all supra-regional geopolitical implications of their decisions (Thompson, 1980, p.7). Added to the fears that Germany and France might gain a foothold in Australia were apprehensions that the US Americans, Germans, French and, after the Crimean War (1853-



1856), even the Russians might want to establish colonies in the Pacific region. “Russophobia” as it existed for some time especially in New Zealand and which also spread to Australia (see Barrat 1981 and 1988) as well as some steadily increasing “Germanophobia” (see Tampke, 2006, pp.117-120) which reached a climax in World War I are terms describing aversions mentioned in the Australian news coverage and found among the population in the second half of the 19<sup>th</sup> and at the beginning of the 20<sup>th</sup> centuries (see Alomes, 1988; Knapman, 1993). It is obvious that these fears were not totally unfounded since both the German empire and France were expanding their spheres of influence in the Pacific region at that time. So, militarisation, which had become a determining factor in all European societies, was applied also to the Pacific region and this was looked upon with great suspicion by Australia (see Moses, 1991).

It is no coincidence that Roger Thompson (1980) called the period of Australian imperialism in the Pacific region between 1820 and 1920 which culminated in the annexation of the German colonies, “The Expansionist Era”. Australia’s interest in its neighbouring regions and in all the region of Oceania is understandable and stands to reason: In the 19<sup>th</sup> century most European steamers had started their voyages of discovery or commercial journeys to the Pacific region in the rapidly expanding town of Sydney. More or less all the powers engaged in this region and their business companies called at Australian ports for ship repairs and for loading provisions either at the start or during a stopover. It appears quite reasonable that Australia wanted to have a “slice of the cake” when it came to the development and control of the Pacific region.

## **THE DECADES AFTER WORLD WAR II: A NEW ERA**

During World War II, Australia was not immediately involved in the war, except when Darwin was bombed. However, from 1942 to 1945 heavy fighting went on in the Coral Sea, in New Guinea and in the whole West Pacific, in an attempt to jeopardize any plans by Japan of advancing towards Australia and presumably becoming a threat to it. In actual fact Japan most likely did not have any concrete plans for invading Australia (Griffiths, 1990, 31ff cited in Kuhn, 2011, p.3). The Japanese soon drove the Australian troops out of the islands north-west of New Guinea, the contingent of 1,500 men in Rabaul (the so-called Lark Force) was quickly wiped out by the Japanese and the Australian soldiers were killed, exposed to bullying in prisoner-of-war camps and left to die, or they were driven into the dense jungle of New Britain, where many of them died of tropical diseases or of their injuries. The Australians were able to hold the line only along the south coast of the Territory of Papua and New Guinea near Port Moresby (Gamble, 2006; Collie/Marutani, 2009). Australia soon realized that the United States had a military potential that their motherland Great Britain could not come anywhere near. So it was only natural that even while the war was still going on, Australia turned away from Britain, which was already worn out by the war, and which had lost its reputation in securing its colonies and supporting its dominions. Australia turned towards the United States. Ever since, Australia has been acting as the deputy, as it were, of the United States in the Pacific (even if Australia’s political administration does not like this description) and is enforcing regulations to safeguard western security interests in the Pacific region, which are laid down, among others, in the so-called ANZUS pact between the United States, Australia and New Zealand as well as in other regional agreements (see Frame, 1993; Rumley, 2001).

Although ANZUS primarily deals with security interests in east and south-east Asia, the Pacific Islands are also part of the overall strategy. For Australia, mainly the islands of Melanesia form a cordon sanitaire in the north, a buffer zone and a deployment zone (see Livingston/Louis, 2011). Australia's continuing direct and massive influence on Papua New Guinea (PNG) after this former Australian administered territory had become independent in 1975, speaks for itself. Next to its significant economic interests especially in the exploration and exploitation of resources, PNG's performance as part of the triangle formed by Australia-PNG-Indonesia and in connection with the long, largely uncontrollable border between PNG and Indonesian West Papua, is closely watched by Australia (see Mair, 1970; Johnson, 1983; May, 1986; Ball/Wilson, 1991). Australia's relationship with Indonesia has long been a tense one especially on account of the East Timor question, but also because of Indonesia's dubious role in West-Papua, highly criticized by Australian Human Rights NGO's since the 1960s and some parts of the Australian population as well as parts of its political administration.

Vis-à-vis the Pacific island states, Australia plays the part of a cooperative helpful partner and thus disguises the hegemonic ambitions of being a regional regulatory force. When PNG was granted independence in 1975, Australia too went through a partly painful process of de-colonization as other colonial powers had previously done (see Denoon, 2005; Mückler, 2013). Australia's wish to continue to exert a decisive influence on its neighbours was more than the wish to uphold the existing trade agreements and keep open commercial access; strategic considerations were a core issue and included the control of the region of the Torres Straits (Thompson, 1994). In addition, the official Australian representatives had to alter from colonial lords over subjects to partners in a partnership, who were in fact not on equal terms, but who enjoyed equal rights by law. Since the Australian colonial administrators for a long time had mostly acted in a racist way (see Wolfen, 1975), this indeed meant some change. The first Prime Minister of PNG, Michael Somare, gradually tried to become emancipated from the former colonial power. This inevitably led to numerous conflicts, which the Australians always tried to solve in their own interests by means of a combination of political pressure and the promise of more development aid. This same strategy was also applied to other Pacific island states. Various agencies acted as sub-contractors in realizing projects with development aid. The well-known AusAID (Australian Agency for International Development) although an independent agency, is subject to the control of the Australian Department of Foreign Affairs and Trade and thus is a direct instrument of Australian foreign politics in Oceania. For example, by means of leading projects that went on for many years, it successfully extinguished polio-myelitis in PNG. The benefits of Australian aid and development programmes are indeed remarkable and have led to marked improvements in a number of the small Pacific island states, especially in the fields of medicine, education and job training, as well as in technology. This kind of aid was sometimes linked to open or hidden terms and conditions, on the one hand in order to make sure Australia remains the primary trading partner of the island states, and on the other hand to obtain their support for Australian foreign politics (Brown, 2012, pp.23–28; see also Hayward-Jones, 2013).

The Pacific Islanders keep a close watch on Australia's attitude towards them. A yardstick in this context has always been which socio-political developments in Australia influenced the relations between the white majority and the native population, the Australian Aboriginals. The conclusion

by analogy, viz that the way the white Australians deal with the Aboriginals might be the same as the way they deal with the Pacific Islanders, may seem far-fetched, but progress achieved in sociological and political acceptance of the Aboriginals (e.g. settlement of the questions of land rights) is indeed registered by the Pacific Islanders. The mutual exchange of information and cooperation among indigenous associations took place not only between the New Zealand Maori and Australian Aboriginals, but also in respect of the Kanaka of New Caledonia and the Maohi of Tahiti, amongst other things within the framework of the Indigenous Rights Working Group (IRWG) of the regional Pacific Islands Association of Non-Governmental Organizations (PIANGO) founded in 1997.

Direct influence in the Pacific was kept low by Australia in the decades after World War II, in spite of the fact that in 1954 representatives of the Australian foreign ministry explicitly spoke out in favour of an active expansionist policy in the Pacific. The natural firewall of the islands situated in Australia's neighbourhood was to be dominated by Australian influence in the interest of national security. The reason was that all the communication channels with Australia's most important trading partner, Japan, are running through the South Pacific, so that Canberra's security interests would be affected in these regions in a most direct way (Goldsworthy, 1995, p. 356; quoted by Holtz 2006). Nevertheless, Australia acted in a relatively moderate way. In the meantime two incidents have led to the policy of 'hands off' by a well-meaning hegemon having been replaced by a policy of intervention by means of 'hands on'. First, in the year 2000 there were two coups d'état within short intervals, one in Fiji and the other in the Solomon Islands. It was typical of both these island states, to have had years of structural deficits, inefficient and corrupt politicians as well as social fault lines, all of which led to these coups (see Finn-Wesley-Smith, 2000; Karle, 2005). Vanuatu and Papua New Guinea were also considered to be fragile states, governed by political minority interests, and classified as 'weak states' heading for a status of 'failing states'. For Australia the instability of the Melanesian island states was a direct threat for which the term 'arc of instability' was readily coined (May et al., 2003; Rumley et al., 2006). Australia feared that Fiji and the Solomon Islands might have set a precedent and, following the domino theory, could lead to instability in the whole region. The second event was 9/11, the terrorist attacks on the New York World Trade Center in 2001, which led to the so-called war on terrorism. The fear that unstable Pacific Island states might develop into a refuge for terrorists, from where they would organize their world-wide activities (the example of Afghanistan plays a role here) was used as an excuse for exercising a more active influence in Oceania, especially by the conservative Australian government under John Howard.

Many commentators consider the Regional Assistance Mission to the Solomon Islands (RAMSI), led by Australia, in which military contingents and experts from a number of island states participated and which has been going on since 2003, the turning point and climax of Australian policy vis-à-vis the Pacific Island states. The reason for this intervention was the de facto breakup of the Solomon Islands caused by an ethnic conflict between the people of the islands of Guadalcanal and Malaita. This would have resulted in a civil war and a fragmentation of the whole state leading to uncontrollable violence, with regional warlords acting in their own minority interests. Although RAMSI had not been the first Australian intervention – on the island of Bougainville (part of Papua New Guinea), which had been acting in a separatist way, Australia

had become engaged some years ago in the local (civil) war (see Wehner/Denoon, 2001) – , this intervention had a new sort of quality (Glenn, 2007). The political expert Andreas Holtz commented in an analysis of the Australian Pacific policy, that the main proponent of RAMSI was the Australian Foreign Minister at that time, Gareth Evans, who, later on, was largely responsible for formulating the ‘Responsibility to Protect’ report (R2P) by the International Commission on Intervention and State Sovereignty for legitimizing humanitarian interventions, and whose approach to foreign politics also included interventionist components (see Holtz, 2011, p.163). RAMSI played a decisive role in saving the Solomon Islands from falling apart, by disarming the combatants of all the parties involved, stabilizing their economy and successfully initiating the setting up of well-functioning political and institutional structures. Australian provision of resources was considerable, the engagement a long-term one, and, in contrast to similar interventions in other parts of the world, altogether successful (Fullilove, 2006; Braithwaite et al., 2011). It can generally be said that Australia’s handling of the situation in Bougainville and the Solomon Islands can be seen as examples of relatively circumspect exertion of influence, accompanied by numerous non-military- and awareness-raising measures. With the aid of social programmes, models for re-integration, projects involving infrastructure and the opening up of economic perspectives, Australia has set an example for similar situations, which quite rightly earned Australia international recognition. A contrasting view of the intervention on the Solomon Islands is that it was not a successful nation-building project, but active power politics like the United States’ anti-terror campaign. It was considered less a change away from Australia’s policy of intervention in the Pacific, but rather the expression of a more rigorous Australian policy vis-à-vis the Pacific states, which nowadays does not even shy away from the sovereignty of these states, as for example, the political observer Andreas Holtz (2006, pp.113–114) is interpreting it.

## **REGIONAL CO-OPERATIONS**

Australia’s ambitions to reorganize the regional economic and security-related structures in the Pacific to suit its purposes, however, go back to the early 1990s, when Australia succeeded in having the so-called Honiara declaration adopted within the framework of the Pacific Islands Forum (PIF) in 1992. This document permitted its members for the first time to intervene in one another’s internal affairs for security reasons, if a danger of regional destabilization came from them. In the Aitutaki-declaration adopted in 1997 and named after one of the Cook Islands, mechanisms for intervening within the framework of preventive diplomacy were discussed. Finally in 2000 the Biketawa declaration re-organized the PIF and turned it into a powerful regional organization. To this end the principle of unanimous consensus was replaced by one of adequate consensus (see Holtz, 2011, p.164). It must be called to mind that Australia and New Zealand are each contributing 37.16 % to the finances of the PIF, so that the vote of these two countries (New Zealand almost always acts parallel with and loyal to Australia) is of decisive influence on the opinion of the rest of the small Pacific Island states, whose life line often are the generous donations in the form of development aid. The Nasonini declaration adopted in 2002 was a reaction to the new situation in respect of security after 9/11, and in the Auckland Declaration of 2004, the issues of security and good governance were explicitly emphasized as having to be considered in addition to issues in the economic and social fields. The Pacific Plan for strengthening Regional Cooperation and Integration also adopted in Auckland was intended

to serve as a guideline for more cooperation and integration between the Pacific nations and Australia. It was adopted in 2005 and focussed on four topics: economic growth, sustainable development, good governance, and security (see Holtz, 2011, pp.164,167). Andreas Holtz (2011, p.165) emphasized that for Canberra security was more important than for the island states, while in contrast the island states granted top priority to social welfare. Although joint governmental responsibility was to be demonstrated here, the measures implemented as a consequence of the declarations – in particular the creation of a multilateral police force – showed that to all intents and purposes Australia has in fact prevailed. Holtz put it concisely, that in view of the imbalance of power within the PIF the declarations following the asymmetrical debates in fact are a legitimization of the unilateral Australian strategy, disguised as a multilateral process. The ‘Pacific Plan’ for the island states raised the question of the interrelationship between sovereignty and regional cooperation: strengthening one element meant weakening the other one (see Aqorau, 2006, p.216 ff). In actual fact the declarations and the ‘Pacific Plan’ of the PIF led to a reduction of the sovereignty of the individual Pacific island states and granted Australia the option to exert more influence.

Regarding the economy, Australia has seen to it that its exclusive commercial access rights to the island states remain unimpaired. In the Pacific Agreement on Closer Economic Relations (PACER) of 2001, which soon followed the Pacific Islands Countries Trade Agreement (PICTA), the trade relations between the Pacific states and Australia were regulated. PACER granted Australia (and New Zealand) the option to conclude free trade agreements with individual island states if these were to conclude such agreements with other countries outside the region. Australia’s reaction here must be seen as a reaction to such negotiations between the Pacific Island states and the European Union. Since these have led to agreements, an equivalent free trade agreement has now been defined in the so-called PACER-plus negotiations between Australia and the island states (see Peebles, 2005). Australia is here trying to influence the Pacific Island states in the pursuit of their goals of obtaining more economic convergence and an institutional evolution in such a way as to retain its own key role (Scollay, 2005, p.132 ff; Powell, 2005, p.218 ff).

It is understandable that a number of island states are uneasy about the Australian dominance, since some of the measures that have in the meantime been implemented will have an influence on the national sovereignty of the small island states. Vanuatu has always been skeptical of, or even negative towards Australian ventures in the PIF. As mentioned above, until recently PNG had a critic of Australia in the person of Prime Minister, Sir Michael Somare, who used to go in for confrontations with ‘Big Brother’ and stuck the Australian leaders out as well. Particularly during the eleven years of the Australian Howard administration (1996 – 2007), the relationship between PNG and Australia was somewhat marred. The so-called ‘shoe incident’ in 2005, when Prime Minister Somare was expected to take off his shoes at Brisbane airport on a transit flight, because the metal detector had gone off when he passed the security check, was a diplomatic affront and for many Papuans and other Pacific Islanders, this snub confirmed their view that obviously very little was thought of policymakers of the small Pacific Island states. A case in point was the secret flying out of Julian Moti, who hailed from the Solomon Islands and was politically active there, and was to be put on trial in Australia for sexual assault. Although he was briefly held in custody in PNG, against Australia’s will he was not delivered to Australia but

transferred to the Solomon Islands instead; this put a strain on the relations. So these incidents must be seen as a form of retaliation, as a 'pay back'. Only under the Labour government of Kevin Rudd did the relations with PNG and other Pacific states return to normal in 2007; this was demonstrated by a symbolic act, viz. that the new policy of Australia's social democratic government in dealing with Oceania was announced in the capital of PNG and is known as the Port Moresby Declaration.

## **FIJI AND AUSTRALIA – CHINESE INFLUENCE IN OCEANIA**

Fiji's Prime Minister Commodore Bainimarama emancipated himself the most from Australia. The conditions governing Fiji's dependencies changed completely after Bainimarama had seized power following a coup d'état in 2006, which swept away a corrupt and racist, and unconstitutionally acting government. Australia (and New Zealand) implemented massive sanctions against Fiji and pursued a policy aimed at isolating the island state. Australia wanted to force Bainimarama to return as soon as possible to western style democratic conditions by holding elections, but he refused with reference to the specific situation in Fiji. He insisted that he would first have to solve the basic structural problems of the country before a new constitution could be worked out to form the basis for general elections. Finally in September 2014 the long announced democratic elections took place and Bainimarama won with his newly founded party "Fiji First", which was established in March 2014. The party had its first batch of 21 candidates released on July 25, 2014 with Frank Bainimarama heading the list. As a result of the 2014 Fijian General Elections, the party won 293,714 votes, 59.2% of all those who voted (495,105 voters), giving the party a clear majority with 32 of the 50 parliamentary seats. On 22 September 2014, Bainimarama was sworn-in as the Prime Minister of Fiji by the President, Ratu Epeli Nailatikau.

Initially the economic situation in Fiji deteriorated dramatically because Australian tourists amongst others were an important source of income for Fiji and also Australian investments came to a halt. Nonetheless, against all odds and the opinion of many diplomats and political observers, and much to the displeasure of Australia, Bainimarama managed to create internal stability, and to ease the fragile ethnic relationship between indigenous Fijians of Melanesian-Polynesian origin and Indo-Fijians of Indian origin, and actually, even if only to a limited extent, to be successful in combating corruption and mismanagement.

Bainimarama knew how to enhance Fiji's prestige on an international level by engaging in a number of international organizations, even attaining the chairmanship in some institutions and whilst there, to represent the interests of the small Pacific states as a whole instead of acting only at a regional level. Therefore, Australia began to feel uneasy. Fiji caused quite a stir and gained sympathetic approval among other Pacific Island states in 2010 with the 'Engaging the Pacific' meeting (two more have followed since); some people saw this event as a counter-event to the annual meeting of the PIF dominated by Australia. In 2011, Fiji was successful in bringing the annual meeting of the regional intergovernmental organization 'Melanesian Spearhead Group' to Fiji's capital Suva, where many Melanesian island states expressed sympathy for Fiji. The Polynesian counterpart, the 'Polynesian Leaders Group' founded in 2011, in this same year invited Fiji to become a member and thus, also indirectly supported Fiji's interests. All these activities were not explicitly but implicitly directed against Australia's attitude towards Fiji.

When the Pacific Island states joined forces at the United Nations to form the ‘Pacific Small Islands Developing States’ (PSIDS), replacing the hitherto informal agreements on the PIF level, this was a visible sign that Fiji, being the most influential state in the region, was still willing to lead the way for the other Pacific Island states and was doing this successfully, for everybody’s benefit. Among the regional groups at the United Nations, Fiji succeeded in having the particular regional group which includes the island states, to be renamed ‘Group of Asia and the Pacific Small Islands Developing States’ (Asia-Pacific Group for short); previously it had been just known as the Asia Group. Obviously Fiji’s neighbors, other Pacific Island states, appreciate such activities. Finally, Fiji’s application for membership in the United Nations Security Council in 2011 was the ‘icing on the cake’. Rarely has a small state of that tiny size ventured to apply for membership in the United Nations’ Security Council – so Oliver Hasenkamp stated in an excellent analysis of Fiji’s current policy (see Hasenkamp, 2012, pp.5–10). Even if Fiji later withdrew again this realistically hopeless candidacy for tactical reasons, this step had not only caused a sensation regionally and internationally, but also made it clear that Fiji’s new national identity could be a model for the activities of other small states, especially in the Pacific. The latest coup was that Fiji – on account of its nomination by the Asia-Pacific Group of the United Nations – has been since the beginning of October 2012, chairman of the influential ‘Group of 77’, (originally made up of 77 developing countries plus China, now 131 members) and is therefore, definitely not isolated any more. Even if some people rightly criticized Bainimarama’s foreign policy as being a distraction from internal affairs and accused him of megalomania, the tactics certainly proved successful: Fiji was able to break free from the isolation prescribed it by Australia and New Zealand and today is more active and more noticeable than ever before (see Hasenkamp, 2012). Fiji is openly challenging Australia’s hegemonic role in the region, an action which is being observed with malicious joy by the other small and very small states. Many Pacific Island states, above all Papua New Guinea, are looking upon Fiji’s activities with great sympathy. The opening of many new embassies in Fiji shows that Fiji is in no way isolated. On the contrary, Australia with its policy towards Fiji has maneuvered itself into a cul-de-sac in regional politics, for which it has even been criticized by the United States, which was pursuing quite a different policy. The United States inaugurated its biggest new embassy in Oceania in Fiji’s capital, Suva in 2012 (see Davis, 2011; Mückler, 2013, pp.105–107). Furthermore, the new US-Ambassador in Fiji called on Prime Minister Bainimarama in Suva immediately after he arrived in 2011, which the ambassadors of Australia and New Zealand had been failing to do ever since 2006.

The gentle rapprochement of Australia (and New Zealand) with Fiji in 2012 shows, that their policy of isolating Fiji had failed, and that the Australian political administration has indeed realized this. Amongst other things, Fiji managed to bring China into play, and thus, fanned Australian primal fears regarding Asian influence in the region. China’s influence on the Pacific Island states is viewed with great suspicion by Australia’s political administration. The Prime Minister of Fiji, Bainimarama, had invited Chinese investors to his country and so the alarm bells rang in Australia, New Zealand and the United States. Critics say that Fiji is allowing itself to be misused: ‘...Fiji is the political football in the geo-political contest between China and the United States... It is very much like the cold war. It’s an insult to Australia and New Zealand and it is also an insult to the Pacific Islands’; this is how the China specialist Anne-Marie Brady

put it (Taylor, 2012) and she was referring to the Chinese practice of lending Fiji money for road construction amounting to 127 million AUD in September 2012. Even if rumors that China might establish a military base in Fiji are a pure invention (at present), they still made the western powers change their mind, so that even the current hardliners can be seen to be modifying the way they are treating Fiji. If indeed China and Fiji were in future to also cooperate closely in military matters, the geopolitical and geostrategic balance in the region would be drastically altered and would lead to grave (and costly) consequences for Australia's defense strategy.

The doors to Fiji had not been completely closed, and this was emphasized by Australia and New Zealand in the second half of 2012, when it was promised that travel restrictions for Fijian politicians would be eased. At the end of July 2012 the resumption of diplomatic relations was agreed upon. In the meantime Fiji has been allowed to continue to participate in the Forum's deliberations on a regional trade agreement, regardless of its suspended membership. The question was how Fiji used the newly gained 'freedom of movement', which affected the relationship between Australia and Fiji. In 2012 it was said that "Fiji is no longer prepared to accept Australia's exertion of influence with Fiji being assigned the role of a pariah state" (Ratuva, 2011, p.23). Within the Pacific Islands region during the last decade, Australia has nurtured a rival that is challenging Australia's role and its national identity as a middle sized power. In 2015 the situation totally changed. Fiji has since a new democratically elected Prime Minister who is the same person as before: the long avoided Frank Bainimarama. Although formally readmitted to the Pacific Island Forum (PIF), Bainimarama tries now to turn the table. He wants Australia and/or New Zealand forced out of the Pacific Islands Forum that they chiefly fund, and new countries admitted. Some analysts believe that Fiji especially wants to invite China, which was a strong supporter of Mr Bainimarama during his eight years of military rule following his coup, to join the PIF, which is the paramount regional political body (Callick, 2015). The PIF, whose secretariat is based in Suva, is now headed by Meg Taylor from Papua New Guinea. It might be interesting to see who will attend the next planned annual summit. It is likely that this issue will be discussed at the next PIF Leaders' Summit in Port Moresby in mid-September, coinciding with the 40th anniversary of PNG's independence from Australian colonial rule.

The current dilemma of Australia's policy of exerting influence in the Pacific is that for decades it frequently linked its considerable sums of financial aid and investments in the Pacific Island states (which were of vital interest for the survival of these states), with progress to be made in developing good governance practices, a package deal which does not work out that way any longer. For a long time money was granted mainly if the island states were prepared to implement western political ideas of (censorship), free pluralist democratic parliamentarianism, and thus to be committed to this western model. If any one state deviated or veered from this consensus, it was 'penalized' by Australia's suspension or cancellation of the financial benefits, which had detrimental effects on the projects for which they were granted. In this way Australia was able to directly control the good conduct of a considerable number of small or very small states of Oceania, and to impede any other external influences on the island states by means of development aid as an effective international policy tool. Until 1991 this concerned mainly the Soviet Union's activities. In 1976 Australia suddenly multiplied by four the money invested in



the Pacific, after the Soviet Union and Tonga had started negotiations on fishing rights in that same year (Hameiri, 2012).

When China presented itself as a generous money-lender and investor in the region, the effectiveness of Australia's policy of money-allocation underwent a radical change because China did not link its financial support to any direct influence on the internal affairs of the island states. China is focusing on long term goals when exerting influence in the region. The Australian model of social engineering which had worked well for a long time is nowadays accused of being culturally insensitive and neo-imperialistic. Today, Australia's development aid is facing the problem that the island states, although they still want and need money, no longer depend on this one source alone. The idea of being able to obtain money without having to fulfill conditions of good governance, seems much more compelling, so that China is gaining attractiveness, and Australia is losing influence: '...Australian aid in particular has been singled out as the most problematic, because it is based on the paternalistic assumption that it is possible to replicate Canberra-based models of governance and ethics around the Pacific by sending out 'experts' to change institutions and associated modes of behaviour' (Ratuva, 2011, p.22). Added to this, 70% of Australia's development aid has been and still is returning to Australia like a boomerang, and only a very small share of it actually benefits local enterprises. This led to criticism of allegedly unselfish Australian aid, and renders null and void any justified criticism by Australia of China's engagement in the Pacific, that it was not transparent, was corrupt and prone to generating liabilities. A further point of criticism by the Pacific Island states generally concerns the anti-colonial attitude of Australia (and New Zealand). True, this is constantly reiterated by Australia, but at the same time Australia has for years successfully prevented the French colony of French-Polynesia from being re-entered on the United Nations list of countries yet to be de-colonized by thwarting any attempts of achieving a unanimous vote in the PIF in favour of this request to the United Nations (Gonschor, 2012, p.18). It is an example of a request supported by the non-aligned states. In 1947 France had arbitrarily cancelled French-Polynesia and New Caledonia from the list of countries to be de-colonized, but in 1986 under pressure from New Caledonian Kanaki-organizations, New Caledonia was re-entered on the list, following an initiative by the then unanimously voting PIF.

## **CONCLUSION**

What do the Australians think of their government's commitment in the Pacific? A country-wide opinion poll by the famous Lowy institute carried out in 2011 showed that 94% of the Australians considered the relationships with their nearest neighbours, and this includes the Melanesian islands, to be extremely important, while only 70% considered it important that Australia should apply for a non-permanent seat in the United Nations Security Council. The financial aspect is also important. More than 50 % of the aid granted to the Pacific Island region came from Australia. On an average this was about 1.2 billion Aus\$ per year in the past five years (Cave, 2012, part 2). There are no figures available (yet) of how much Chinese money goes into the region, since these figures are classified, but one observer (Hameiri, 2012) estimates it to be about 222 billion AUD per year. From another perspective, it might be concluded that many of the Pacific Island states are somewhat resentful because the Australian political administration

and population are focusing on their relationship with Asia, and they would wish for the same focus on their relationship with Oceania.

What is important for Australia's role in the Pacific today is access to and control of existing and presumed natural resources in the region. The race by the United States, Australia, China and some European countries for the raw materials in larger countries such as Papua New Guinea, as well as for unexploited mineral deposits in the deep ocean is under way. Australia and China are competing for licenses to exploit the resources in Papua New Guinea. In 2012 China obtained a license to exploit bauxite in Fiji in the region of Bua. The fishing grounds of the Pacific island region as a whole are of utmost importance for many countries engaged in fishing, such as China, Japan, South Korea, the United States and Canada, because of the large Exclusive Economic Zones (EEZ) surrounding the island states. In this context there is the dilemma for Australia that it is criticizing China's engagement in the region and at the same time it is entertaining close economic ties with China. The economic ties between China and Australia will be intensified even more in the years to come, according to all the predictions (see also Huang/Austin, 2011), with the result that Australia will have to accept China's policy in Oceania. Terence Wesley Smith appropriately put it the following way: 'Existing regional powers have no option but to accept that China is in Oceania to stay' (Wesley-Smith, 2007, p.28; Wesley-Smith/Porter, 2010). From this statement one deduces that Australia's back yard will become more diverse, more interesting, more competitive and marked by changing developments and alliances and that Australia in the 21<sup>st</sup> century will merely be one among many players. Richard Allan Herr, a long-time advisor of the Australian government, defined the two main challenges currently to be the 'changing tectonics of the Asian century' and 'a bitter intra-regional dispute with Fiji' (Herr/Bergin, 2011, p.1). But it is more than that: the weights are shifting categorically. To mark this, at the meeting of the leaders of the Pacific Island states at the Pacific Island Forum (PIF) in the Cook Islands in August 2012, both the US Secretary of State Hillary Clinton, and a large Chinese delegation were among those present. This reflects the increasingly competitive and many-voiced tendencies in the region, which has increased since (looking back from 2015).

In future Australia's reputation and influence in the Pacific Island states will depend on the extent to which it will succeed in respecting the political administrations of the island states, irrespective of their size, as serious partners, without exerting too much influence by attempting to interfere with their cultural traditions and individual strategies for organizing their local communities, to make them suit Australia. The so-called "Pacific Plan", endorsed at the 2005 Pacific Islands Forum meeting, was planned as a master strategy for regional integration and coordination in the Pacific. The plan, based on the four pillars; economic growth, good governance, security and sustainable development, showed how sensitively Australia had to act towards the Pacific Islands states. Their 'values' had to be considered in a proper way, a point which Australian foreign politics only partially fulfilled (Brown, 2012, pp.8-9). The situation is today even more aggravated because of the increasing involvement of China as a challenging strategic player in the region. Regarding this aspect Peter Brown drew attention to a statement of Paul D'Arcy: "(He) identified two possible scenarios for future Australian engagement in the region: increased Australian aid to Pacific island nations in an attempt to counter Chinese influence in the Pacific and persuade or influence Pacific island governments to adopt policies it sees as best for the region; or Australia seeking to work cooperatively with China and Pacific island governments to deliver development that benefits islanders and preserves all parties' national interests

through a degree of compromise” (cf Brown, 2012, p.20; D’Arcy, 2007, pp.1-9). The adopted way will lie somehow in between. An additional point which has to be constantly observed, will be the internal development of the political situation in China from an authoritarian to a more democratic order, as well as China’s slowly increasing tendencies for expansionism into the Pacific region.

The first step to recognize Pacific Islanders cultural traditions and individual strategies has already been done: Steven Ciobo, who was recently appointed Parliamentary Secretary to Australian Foreign Minister Julie Bishop and the Trade and Investment Minister Andrew Robb, has returned from his first official visit to Suva, where he met Fiji’s Foreign Minister Inoke Kububola, and announced that “We hold the belief that ongoing dialogue is important, to which Fiji agrees” (Callick, 2015). It seems that cooperation instead of confrontation leads the way into a prosperous future based on partnership again.

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## The Magnus Effect and the Flettner Rotor: Potential Application for Future Oceanic Shipping

*Peter Nuttall & John Kaitu'u*

### ABSTRACT

*Shipping is the lifeline of the Pacific. All current sea-transport options are fossil fuel powered and increasingly unsustainable. Globally, a range of renewable energy technologies is emerging with application in commercial shipping, including wind, solar and bio- fuels/gases. Such technologies have, to date, received little attention in the development of alternative energy solutions for Oceania, despite transport being the largest user of fossil fuels by Pacific Island Countries (PICs) and exploration of appropriate technologies for PIC sea-transport is currently embryonic. Anton Flettner invented and proved the Flettner Rotor that utilises the Magnus effect for propulsion in the 1920s as an effective method of reducing fuel use and increasing ship stability for commercial blue water shipping. The then low cost of fossil fuels and the emerging diesel ship propulsion engineering did not see the idea progress past the initial prototypes. The technology was briefly revisited in the 1980s. In the past decade a number of leading shipping designers and researchers have begun seriously re-investigating modern application of Flettner technology with impressive results. This technical review documents the literature of this technology to make it available to researchers seeking potential means for reducing Oceanic shipping costs for both transport and fishing at all levels of vessel size.*

**Keywords:** *Wind Energy Technology, Pacific Shipping, Climate Change Adaptation, Sustainable Transport, Flettner Rotor, Magnus Effect.*

## **INTRODUCTION**

This paper provides background context to the potential use of a proven renewable energy technology, Flettner rotors, for sea transport in Oceania.

The application of this technology type for Oceania has not previously been considered. This paper examines the substantive literature base on Flettner rotors published since the 1920s and follows the various phases of research into the technology, including the most recent innovations, before considering the potential use of this technology in a Pacific setting. It concludes there is substantial potential benefit accruable to a low-carbon Pacific shipping agenda in immediately implementing a research and development agenda for this technology, especially given its simplicity, relatively low cost, suitability for small-scale shipping, ability to retrofit to existing assets and proven track records.

A growing body of recent research illustrates the critical importance of sea transport to Pacific countries and communities (Nuttall et al, 2014a), the uniqueness of the barriers to cleaner, more appropriate and affordable solutions for this region (Nuttall et al, 2014b), the potential for renewable energy in such solutions (Mofor et al, 2015, Lloyd's Register, 2015) and the need for a structured research and education programme to assist Pacific countries' and communities' transition to a low carbon transport pathway (Newell et al, 2015, Prasad et al, 2013).

All published research to date concurs that renewable energy applications, wind in particular, has a strong role to play in any low carbon agenda for Pacific sea transport. On the basis of the literature reviewed, Flettner rotors show strong potential as an option for progressing toward expanded research and practical trial applications.

Flettner rotors is used here as a generic term to include all forms of rotor technology harnessing the 'Magnus Effect' for inducing propulsion for ships. Although proven as a cost and energy effective technological innovative response to the post WWI energy crisis in the 1920s, it failed to embed in commercial shipping when real oil prices fell to their lowest ever level at the end of the decade (see Fig 1). It was largely forgotten until the 1970/80s oil crisis where it was briefly re-examined. Today, there is growing international research in this field, including initial 'proof of concept' designs. The technology is relatively simple in both construction and operation and is considered to have potential high application across a range of shipping scenarios (including small and large scale transport and fishing vessels) (Bergeson, 1981).

FIGURE 1: Crude oil prices since 1861



Source: [http://en.wikipedia.org/wiki/Price\\_of\\_petroleum](http://en.wikipedia.org/wiki/Price_of_petroleum).

## THE PACIFIC SEARCH FOR LOW-CARBON SHIPPING SOLUTIONS

Shipping is the lifeline of Pacific Island Countries (PICs). All current sea-transport options are fossil fuel powered and increasingly unsustainable (Nuttall, 2013; Nuttall et al, 2014a). Shipping, internationally, is a significant contributor of airborne emissions with implications for global climate change and public and environment health, including ocean warming, sea-level rise and acidification of the world's oceans (see Buhang et al, 2009; Eyring et al, 2005; Faber, 2009; Fuglestedt et al, 2009; ICCT, 2011; Lauer et al, 2009; Peters et al, 2012; Ribero et al, 2007). Shipping is the last major anthropocentric energy user to face international regulation and this, combined with current high oil prices and predicted future fuel cost increases, is driving increasing international research into energy efficiency and replacements for fossil fuel technology across the sector.

Preliminary research (Nuttall, 2013) suggests a cogent argument for investigating alternative technologies to the current exclusively fossil fuel powered propulsion for domestic shipping for Oceanic countries, especially in light of the region's unique sea-transport issues (ADB, 2007; SPC, 2011; Nuttall et al, 2014a), the high dependency of many Oceanic communities on sea-transport as an essential lifeline (SPC, 2011; Nuttall, 2012; 2013), the extreme dependency of the region on imported fossil fuels (Woodruff, 2007) and the increasing issues posed by global warming and climate change (see Holland et al, 2014). A range of such alternative technologies are available or emergent (Lloyd's Registry, 2015; Mofor et al, 2015), albeit that they have been poorly characterised or assessed within the context of the Pacific sea transport scenario since the last oil crisis (Nuttall, 2013; Nuttall, et al, 2014a). Hybrid applications (i.e. technologies that employ two or more types of propulsion technologies), whether these are combinations of fossil fuel and alternative energy or combinations of alternative energies, are suggested as the most appropriate future applications. Various forms of wind, solar and bio-gas/bio-fuel derived

propulsion energies present as the most logical candidates for investigation (Mofor et al, 2015).

There has been an increasing regional agenda over the past decade to investigate and implement a range of technologies to substitute renewable energy for electricity generation for PICs, but measures in the transport sector, the user of some seventy percent of PIC imported fuels (Mofor et al, 2013), is still embryonic (Holland et al, 2014). SIDS DOCK, the AOSIS led initiative to which 13 PICs are signatories, calls for a target of 25% reduction in fossil fuel use for transport by 2033 (Henderson, 2013). A new inter-disciplinary programme of research into sustainable sea transport by the University of the South Pacific (Prasad et al, 2013) is looking broadly at issues of policy, economic analysis and practical trialling of various vessel types. Recent papers have established some literature in this previously largely unpopulated field (Nuttall, 2012; Nuttall, 2013; Nuttall et al 2014a; Holland et al, 2014; Newell & Bola, 2014; Newell et al, 2015) and builds on work from the last oil crisis (e.g. ADB, 1985; Clayton, 1987; FAO/UNDP, 1989; Satchwell, 1985, 1986) where renewable energy technology was achieving significant savings in selected maritime applications (summarised in Nuttall et al, 2014a).

Globally, measures to improve shipping efficiency can be divided into four broad approaches: operational changes (slow steaming, port efficiencies, seasonal and weather routing, just-in-time routing, bulk fuel purchase, etc); technological (including advances in hull design, propeller upgrades, waste heat recovery, etc); alternative fuels (including LNG, hydrogen, methane and various biofuels) and renewable energy (primarily wind, wave, solar and various biofuels) (Buhang, 2009; Faber, 2009; ICCT, 2011; Royal Academy, 2013). Many operators already employ operating procedures, such as slow steaming, where possible. Technology advances, such as improved propellers and hulls design are largely restricted to new build assets and the cost of retrofitting existing ships with either emissions reduction equipment or for using alternative fuels is likely prohibitive for the existing Pacific fleet.

Renewable energy is not seen as a major overall contributor to overall ship bunker reduction at the global scale (Buhang, 2009; Royal Academy, 2013) although an increasing number of researchers and industry innovators, primarily in northern Europe, are modelling, designing and producing trials with renewable energy shipping innovations, some potentially producing 100% of energy used in selected applications (see for example websites for Greenheart project, B9 Shipping project, Ecoliner project, Future Ship project, Orcelle Project). This emergent range of renewable energy technologies is thought to have strong potential application for Pacific domestic shipping, given that greatest efficiencies are initially likely at the small-scale shipping end of the sector for these types of technologies (Nuttall et al, 2014a, Mofor et al, 2015). The issues surrounding why such technologies have, to date, received little attention in the development of alternative energy solutions for Oceania since the end of the 1980s oil crisis are complex, poorly understood and often perceptual (Holland et al, 2014; Nuttall et al, 2014b; Rojon, 2013; Rehmatulla et al, 2013).

## **USING WIND ENERGY FOR SHIPPING**

Wind as an energy source for propulsion has been regularly discussed in the context of renewable energy solutions for maritime application (ADB, 1985; Bøckmann & Steen, 2011; Buhang,

2009; Clayton, 1986; ICCT, 2011; Lloyds Register, 2015; Mofor et al, 2015; Royal Academy, 2013; Satchwell, 1985; Smith et al, 2013). The sector was of course primarily wind-powered for centuries, albeit at low cargo volumes and a high labour content, prior to the wholesale conversion of the global fleet to fossil fuel power, beginning initially with the coal powered steam screw in the 1800s and more recently oil based technologies, in particular the use of Marine Diesel Oil (MDO) and Heavy Fuel Oil (HFO). With the exception of nuclear propulsion, primarily a military application, oil is the monopoly primary energy source for the sector today at all shipping scales (ICCT, 2011; Royal Academy, 2013).

Initiatives for harnessing wind power for shipping currently fall primarily into four categories soft sails, fixed wing sails, kite sails and rotor technology. The last mentioned is considered in this paper under the generic label of Flettner rotors. Innovation is occurring at some pace in each of these categories. For example, B9 Shipping's 3,000 dwt bulker and the 7,000 dwt Ecoliner designs both use the DynaRig soft sail and have undergone extensive tank and tunnel testing. University of Tokyo is proposing fixed wing sails on 50,000 ton carriers and Solar Sailor in Australia has proof of concept for harbour ferry models operating commercially in Sydney, Hong Kong and Shanghai harbours using fixed wing sails combined with PV panels. Kite sails, primarily promoted by Sky Sails, offers strong promise of fuel savings from towing in following winds but these are not yet sufficient to justify deployment without increased fuel prices. Enercon, the German wind turbine innovator and manufacturer, launched the E-Ship-1 in 2010 which combines Flettner rotors with improved hull and waste heat recovery systems to save a proven overall 25% of fuel (Enercon, 2013).

## **THE MAGNUS EFFECT AND THE INVENTION OF THE FLETTNER ROTOR**

Flettner rotors exploit a force known as the Magnus Effect after physicist Heinrich Gustav Magnus who, in 1851, described a hitherto undefined force that arises when air flows over a rotating body. (Stojkovic, 2002; Tradt, 1925; Wagner, 1991). The effect is well-known from many sports in which balls with an applied spin follow a curved trajectory as they pass through the air, such as baseball or table tennis.

In 1922 Anton Flettner first patented the Flettner rotor which harnessed the Magnus effect using a vertically rotating, deck-mounted cylinder to provide propulsive energy (Tradt, 1925). Flettner was a trained mathematics teacher and self-taught engineer who came up with his idea for a ship-powering rotor after hearing about the research of Professor Ludwig Prandtl, Director of the Aerodynamic Research Institute (Prandt, 1925). 'Blue coal' is how Flettner described the wind-fuel he thus harnessed and noted billions of horsepower was cheaply available (Martin, 1926). He was a prolific inventor who also patented the trim-tab steering system, which is still used extensively today by both planes and ships, and the motorless ventilator used globally on vehicles, caravans and motor homes (Martin, 1926; Gilmore, 1984). Flettner is also well recognised as one of the fathers of the modern helicopter and was largely responsible for German advances in this field during WWII and in the US post-war (Gilmore, 1984).

The physics of the Magnus Effect as applied by Flettner is well understood (Ackeret, 1925; Aoki & Ito, 2001; Tradt, 1925; Wagner, 1991). In essence, Flettner's invention is simply the

application of the scientific principle that a cylinder rotating in the wind exerts a force at right angles to the wind. On the side of the cylinder moving against the wind, the air piles up and exerts pressure. The cylinder must have external energy applied to provide initial rotation, usually at low revolutions of 100-400 rpm. In his initial patented model this was provided by use of a clockwork motor (Martin, 1926). Once the initial motion is established the power harnessed is relative to the force of the wind applied, but results in a many-fold increase in the propulsive horsepower (Tradt, 1925; Wagner, 1991).

Despite some confusion resulting from the work of the physicist Thom in 1934, who postulated that fitting horizontal 'fences' or discs to the cylinder and significantly increasing the speed of revolution by up to a factor of four, could produce greatly increased vertical lift and forward propulsive power (Thom, 1934; Craft et al, 2012). The theory behind Flettner's invention is well-characterised and agreed in the literature and not further discussed here.

In 1924, under Flettner's direction, the Germania Shipyard retrofitted the 2000-ton schooner *Buckau* with two rotors 15m high and 3m diameter driven by a 37kW electric system to power her first voyage in 1925 across the North Sea (Seybold, 1925). The two motors that spun the towers at the rate of 120 rpm required the equivalent of 20 horsepower and Flettner calculated that they took about 1000 horsepower out of the wind (Seybold, 1925). She out-performed the old rig in all conditions, achieving more than 8 knots of speed compared with 6.5 knots under sail (Seybold, 1925). 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 (Collie, 1985). The total weight of the complete mechanism - towers, engine and motors - was just one-fifth the weight of the discarded sails and rigging on the same ship. Reversing the direction of rotation propelled the ship backward and by combining the two rotors the vessel could be stopped and turned within her own length (Tradt, 1925)

**FIGURE 2:** *Buckau*



Source: <http://www.sdtb.de/Flettner-Rotor.1623.0.html>

Early film footage shows her both at sea and moving at some speed up the Humber River in England, entirely driven by her rotors. Early eyewitness reports graphically illustrate the impact of this new type of propulsion:

*The schooner Buckau recently put out to sea, a ship without sails or steam. Like a ghost ship it moved mysteriously through the water with no apparent means of propulsion. ... The astounded spectators on shore knew that the boat was an old 2000-ton steel vessel and that previously 500 square yards of canvas had been needed to propel her. ... Two strange cylinders, resembling giant smoke-stacks, rose from her deck. But no smoke was pouring from them and no engine noise was heard. There was no churning of screws. Yet the ship plowed its way through the rough waters of the Baltic, at nearly twice its former speed. (Seybold, 1925, p. 36)*

In 1926, renamed *Baden Baden*, she sailed to New York via South America (Craft et al, 2012). The 6,200 nautical mile voyage across the Atlantic used only 12 tons of fuel oil, compared with 45 tons for a motor ship of the same size without rotors (Martin, 1926).

An interesting signature of the technology is that the rotors heel (or lean over) into the wind, not to leeward as in a conventional sailing ship. This provides perhaps the most unique feature of the Flettner rotor, its inherent load limiting characteristic which can result in a virtually storm proof sail system. As the wind force increases, the vessel wants to lean to the weather, whereas a conventional sail vessel is being pushed further over by the increasing force of the wind to an ultimate point of capsize if it continues to carry sail. On its initial Irish Sea crossing Flettner noted that the total sail force exerted by the wind on the spinning cylinders did not increase as the wind speed increased from 35 to 80 mph (Ackeret, 1925). Flettner's ship was able to sail through storms that conventional sailing ships had to ride out with "bare poles" (Bergeson, 1981).

**FIGURE 3:** *Kiernan and Hastings rotor yacht*



Source: <http://www.see.ed.ac.uk/~shs/Climate%20change/Flettner%20ship/1926%20account.html>



A few pioneers followed Flettner's lead. US Coastguard officers Kiernan and Hastings were students in naval architecture at the Massachusetts Institute of Technology. They acquired an abandoned 10 m navy cutter and built a rotor with discarded materials. Powered by a 5 h.p. motor they raced against a conventional racing yacht on a triangular course. The yacht won, but only just (Popular Science Monthly, 1925). In 1926 the German Navy commissioned Flettner's second rotor ship, the 3,000 tonne *Barbara* (Martin, 1926). The two prototypes proved that the technology functioned reliably, and the *Barbara* served as a normal freighter in the Mediterranean between 1926 and 1929 (Collie, 1985).

**FIGURE 4:** *Barbara*



Source: <http://www.sdtb.de/Flettner-Rotor.1623.0.html>

Back in America Flettner had by 1928 secured orders for six new ships of the *Barbara* class. However, two events conspired to defeat him. In 1929 the global economy crashed causing his customers to default (as did most new build shipping in this period). In this time also Marine Diesel Oil (MDO) and the related engine technology to use it became readily and cheaply available. As with many other renewable energy transport technologies and innovations, petroleum-based approaches totally displaced and dominated any other ship propulsion initiative (Rojon, 2013). The history of the rotor ship came to an end for the time being and Flettner turned to inventing the modern helicopter.

It was half a century before Flettner's ideas were next considered. When fuel prices spiked after the oil crisis of 1973 shipping companies began looking for efficiencies. Flettner's idea was dusted off and the Hamburg shipbuilders, Blohm & Voss, drew up plans to install rotors on a chemical tanker (Blohm & Voss, 1984). But the idea was dropped in 1986 when the oil price fell again.

In 1980, the French oceanographer Jacques Cousteau dreamed of creating a ship with a modern engine that would be powered, at least in part, by the wind. He looked initially at a Flettner

rotor before coming up with a new design, the Turbosail working with associates, Malavard and Charrier. The Turbosail utilises a movable shutter and system of fan-drawn aspiration into a non-rotating cylinder (Cousteau Society, 2014). Small-scale models tested in a wind tunnel performed well and the invention was first tried on a catamaran christened *Moulin à Vent* on a route from Tangier to New York. The crossing was nearly complete when they ran into winds of more than 50 knots. The soldering that held the Turbosail in place gave way and the prototype fell into the sea.

FIGURE 5: *Alcyone*



Source: <http://escales.wordpress.com/2009/02/24/1%E2%80%99%C2%AB-alcyone-%C2%BB-de-cousteau-en-escale-a-caen/>

This experience was applied to designing a new research vessel *Alcyone* with an innovative aluminium hull, a catamaran-like stern and with two Turbosails to supplement two conventional diesel engines. Savings of 20-60 percent were claimed for *Alcyone* (Collie, 1985), although it may have been considerably less. The Turbosail is not technically a rotorship and does not use the Magnus Effect. It is a Savonius turbine, whose maximum efficiency is 13% (Turnquist & Appl, 1976).

Also at this time, in work led by renowned American naval architect, Lloyd Bergeson, the Wind Ship Company in the United States commenced intensive research on wind propulsion for ships in early 1979. Their 1981 comprehensive research report to the U.S. Maritime Administration analysed more than 75 different types of rigs and sails and concluded that the Flettner rotor appeared to have the greatest potential over the broadest ship size spectrum, from 18 to 100,000 ton range (Bergeson, 1981).

Bergeson found the cylinder to be an ideal structural shape, with bending stresses that are so low that fatigue should not be a problem. Since the rotor has no angle of attack or stall angle, the usual sail problem of adjusting the angle of attack does not exist. There are no configuration changes of any kind involved with operating a 'Magnus Effect' rotor and thus, no crew requirement. The helmsman can start and stop the rotor and select the RPM and direction of rotation. The total rig is less than half the height of an equivalent sail rig, producing four times the power. The weight of the rotor subtracts from the vessel's payload. This weight times the height to the centre of gravity of the system directly subtracts from the vessel's static stability. Bergeson found that the rotor was by far the lightest sail system known, simple to manufacture and offered the lowest installed cost of any sail system and the resultant system produced a virtual storm proof sailing vessel (Bergeson, 1981).

In 1983 Bergeson instituted a programme to design and test a prototype using a 'Magnus Effect rotor' 60 cm in diameter and 7.3m high which he installed, instrumented, and extensively tested aboard the 18-ton, 13 m displacement launch *Tracker*. The rotor was driven up to a maximum of 600 rpm by a hydraulic motor which in turn was driven by a hydraulic pump turned by a small petrol engine (Gilmore, 1984). The results confirmed Flettner's claims and the potential of the rotor as a reliable, economically viable, sail-assist device that can provide substantial fuel savings for modern fishing vessels and commercial ships. *Tracker* was extensively tested in Vineyard Sound where summer winds are consistently 16-20 knots and, with the rotor revolving at 400 rpm, averaged 50-65% fuel savings. Under rotor power alone, the *Tracker* reached a maximum speed of 6.1 knots in an 18.4 knot wind and a true wind angle of 122 degrees. (Gilmore, 1984). The key results are shown in Table 1. By way of comparison this is the equivalent of driving a small bus powered by a large lawn-mower motor.

FIGURE 6: *Tracker*

Source: Gilmore, 1984

TABLE 1: *Tracker* trail results (adapted from Gilmore 1985)

Power Mode	Av. Wind Speed (Knots)	Av. Boat Speed (Knots)	Av. Fuel Savings (%)
Rotor Assist	16.1	7.0	44
Rotor Assist	12.9	6.0	27
Rotor Sailing	17.7	5.3	100

Bergeson was convinced the Wind Ship Company research and related *Tracker* trials indicated that no major technical barrier existed to the introduction of sail-assist technology for the world's shipping fleet. He calculated that in 1984 the world shipping fleet consumed 730 million barrels of petroleum annually at a cost of approximately \$30 billion or 3% of world petroleum demand (Gilmore, 1984). By 1984 the price of marine fuels had multiplied more than 15-fold during the previous decade to become the largest component of operating costs for maritime shipping. However, by 1986 oil prices fell to post-WWII levels and interest in renewable energy technologies for shipping again waned. Development into rotor technology again stalled and was not revisited for another 20 years.

Rising fuel costs and the potential regulation of shipping emissions in the last decade has now seen interest in rotor technology revived. Wind tunnel tests carried out by the UK NPO research group Greenwave in 2006, under Lloyd's Register supervision, modelling a medium size bulk carrier, established that thrust developed by a Flettner rotor is eight to ten times more than the thrust developed by sails of equal surface area. The Greenwave research team carried out a series of performance, handling and stability tests using four rotors aboard a 25:1 scale model at Warsash Maritime Academy in Southampton (Insight, 2010). A full-scale prototype of the

proposed turbine, 17m high and 2.3m diameter was then erected at the Port of Blyth in England, again monitored and verified by Lloyd's Register.

**FIGURE 7:** *Greenwave trials 2006*



Source: <http://www.greenwave.org.uk/achievements-221.html>

Based on these trials, Greenwave was able to predict reduction of greenhouse gas emissions and other harmful exhaust emissions like NOx and SOx by an average of about 13% per ship per year, representing around 1,000 tons of fuel and over 3,000 tons of CO2 per ship per year for this class of vessel. Greenwave claim that while the theory of their 'Wind Engine' remains the same as that of Flettner's 1926 version, they have used modern design, manufacturing and materials to create a patent protected design. This includes creating the 'Wind Engine' in a modular form that enables it to be containerised for easy transportation to any port around the world (Greenwave, 2012). In 2012 Lloyd's Register announced that Greenwave was proceeding to full size application of four wind engines on a 95,000 dwt bulk carrier under construction at Jiangsu Eastern, but there have been no further reports on progress (Lloyds Register, 2012).

In 2006 the University of Flensburg researchers built a Flettner rotor mounted on an 8-metre proa, (although the vessel is described as a catamaran). The *UniKat* drives the rotor by a simple solar cell of only a few watts. The properties of the Flettner rotor mean that by reversing the direction of rotation an opposite force can be applied allowing the vessel to sail as efficiently backward as forward. This allows potential for a true *drua* or proa sailing paradigm to be employed with the vessel shunting rather than tacking through the wind. Given the tendency of the Flettner rotor to heel to windward rather than leeward, consideration would need to be given as to whether the *cama* (smaller hull) was held to windward as with the traditional central and northern Pacific *drua*/proa designs.

FIGURE 8: Flensburg University UniKat



Source: [http://commons.wikimedia.org/wiki/File:Uni-Kat\\_Kiel2007.jpg](http://commons.wikimedia.org/wiki/File:Uni-Kat_Kiel2007.jpg)

Since 2008, a leading group of geo-physicists led by Emeritus Professor Salter of Edinburgh University have proposed building a fleet of 1500 unmanned, radio-controlled craft driven by Flettner rotors (Salter et al, 2008). Their objective is climate engineering, specifically the ability to use atomised seawater particles to accentuate the albedo effect of cloud formations. The ships would vertically eject a fine mist of seawater leaving ultra-fine salt grains, a proportion of which would be lofted to form additional cloud condensation nuclei, thus brightening the low-level marine stratus clouds to reflect an increased proportion of incident sunlight (Salter et al, 2008). The team believes that such a fleet would be sufficient to reduce the sunlight incident upon the earth by roughly 2% which should reduce global mean temperatures to those prevailing at the start of the industrial revolution (Salter et al, 2008).

Resulting from the Salter proposal, Discovery Channel contracted multihull designer, John Marples, to retrofit 'fenced' Flettner rotors to a 10-meter Searunner trimaran, the *Cloudia*. The rotors were each powered by a 48 volt 10 h.p. electric motor driving the rotors at 400 rpm (Marples, 2009). The vessel was tested in light winds, performing flawlessly and achieved 6.5 knots speed in 6 knots of breeze in tests at Fort Pierce, Florida in February 2008. With a rotor drive power of 600 watts, she could sail faster than the beam wind, stop, go into reverse and yaw 180° in either direction about her own axis (Marples, 2009). Concerned about legal advice over potential liability for accidents, Discovery ordered that the rotors should be destroyed following the trial (Marples, 2009).

Salter's original concept drawings show extensive use of the "Thom fences" or horizontal discs as discussed previously and these were also fitted to the *Cloudia* rotors (Marples, 2009). Extensive computerised modelling by Manchester University (Craft et al, 2012) has since demonstrated that "the addition of discs, while leading to apparently negative drag coefficients, does not

produce the striking rise in lift coefficients that Thom's experiments had shown. Moreover, the great increase in torque coefficients associated with adding discs seems to exclude their use in sea-going propulsion applications" (Craft et al, 2012, pp. 6-7).

**FIGURE 9:** *Cloudia*



*Source:* Marples, 2009

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 and modern Flettner-rotors with automatic control systems. The exhaust fumes of the diesel engines power a steam turbine that generates additional electricity used to spin her four Flettner-Rotors. Following an initial trail from Germany to Ireland, *E-Ship 1* had travelled 170,000 sea miles by 2013 and averaged 25% overall fuel savings, of which 15% are directly attributable to the use of the rotors (Enercon, 2013).

**FIGURE 10:** *E-Ship 1*



*Source:* <http://www.motorship.com/news101/industry-news/e-ship-1-passes-kiel-canal-for-first-time>

Flettner's designs are now appearing on leading naval architects drawing boards, with at least four major companies proposing its use in new generation vessels, particularly targeted toward large ship and new build designs. For example, Germanischer Lloyd's subsidiary FutureShip has developed a zero-emission propulsion concept for shipping company Scandlines, due for service within five years and featuring four Flettner rotors predicted to provide 10% of fuel and emissions savings. A number of leading research universities, including Hochschule Emden/Leer, Manchester University, Tyndall Centre for Climate Change Research, CE Delft and UCL, have current research programmes looking at both the engineering and computer route and efficiency evaluation of this technology for various near future applications. Comparative analysis of projected savings on computer modelled trans-Atlantic routes using historic wind data has been undertaken for ships fitted alternatively with DynaRig sails, kite sails and rotors with favourable projections (Bøckmann & Steen, 2011; Smith et al, 2013; Traut et al, 2014). A USA company, Monorotor, is proposing large diameter rotors rotating at 40-80 rpm for medium scale bulk carriers and container ships such as the 55,000 ton Handymax with projected savings of 8.2 ton of fuel per day and between 17 and 35 ton/day for VLCC tankers. The IRR on such investment is calculated to be less than 2 years (Poulsen, 2012). Other innovators are proposing retro-fitted rotors that can either retract telescopically or are hinged to lie down on the deck between hatches when in port or passing under structures.

### **WHAT IS THE POTENTIAL FOR FLETTNER ROTOR TECHNOLOGY FOR OCEANIA?**

This review suggests there is a strong rationale for further investigating the potential for a derivative of this form of technology as a practical alternative propulsion mechanism on small and medium-scale commercial vessels, including passenger, cargo and fishing applications, in Oceania now. It is suggested that ultimately this technology will have greatest application when employed in a hybrid combination with other propulsion methods and a wide range of these are available, including conventional fossil fuel power, bio-fuel in conventional or new generation motors and electric motors powered by bio-fuels or photo-voltaic solar energy.

While international attention is focussed on large and international shipping, all research indicates the greatest savings from this technology are accruable for small to medium ship application, and it should therefore have greatest applicability in domestic maritime island use and inter-regional shipping. Obviously this research is embryonic and further investigation will require establishing partnerships with leading researchers internationally to support and backstop a regional programme. But the potential is too great to now overlook or discard.

The ability for the technology to be retro-fitted, assuming sufficient deck space and clearances, is critical for Oceania where the majority of the fleet is aged and there is tendency to use second-hand assets as opposed to new builds for fleet replacement. In this application it is assumed the rotors would be used as auxiliaries to the existing conventional propulsion drives. Further research and trials in Pacific settings will be needed to determine what other aspects of ship operation would require modification in order to adopt rotor technology and what range of vessels could be potentially fitted with such technology.

Economic modelling will be essential to prove the commercial viability of such adaptations under



various operational and route scenarios. But with the cost of bunker now, the majority operational cost for Pacific shippers, and greatest savings available from this technology at the small ship scale, the promise of savings of even 15% for minimal investment must surely be attractive. An additional and significant advantage, especially in tropical zones, is the stability of the rig under increasing wind strength.

The greatest savings and performance thus far demonstrated in practical trials is arguably Bergeson's *Tracker* with records showing greater than 50 percent average efficiencies. While international research attention is focused on large scale shipping, at the village level the greatest concern is replacement of the outboard motor driven vessel, generally less than 20 ton in size. *Tracker* was a small displacement launch and future discussion on the potential for Flettner use in PICs for village level use will need to consider the hull platform as well as the rotor technology mounted on it. Catamarans are likely to have high application in future domestic shipping, and the *Cloudia* and *UniKat* experiments aside, there has been little discussion to date on the use of rotors on multihull vessels.

## CONCLUSION

PICs' need for more sustainable sea transport options is essential for connectivity at all levels of Pacific society and economy. Flettner rotor technology, a proven if little recognised propulsion technology, offers high promise of significant savings in fuel consumption for relatively minor investment in research and development through to proof of concept trials. It is unfortunate and frustrating that securing the necessary international support for the progress of this agenda is not forthcoming at the time of writing. On the basis of the evidence offered in this paper, establishing proof of concept of rotor technology presents as a cost effective and easily achievable objective.

In closing, we want to focus on the experimental vessel developed by Flensburg University. In this example, a Flettner rig is applied to a proa, the traditional double hull design of the *drua*, Fiji's indigenous vessel. All sources concur that the Fijian *drua* (also called *kalia* in Tonga and *'alia* in Samoa) was the most technologically advanced double-hulled naval design to come out of the Pacific (e.g. Finney, 2006; Hornell, 1975; Lewis, 1980; Nuttall et al, 2014c). The *drua* represented a paradigm shift in naval design, incorporating asymmetrical hulls with the *ama* (smaller hull) always carried to windward and using an Oceanic lateen rig that the famed engineer Marchai described as the most efficient sail shape ever designed (Marchai, 1996).

**FIGURE 11:** *Drua*

Source: <http://collections.tepapa.govt.nz/theme.aspx?irn=2356>

When the *drua* was first encountered by European naval experts, they were at a loss to describe how this apparently frail design, so totally different to anything they had ever encountered previously, could perform so effectively and efficiently. Pacific naval architects were able to achieve such brilliance in design and application, we argue, because they were not afraid to experiment and adopt new technological concepts. Perhaps the Flettner rig offers the opportunity to again embrace such a willingness to be innovative today. After all, despite its odd, even ugly, appearance, it is a technology that offers promise of savings well in excess of the current inefficient naval technology on which the countries of this ocean are currently so dependent.

Despite working from highly limited resource bases, the naval architecture and technological mastery of Oceanic peoples in the days of the *drua*, led the world. What lessons does this hold for the future? In the past half-century or so the Pacific has been repeatedly used as a global testing ground for advanced technology, often with disastrous results for its communities. We see no rational reason why it should not be used now as a global testing and trialling ground for renewable energy technologies for sea transport.

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## Irrigated ethnoagriculture, adaptation and development: a Pacific case study

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### ABSTRACT

*The practice of terraced and irrigated creekfield taro (Colocasia esculenta) agriculture was once prevalent in the seasonally-dry regions of many Pacific Islands. This ethnoagricultural system has been characterised as technically sophisticated, intensive, highly productive and ecologically sustainable; with links to social stability and enhanced biodiversity. The food output is highly nutritive. However, despite these advantages, a decline in irrigated terracing has been the historic trend over the last century. Given the decline, the question must be asked: how resilient and sustainable is creekfield ethnoagriculture, especially in a changing world? The late Holocene development of irrigated creekfields was probably advanced by superior characteristics of resilience and adaptation in the face of climate change, but evidence is hindered by lack of research. Conversely, creekfield decline appears to have a strong relationship with the influence of extralocal colonial, modern and globalised development during a historically benign climate period of low agricultural risk – now being replaced by a putatively higher-risk period of vulnerability driven by Anthropocene global warming. An ethnoagricultural case study of Fijian irrigated terrace systems (colloquially called vuci), amid other research from the Pacific, indicates enhanced resilience and increased livelihood stability – characteristics that are needed for adaptation to the predicted adverse conditions of the future. The prospects for the revitalization of such systems are discussed. Only some of the reasons for decline are important today, and a developmental reintensification is possible, especially with increased populations and parallel food demands. Innovative technologies can be used to ‘progress with the past’, exemplified by the activities of an NGO which has been reintroducing the ideas and practice of vuci in the Fiji Islands.*

**Keywords:** Irrigation, agriculture, Navosa, Fiji, Pacific, adaptation, Colocasia esculenta, indigenous development, technological change, climate, environment.



## INTRODUCTION

One of the features of the relations between people and their environment in the Pacific Islands is the importance of adaptation (Barnett & Campbell, 2010, pp. 15-17), either of people to the environment, or of environment to the impact of people (Bennett, 1976; Fosberg, 1972). Bennett perceived adaptation as part of transformative 'interactive matrices' (Bennett, 1996, p. 5) between humans and environment: together they comprised a historical process he called the 'ecological transition' (Bennett, 1976, pp. 123-155) whereby an increasing (or decreasing) intensity of extraction of 'resources' are used concomitant with changing human population densities in lieu of less (or more) intense ways of using nature. The process of ecological transition in the southwest islands of the Pacific has been a late-starter in historical terms. More controversially, the transition may be proceeding relatively slowly because of the omnipresent force of nature, especially in the form of strong geophysical and climate-related events (see Nunn & Britton, 2001; Nunn, 2007) and the risks they pose to sustainability (Sturman & McGowan, 1999, p. 3). As such, the southwest Pacific region is an ideal field site to study the basic adaptive relationships of people in an environment that is perhaps less predictable and carries more risk than many other regions.

The processes of adaptation<sup>1</sup> are particularly germane in the case of climatic influence and the effects of dramatic weather events such as cyclones for which the South Pacific Convergence Zone is renowned (Field, 2005; Salinger, *et al.*, 1995). These influences, together with periodic El Niño precipitation anomalies, have a pronounced effect upon agricultural risk and related strategies, including the choice of crop cultivars by cultivator-farmers and the type of agricultural intensification (Allen, 2004; Downing, *et al.*, 2002). These effects are likely to be further pronounced by the advent of Anthropocene global warming (Rosenzweig & Hillel, 1998; Rosenzweig & Parry, 1994; Santoso, *et al.*, 2013). In addition to demographic, cultural and political influences towards agricultural intensification (Boserup, 1965; Brookfield, 1972; Leach, 1999; Morrison, 1994), adaptive influences are surmised to be equally important and relevant to the case of irrigation development<sup>2</sup>.

It is reasonable to assume that the development of irrigation was at least partially an attempt to reduce the risks involved in food production by overcoming vulnerabilities in local environments and agricultural methods<sup>3</sup>. Barrau (1961) posited that the 'deterioration of soils and vegetation' (p. 18) associated with shortened-fallow swidden cultivation led to the need for alternative agricultural strategies including the development of irrigation. Spriggs (1985), on the other hand, has argued that fertility was enhanced by accelerated erosional deposition (resulting from swidden burning) accumulating in colluvial and alluvial sediments subsequently used for agriculture – at least alleviating some of the destructive consequences of erosion. The question of whether either of these processes was a dominant influence on the intensification of irrigated terracing is unresolved – a lack of appropriate data hinders further enquiry. In general, there has been little research on risk and adaptation as they are related to the development of historic or prehistoric irrigation systems despite suggestions of their relevance (Addison, 2008; Brookfield, 1984).

## THE DRY AND THE WET OF TRADITIONAL IRRIGATED SYSTEMS IN FIJI AND THE PACIFIC

Gravity-fed, terraced and irrigated agricultural systems growing the food-cultigen taro (*Colocasia esculenta*) are a prehistoric, historic, and in a few places, current feature of the seasonally-dry leeward sides of Pacific Islands with orographic features, an agrobioclimatescape sometimes called ‘the dry’ (the opposite is ‘the wet’ – places that are continuously moist as a result of orographic processes) (Barrau, 1965; Kirch, 1994; Kirch & Lepofsky, 1993; Spriggs, 1981b; 1982; 1990). Taro is unusually adapted to hydroaerobic (moist and aerobic) edaphic conditions – and the humidity that is prevalent in the all-season moist windward areas (the wet) parts of the Pacific Islands. The dominant practice in the wet is unirrigated rainfed cultivation; irrigation has not been necessary and is not common in these windward locations where the bulk of taro production occurs today (Lambert, 1982).

Leaving aside both the gravity-fed, irrigated terrace and the rainfed gardens, there are many other ways of growing taro in the Pacific region, including: non-terraced natural spring-fed, springside (sometimes downstream-side of the spring) wild or semi-wild gardens (called *vure*<sup>4</sup> in Navosa sub-province, in the west-centre of Viti Levu) (King, 2012b), drained swamp gardens (*sabe* in Navosa), raised-field, island bed, and atoll pit-garden systems. Atoll pit-gardens are somewhat different in that they are predominantly associated with the production of *Cyrtosperma chamissonis*, a larger but less palatable aroid which is more tolerant of anaerobic conditions than taro. I have unconfirmed reports that floating taro gardens existed in the Rewa Delta of Fiji, and Spriggs (1989, p. 6) has observed furrow irrigation on Aneityum, Vanuatu; and documented simple flooded-field and bunded-creek systems for Papua New Guinea (Spriggs, 1989, p. 5). These ethnoagricultural techniques exhibit opportunistic and clever use of natural environments that minimize the loss of biodiversity (Thaman, *et al.*, 1979) and reduce the vulnerability to risks associated with irregular environmental forces. Each of these technological types involving the control of water for agriculture is worthy of research, but in this study the focus will be on gravity-fed systems where fresh flowing water is directed into flooded garden plots or creekfields (conventionally called pondfields<sup>5</sup>) growing taro surrounded by a containment wall (dyke or embankment).

Only a relatively small and scattered number of traditional gravity-fed irrigation systems (usually called *vuci*) exist in the dry regions of Fiji today, despite a substantial area of visible prehistoric and historic landesque capital (Blaikie & Brookfield, 1987b, p. 9; Håkansson & Widgren, 2014) indicating capacious irrigated terrace gardens (Kuhlken, 1994a; 1994b; 2002; Kuhlken & Crosby, 1999; Parry, 1987; 1994; 1997, pp. 129-137). A similar decline is apparent on many other islands with irrigation histories (Thaman, 1984, p. 106)<sup>6</sup>. Notable examples include New Caledonia, Vanuatu, Rarotonga, Mangaia, the Marquesas, the Society Islands, Mangareva, Tubuai, Rapa and Hawaii (Kirch & Lepofsky, 1993). The practice appears to be still vibrant on Futuna (as indicated by satellite photography, local confirmation is needed), and some parts of the Hawaiian Islands (Spriggs, 1989, pp. 14-15) where irrigated production of taro using mechanization and fertilizers is practised commercially as well as for subsistence (de la Pena, 1983). In Vanuatu also, disused irrigation systems have been reactivated, both as an ongoing part of traditional taro

livelihoods (Caillon, 2012; Walter & Tzerikiantz, 2012) and as a consequence of intentional development (Spriggs, 1981a, 1989).

Only three examples of traditional irrigated *vuci* growing *dalo* (taro, *Colocasia esculenta*) were observed by the author in the dry season of the relatively traditional, indigenous mixed arable-pastoral-arboriculture farming regions of Navosa and Ba in western Fiji during sustainability research in 1997-1999 (King, 2004). All of these creekfield systems were small and protected from the depredation of free-ranging ungulates (mainly cattle, horses, goats and pigs) by fences or by impenetrable natural forms such as cliffs and precipices. As previously documented (King, 2012a), the exponential increase in ungulate populations during the 20<sup>th</sup> century, and the lack of fencing, was likely to have severely constrained the development and use of *vuci* during and from this time in the dry of Fiji. Another bulwark, especially for larger historic systems, was the prevalence of (mainly storm-induced) gully erosion in feeder creeks which had restricted the ability of *vuci* cultivators' to form diversion weirs (*vono* in Noikoro dialect, Navosa) at the water intake. There were many other reasons for decline including: a late 19<sup>th</sup> century invasion of epidemic disease which induced a severe trough in population in the early 20<sup>th</sup> century (ibid), possibly leaving insufficient labour<sup>7</sup> to develop and maintain larger *vuci*; and the forced relocation of villages downstream away from their *vuci* during the colonial period. Colonial authorities later promoted plough agriculture and cash cropping to raise tax revenue (Frazer 1964; Knapman 1987) at the expense of traditional exchange and tribute to which the value of taro was strongly linked.

Other changes occurred in local cultural ecologies that may have been detrimental to irrigation. For example, this author theorizes the possibility that the introduction of horses (*Equus caballus*) may have accelerated the decline of *vuci* by facilitating the transport of juvenile taro plants from the <100 m creekside (or riverside) *tanitani* nurseries to elevated 600-900 metre high rainfed growing areas (see Hashimoto (1990) on the vertical distribution of garden types in relation to climate zones in Navosa). These heavy loads would have been carried by people before horses became available (around the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries) and it is likely that the strenuous nature of this work (and danger during war (Field, 2002)) imposed limitations on either or both the number of juvenile plants carried and the distance the cultivators were prepared to travel. The likely effect is that pre-Equus Navosa communities were less inclined to transport taro plants over the riskier, longer (and often very steep) distances required to maintain separate high altitude rainfed gardens than is the case today. In contrast, the alternative of locally-situated *vuci* systems near to their habitations may have been more convenient and involved less social (and possibly, environmental) risk. This theory about a situation-specific effect following the introduction of horse transport, which I call the *Equus*-Enabled Space Compression Theory, is supported by evidence from aerial photography interpretation studies (e.g., Parry, 1987; Field 2002) which indicate that former irrigation terraces are generally at low-medium to medium elevations quite close to the numerous small villages of the time (and their creekside or riverside *tanitani* nursery sites). Some terraces in the upper Sigatoka Valley are at higher elevations where generally moist climates facilitate year-round rainfed cultivation for nearby upland communities. In these places there is usually no necessity for irrigation or vertically-transported replanting but some *vuci* systems existed at quite high altitudes (e.g., on the Tawalese, Wainivau-Lotoloto, Nakaumata and

upper Solikana Creeks), where they were able to exploit high quality water sources, or where good lower-altitude *vuci* sites were lacking (e.g., the Busa-Nadaka Creek).

Taro cultivation has been practised for thousands of years (Chandra & Sivan, 1984; Matthews, 2010), but the origin-dates of Pacific irrigation systems are still largely uncertain. However, it can be confirmed that archaeological evidence across the Pacific situates structured creekfields of substantial size on more than one island about AD. 500 (Kirch & Lepofsky, 1993). It is probable that these systems had a much earlier genesis (Addison, 2008) and developed gradually with increasing populations, although it is possible that a sudden flowering of irrigated terrace construction occurred, synergistic with relatively rapid environmental or sociocultural change, or both. The dating of irrigation features such as terrace walls is highly desired for chronological understanding, but has so far been rarely achieved, probably because archaeological research has been focussed elsewhere. It may be possible to find dateable fossilised charcoal underneath the basal stones of terrace walls, thus allowing inferences about the date when they were constructed. In addition, progress has been made with scientific techniques that allow the dating of fossilised fragments of cultigens (e.g., Ladefoged, 2005).

There has been a long-standing debate about whether the practice of irrigated taro cultivation was ancient and diffused, or innovated independently within island settings (Addison, 2008; Kirch & Lepofsky, 1993, pp. 184-185; Spriggs, 1982, p. 317; 1990). My view, from the perspective of an observant researcher with cultivation experience at the farm scale, is that it would be difficult not to innovate irrigation creekfields for growing taro, and equally but contrarily, that it would be difficult to ignore one's forbearers' knowledge about growing taro. In the first case, the learned praxis or act of transplanting juvenile taro crowns or suckers in new locations (sometimes in moist settings near running water) inevitably involves consideration about hydrologic conditions and the possibility of diverting or draining water to improve these conditions, in part, because of the hydroaerobic sensitivity of the *Colocasia esculenta* cultigen. In my view, all intelligent cultivators are involved in this cognition-action performance (Richards, 1989; 1993) on a day to day basis and technological innovation in these situations is a gradual outcome of trial and error praxis-performance of crop success or failure and the necessity to produce food.

Here are some examples: a taro crown or sucker may be planted in flowing water and the outcome evaluated. A very small ditch may be dug to allow flowing water into a small riparian patch suffering dryness. Floods may come and rearrange the hydrologic conditions of creekside gardens – and the changes observed. Drains are dug to dry a patch where the flowing water has stopped and stagnancy threatens. These are some of the regular experiences and actions of cultivators who adapt their methods to prevailing conditions: some of the outcomes may be conceptualised as innovation, but the extent to which they are truly independent is highly questionable, given the conceptual templates of taro-growing methods as part of indigenous or local knowledge and performance already held within relevant communities and learned from forbearers (also see Yen, 1973).

One point to qualify: today, communities can lose indigenous knowledge quite quickly (after one generation), if they are no longer performing the relevant skill. For example, one of my 1998 guides (an intelligent and skilled young alluvial soil farmer) was not able to recognise prehistoric irrigated

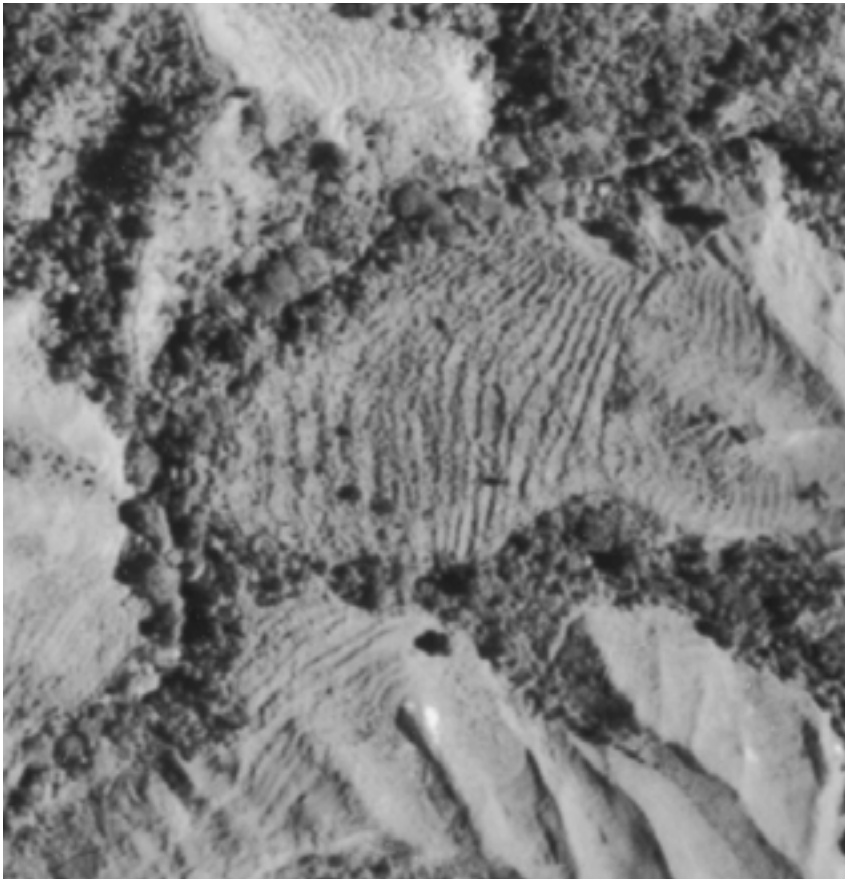
terrace features at first sight. He had not learned about these, although he lived nearby within the region. I have met other (coastally located) Fijian youth from the wet, who did not know how to grow taro at all. In these situations involving the loss of traditional knowledge, where the transfer of knowledge is latent rather than active, communities may effectively become epistemologically independent of each other over time, at least satisfying one aspect of independence and therefore partially justifying a theory of independent origins. More succinctly, the praxis or performance of taro cultivation involves traditional knowledge and skills in a diverse hydro-edaphic context that is situationally-creative, adaptive and conducive to innovation. Both traditional knowledge and the potential for innovative hydro-edaphic intensification coexist at the local scale, and there is no necessity for notions of unilinear evolutionary diffusion or the need for powerful social influence in the incipient stages of irrigation development<sup>8</sup>.

## **RESILIENCE: FIJIAN AND PACIFIC CASE STUDIES.**

In Fiji, irrigated creekfields are generically called *vuci* (but there are many dialect or communalect synonyms associated with particular communities; see King, 2012b, p. 4). Prehistoric remnants have been recorded by Parry (1987; 1994; 1997), Kuhlken (1994a; 1994b; 2002; 2007), Kuhlken & Crosby (1999), and Field (2002). For the historic record, beginning in the mid 19<sup>th</sup> century, several itinerant observers made note of irrigation (see Perks, 1980), especially in the interior of Viti Levu (see King, 2012a, p. 156) and studies of extant irrigation systems (either in part or *in toto*) have been documented (Hashimoto, 1990; King, 2004; 2012a; 2012b; Kuhlken, 1994a; 1994b; 2002; Sahlins, 1962; Watling, 1984).

Fijian *vuci* systems, especially those of the dry, were primarily contoured on non-alluvial hillslope soils usually above the colluvial zone (*contra* the usually low-lying creekfields in Hawaii and Futuna (Earle, 1980; Kirch, 1994)). One of the larger examples is the disused Drau *vuci* (see Figure 1) on the upper Wainimosi Creek in central Navosa (almost exactly in the centre of Viti Levu). It has about 15 full-length irrigated (some terraces are shorter and narrower) contoured *tavi* (terrace steps) on rich soil. The longest of these, measured on the ground by the author, was Terrace 11 at 209 m long and 4-8 m wide. Terrace 1 (higher up and receiving the intake canal) was 117 m long and 5-14 m wide (unusually, it was flared at one end over a more gradual gradient). There is a further set of unirrigated terraces of about 12 levels (divided by a ridge) above Terrace 1 (making a total hillside count of approximately 27 vertical terrace steps). Informants stated that these topmost unirrigated terraces were planted in rainfed taro; probably only successful in wet years, but possibly valuable for: accommodating excess juvenile plants after the main planting, as a wet season cultivar-exchange reservoir serving (vegetative) propagation, and to lessen risk in case of damage to the *vuci*.

**FIGURE 1:** *Drau (means one hundred) vuci irrigated taro terrace complex, Wainimosi Creek, Noikoro district, Navosa, Viti Levu, Fiji. Aerial photo courtesy of Lands Department, Government of Fiji, 1990. Disused. The topography is steep and nearly all terraces were built on slopes above the narrow colluvial zone. The longest terrace is 209 m long. The water source is well out of the picture on the top-right but the bottom of the main intake canal can just be discerned. The narrow terraces above the intake canal on the right of the photograph were not irrigated. The terraces on the bottom-left of the photograph to the right of the main creek were fed via aqueducts crossing the gully in the lower-centre of the photograph from the main system.*



Only a very few alluvial *vuci* existed but the author is familiar with one: the (about 1 hectare) Nakula creekfield in the Noikoro district of Navosa was functioning up until 1992-1993 when its intake canal adjacent to the Wainivau Creek was destroyed by Cyclone Kina. The author was asked for help in repairing the canal on a visit to Namoli village in 2005, but the request for a bulldozer was beyond development capacities. Today, the Nakula *bila* (alluvial terrace) which includes part of the area previously occupied by the *vuci*, is planted in watermelon, pumpkin, peanuts, cassava and other crops by cultivators mainly associated with Korolevu village.

Some of the larger irrigation systems had very sophisticated hydraulic arrangements where irrigation water descends staircase terraces over multiple levels (4 to 15 levels was typical) and distributed over gullies using aqueducts. Water was sourced from creeks with diversion weirs

(or sometimes springs<sup>9</sup>) and transported via intake canals (typically cut into steep hillsides) sometimes hundreds of metres long (Kuhlken, 1994a; Kuhlken & Crosby, 1999). The intake canal for Drau *vuci* follows the contour on a steeply dissected hillside and is estimated to be 750 m long to the intake weir on the upper Wainimosi Creek. Drau is a large-scale system but lesser-scale systems were more numerous. The smallest are the small springfed systems, maintained by an individual family or subclan (*bito*, *beto*, *tokatoka*) rather than the chiefly *mataqali* (clan) although often serving the clan<sup>10</sup>. These small systems were probably important to livelihoods in the past: they were the only type remaining at the time of the author's 1998-1999 research (King, 2004, pp. 185, 361), suggesting that they are more resilient than the larger systems. An agronomic reason for their continuance favoured by the author is that they are more easily protected from ungulates than larger systems. However, reasons associated with sociocultural and politico-economic change are also likely to be important in many cases.

These irrigation systems were developed to be adaptive with Pacific agrobioclimatescapes at their time of construction. The general view is that they are almost universally highly productive (Spriggs, 1989) compared to dryland cropping systems, although there are many variables influencing the yield of corms and other outputs (Spriggs, 1984, pp. 125-126; Caillon, 2012, pp. 202-204), and a scarcity of rigorously-designed comparative studies which are necessary for firm conclusions. In general, there is a paucity of taro studies across many domains (Sunell & Arditti, 1983, p. 34), and most cogently, in the economic, sociocultural, historical and sustainability realms related to the livelihood role of taro (but see the ethnographic studies of: Caillon, 2012; McKnight *et al.*, 1960; Walter & Tzerikiantz, 2012, discussed later). One difficulty in researching *Colocasia*-based livelihood systems is that there are a large number, and more especially, dynamic and varying range of potential research variables (e.g., geographic, climatic, edaphic, floristic, aqua-cultural, agronomic, social, politico-economic and cultural) that influence outcomes and interpretations of outcomes. Most of the studies done so far only consider a very few variables based around the yield of corms, supply of nutrients and less commonly, labour requirements (Bayliss-Smith, 1980, p. 87) as part of the commercial development of taro corm production. More recently, studies have emphasised the role of genetic resources and have incorporated the type of cultivar into this list (Manner & Taylor, 2010; Singh *et al.*, 2010; Taylor *et al.*, 2010). Plant physiologists have begun to study mechanisms that may help explain the adaptation of *Colocasia esculenta* to freshwater wetland environments (e.g., Konnerup, *et al.*, 2011). Research on how taro can be used for the phytoremediation of polluted sites is growing (e.g., Bindu *et al.*, 2010; Madera-Parra *et al.*, 2015). Research on the bioenergy potential of taro has also been initiated (Adelekan, 2012). Further ethnographic studies of existing systems similar to those mentioned above, in Vanuatu and other Pacific islands, may prove especially valuable. However, the interpretation of research requires caution: some variables, e.g., yield, are subject to inconsistency of measurement: many studies do not clearly state the type of scale (i.e., metric or other) that becomes represented as 'tonne' values, and sometimes 'per year' is not calculated, but merely the crop-cycle presented (crop cycles can vary from less than 5 months to 18 months or more). Native soil types and fertility can have a large influence but are often not evaluated. Labour inputs are very difficult to measure accurately and comparisons between studies in different places and cultures may be unreliable. For example, some cultures emphasise group organisation and collective input rather than an individual's input around irrigation (e.g., Östberg,

2014; Sheridan, 2014; Watling 1984), and labour input can be spontaneous and opportunistic in the midst of performing other work. Despite this overall variation, some findings are presented here in an attempt at synopsis.

Purseglove (1972) reported that: ‘In Melanesia, crops grown without irrigation are said to yield 7.5 ton/ha, but double this amount when irrigated’ (p. 64). Spriggs (1984) adjudged: ‘For taro the yield per hectare with irrigation is considerably higher than in rain-fed dryland conditions in a similar environment’ (p. 123), a view supported by Onwueme (1999): ‘the corm yields are much higher (about double)’ (p. 12). The controlled-moisture characteristics of irrigation systems have the potential to allow year-round and out of season production, aided by the relative absence of weeds (following flooding and suffocation) with protection from some pests such as the taro beetle (*Papuana spp.*). The reduction of weed and pest competition contributes towards high planting densities and higher corm yields. Higher planting densities, and the greater density of foliage produced from the increased production of suckers associated with submerged conditions<sup>11</sup>, in turn, reduces weed competition. Research carried out at Maewo in Vanuatu realised irrigated corm yields of between 25.1 t/ha/yr and 58.1 t/ha/yr (Spriggs, 1984, p. 126). Caillon (2012) has reported an average yield (partially drought-affected) of 18.3 t/ha (pp.202- 203) for taro water-gardens in Vanua Lava, Vanuatu; that use a sequential (rather than continuous) flood irrigation technique. Futuna creekfields, established many generations ago, yielded between 13.3 and 20 tonnes/ha/yr of *cooked* corms (Kirch, 1994, p. 154) together with crayfish, mud fish (*Tilapia spp.*), and eels. Hawaiian pondfield farmers (using heavy fertilizer and weedicide inputs) produced yields between 22.4 t/ha/yr and 49.4 t/ha/yr (Bayliss-Smith, 1980, p. 89)<sup>12</sup>. According to the Queensland Government Department of Agriculture and Fisheries, dryland (rainfed) taro: ‘yields vary from 4 to 30 t/ha. Yields up to 70 t/ha have been recorded in Hawaii with heavy fertilisation. Commonly, yields of 10 – 25 t/ha are achieved’ (QGDAF, 2015). The studies of ‘dryland’ taro reported by Lebot (2009) indicate yields from 14.85 t/ha to 33.55 t/ha (p.332), but ‘dryland’ yields can be increased with intercropping (p. 333). As alluded to before, a number of studies on yield have been conducted in Hawaii, some of them on irrigated ‘wetland’ (meaning creekfield) cultivations including larger creekfield complexes of many hectares (Plucknett & de la Pena, 1971). In 1992, taro creekfields in Hawaii covered 123.43 ha (Fleming, 1994)<sup>13</sup>. An analysis of an irrigated taro cropping cycle of 15 to 16 months showed yields (after metric conversion) of 19.36 kg/ha/yr of corms (*ibid*).

To summarize, it appears, very broadly, that the upper margin of the average of rainfed yields is about the same as the lower margin of the average of irrigated creekfield yields. It is possible that agricultural development, focused mainly on rainfed systems and cultivars, has increased non-irrigated taro yield at the expense of irrigated yield, leading to a reduction in the yield difference between these production types that Purseglove, Spriggs and Onwueme reported at an earlier time.<sup>14</sup> The production of taro corms is only part of the yield, however, because cultivators can also selectively harvest eels, prawns, fish (and following a special transplanting technique, shellfish) from creekfields and aqueducts. Also, similar to intercropping in rainfed systems, tree crops, fruits and green vegetables (including watercress, taro leaves and edible ferns) can be harvested from different parts of the irrigation infrastructure (field observations, VNV-FOSLE). This diversity of productive outputs is highly variable, often temporally intermittent and harvested



by different persons or households, making these outputs very difficult to measure. Overall, they are probably of minor importance on average, but they can become valuable in times of stress or shock (e.g., in droughts and after floods or cyclones) when they serve to enhance livelihood resilience.

As alluded to above, there have been very few specific studies of taro livelihood systems in the Pacific. Perhaps, the ethnographic work of Caillon in Vanuatu (e.g., Caillon, 2012) has been the most detailed and revealing in the way it focuses on the historically fluid, but strongly-linked social and cultural relationships between Vanua Lava communities and their sequentially-flooded intensive taro water-gardens in a region of relatively low but increasing population intensity. In that place: ‘Taro is good to eat and think’ (Caillon, 2012, p. 189), and according to Caillon, amounts to a taro civilisation where ‘they live to cultivate and eat taro every day’ (p. 189). In these ‘social and sustainable’ (p. 204) places taro is the dominant food (each person consumes 1.09 kg fresh taro daily (p. 203)) and cash income comes from the sale of copra. Walter and Tzerikiantz (2012) argue that the apparent stability of traditional taro production in Western Santo, Vanuatu, is actually a product of processes of constant renegotiation, migration and change. Gardens tend to die with the person who initially established them, only for descendants to re-establish gardens elsewhere, sometimes in places already endowed with landesque capital in the form of ‘great horticultural complexes’ (p. 209) (terraces, walls and water conveyancing) and agroarboricultural gardens that were once utilised in historic or prehistoric times: ‘in a sense, nothing is abandoned, rather, the existence of a large complex allows a rotation of pondfields in use, which benefits productivity and provides strategic flexibility’ (*ibid*, p. 216).

Articles by Kuhlken (2002) and Watling (1984), and to some extent, Hashimoto (1990), describe some of the social, livelihood and adaptation factors around extant irrigated systems in Fiji. Kuhlken’s contribution describes the livelihood value of the then existing irrigated terracing (*vuci*) at Ravitaki on the island of Kadavu in some detail. He comments: ‘wetland taro was probably never a required cropping strategy, only a relatively fail-safe one.’ (2002, p. 168). Thus, risk-reduction around food scarcity is a benefit. Further:

*‘Villagers there persist in cultivating taro in a pondfield environment for a number of reasons. They speak of drought and cyclone hazards, of higher yields and preferred taste, but also tell of perpetuating the obligatory custom of serving irrigated taro for feasts.’ (p.176).*

Feasts are understood as enjoyable events but the villagers also ‘cite advantages of the communal labor required for maintenance of the terraces and associated infrastructure’ (p. 177). These findings are largely in accord with my own observations and interview records from Navosa, where the *solesolevaki* (communal work group) was highly valued as a means to perpetuate clan, religious or village solidarity in the face of socioeconomic changes leading to altered identities, individualism, and fragmentation. The onerous work component of *solesolevaki* is often relieved by joking banter and social sharing, with the outcome that participants may perceive the day’s work (or performance) as enjoyable and rewarding in itself. Kuhlken also comments on the decline of *vuci*:

*The persistence of irrigated taro cultivation on terraced pondfields in Fiji may be viewed as a deviation from the normal path of agricultural disintensification. In the face of overwhelming reasons not to practice such intensive methods, its perpetuation is surprising, though understandable within the context of cultural forces supporting the esteemed position of wetland taro in ceremonial and social gatherings (p. 186).*

In other words, for Kuhlken, (traditional) culture is the ‘preserving factor’ that perpetuates *vuci* in history around the dusk of the 20<sup>th</sup> century.

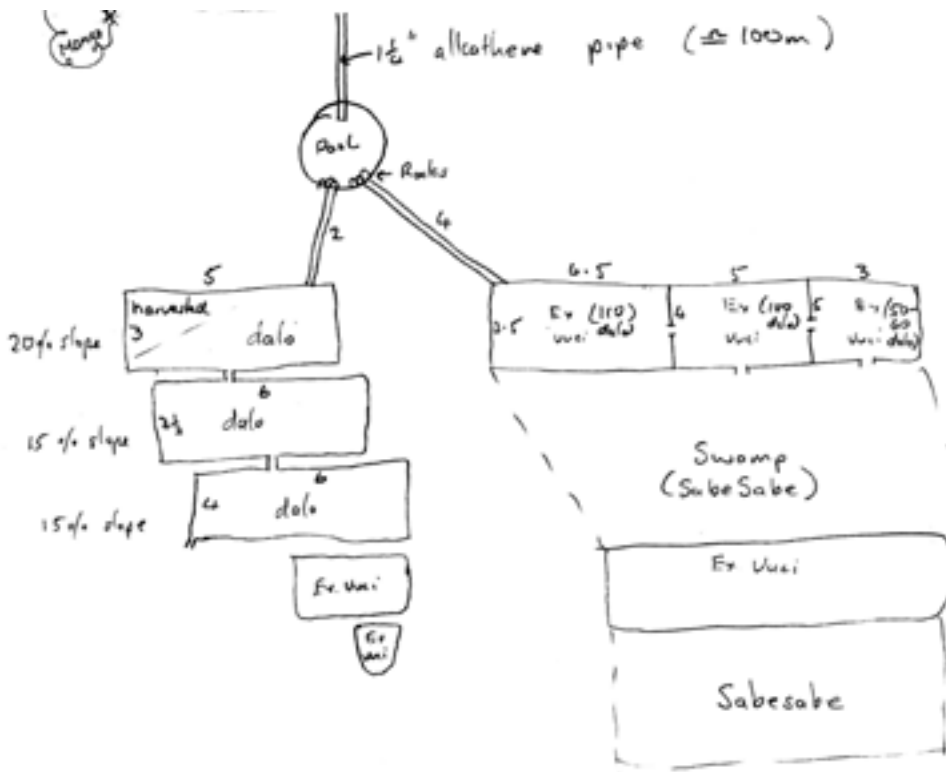
Watling’s (1984) article presents a Fijian history of irrigated creekfields and a study of the *vuci* at Vatukurukuru, Gau Island, describing the technical features of the traditional irrigation system. Polyvinylchloride (PVC) pipes were used here in addition to traditional bamboo piping. Similar to my observations elsewhere in Fiji, there was a preference to plant from January to April in order to harvest near Christmas in December. The advantages of irrigated terrace cultivation that Watling recorded were: (a) especially tasty taro (excellent for *vakalolo* pudding, served at feasts), (b) greater numbers of suckers are produced, facilitating replanting, and (c) less weeding (p. 134). One of the disadvantages mentioned that accords with observations elsewhere in Fiji by the author is the need for ‘continuous supervision’ (p. 134). This is a significant detraction where cultivators have several gardens dispersed over a landscape (a common practice in Navosa today, see Hashimoto (1990)), growing a much greater range of crops (and animals: see King, 2012a) compared to traditional times when yams and *vuci* were ‘king’. Consequently, less time is available to monitor any one crop, *vuci* included, adding to the challenges of *vuci* revitalization projects.

Nevertheless, *vuci* are relatively (compared to yams and cassava) resilient in the face of cyclone shock – *Colocasia esculenta* and its relatives withstand severe winds better than many competing crops, especially when the plants are small. Evidence for this comes from the author’s 1998-1999 research data (previously unpublished) from Nasauvakarua and Nawairabe villages, Navosa, where every household in each village (both had a total of 34 households) was interviewed. Cassava was the main food crop with a total planting across both village communities of 231 square chains (sq ch.), whereas taro was the second most planted food cultigen covering 161 sq ch., substantially more than the third most common (*Xanthosoma taro*, 41.5 sq ch.) and other food cultigens. *Yaqona* (*kava*, *Piper methysticum*) was most widely planted occupying 276 sq ch., but was a drink, not a food crop. The participants were asked: which food was best after a cyclone? *Xanthosoma taro* (*dalo ni tana*) ranked the highest (2.57 av. rank), before cassava (2.83) and then taro (2.85) followed by several other food crops and purchased commodities. The high ranking for *Xanthosoma taro* is partly because it is usually planted in sheltered, semi-shade locations (often part of intercropped agroarboriculture) and has side-tubers that tend to escape damage. The high score for cassava is explained by its usefulness immediately after a cyclone before the damaged tubers begin to deteriorate, but taro was consistently rated highly despite being planted in typically open, sunlit and exposed situations. The participants were also asked: which food is best during a drought? Cassava rated highest (av. rank 1.23) followed by sweet potato (2.68) and *Alocasia* (*via*, or giant) taro (2.8), while

(rainfed) taro was not ranked highly, a consequence of its lack of resilience under dry conditions. Thus, it is apparent that taro is valuable for avoiding food scarcity following cyclonic storms in the wet season, but unirrigated taro has little value during long droughts. This result is expected given that the cyclone season overlaps with the main wet season taro-growing period and very little (rainfed) taro is available during drought-prone dry seasons. Unfortunately, there was virtually no irrigated *vuci* taro (except for one very small streamside creekfield of about 1.5 m x 1.5 m in Nawairabe) to build a comparison with the rainfed technique.

Flooding will damage taro planted in running water at riversides and larger creeksides, but the practice in Navosa is to transplant such taro (usually juvenile plants, called *tanitani*) to rainfed fields at higher elevations, either on the alluvial terraces (a lesser flood risk) or to secure upland agroarboriculture gardens (*teitei*), in the months preceding the beginning of the cyclone season (about September to November). In the past, they were probably also transplanted to *vuci*. Some *vuci* systems are resistant to drought stress, in particular those fortunate enough to have consistently reliable sources of cool water (Addison, 2008). However, those *vuci* subject to a severe decline in the supply of water during drought are less resilient. Taro rot (*Pythium spp.*) can invade the corms if the water supply slows and becomes hot and stagnant or where a *vuci* dries-out and the mud becomes hot. It is posited here that those creekfield systems with secure and reliable water supplies, *ceteris paribus*, are most likely to be both the oldest and the most sustainable. They were also places that are likely to have attracted nearby settlement in the prehistoric past. Creekfielding supports agrobiodiversity by distributing water over larger areas, utilizing dampness efficiently and protecting nearby biodiverse forests. In this way *vuci* can be an adjunct to the agroarboricultural systems common in the Pacific (Clark & Thaman, 1993). Several other advantages of taro irrigation systems are already documented (Spriggs, 1984, 1989; Thaman, 1984) and there is insufficient space to cover all of the reasons here, but I will finish with a description of a small extant *vuci* located at a high altitude (690m asl.) settlement at Natoka in Navosa, Fiji (see Figure 2).

**FIGURE 2:** The author's 1998 hand diagram of the small *vuci* at Natoka (690 m asl.) in upland Navosa, Viti Levu, Fiji, referred to in the text. It was one of two *vuci* observed as being used in Navosa in 1998. The other, at Nawairabe (which used a traditional *tula* (bamboo pipe)), no longer exists. *Dalo* is the Fijian word for taro, and the numerals refer to metre length (except the 1¼ inch (32 mm) polythene pipe). This pipe, from the water source, enters at the top of the diagram and empties into a small (about 1 m diameter) pool before being distributed to the two sections of the *vuci* below through rock filters, and further down to the *sabesabe* (drained swamp taro beds) which receive the outflow from the *vuci*. The slope for the section on the right was about 10%. This place was situated near the chief's house - helpful for security purposes. It has been observed elsewhere that relatives or other community members have harvested taro leaves from *vuci* gardens for *bote* or *rourou* (Fijian spinach) without asking the cultivator. Although this serves community livelihoods in general (and is part of Fijian egalitarianism), it compromises the production of the especially tasty *vuci* taro corms and the special efforts of the cultivator for this end.



The interview with the senior *dau ni vuci* (expert *vuci* cultivator, who was also the hereditary chief) was conducted in the drought of 1998. In his view, any soil can be used for *vuci* (most of the surrounding soil was heavy and of good fertility). He installed the 32 mm diameter PVC pipe of about 100 m length to bring water from a small upland spring to his *vuci* (costing him \$100 in 1971). The water flow, which he considered to be ample, was about 36 litres/minute equally divided between his two small sections totalling 117.75 square metres of active *vuci*. He outlined some *vuci* advantages: labour requirements for the *vuci* are mainly in the dry season which complements the labour requirements of wet-season *yaqona* (the dominant cash crop). *Vuci* taro

also has better taste and obtains a good price. A disadvantage is that it requires more digging to prepare the bed of the *vuci*, compared to rainfed taro.

His *vuci* (which was situated next to his house) was divided into two sections (south and north). The south section was comprised of three active beds (*vuci* fields, from top to bottom, west to east, each draining into the next: 5 m x 3 m, 6 m x 3.5 m, 6 m x 4 m) plus two smaller retired beds below these (slope gradient varied from 20% at the top to 15% below). The north section consisted of 3 beds (from top to bottom, south to north, each draining into the next: 6.5 m x 3.5 m, 5 m x 4 m, 5 m x 3 m). It had been used for 2 or 3 years and some of the area on the slope below (gradient about 10%) was now in the *sabesabe* (drained swamp) style without creekfields. The 6.5 x 3.5 bed contained about 110 plants, the 5 x 4 bed contained 100 plants, and about 50-60 plants occupied the north section 5 x 3 bed. All beds were densely packed with taro plants: it was not ascertained at the time, but it is assumed that a considerable degree of suckering had occurred. There were scattered straggling weeds in the *vuci* and a weeding task was probably imminent. Both suckers and crowns (tops) are used for replanting.

The plants take a full 12 months to mature compared to the 6 to 12 month maturity period for the rainfed traditional Vavai and Toga cultivars planted on other slopes nearby. He uses two traditional cultivars in the *vuci*: Lewa ni vuya and Vudra. Both have the advantage of staying sound in over-maturity, but Lewa ni vuya was better in this respect. They are used for local consumption, but were also sold to the Ba market for \$15 a bundle of 5-6 (approx. \$2.00 - \$3.00 kg). When the taro is mature he dries the *vuci*, which makes harvesting easy (the roots die and leaves wilt and the corms can be pulled in half a day). Planting can be done anytime, but is more difficult than harvesting – it takes a whole day: the soil must be moist and digging deep is necessary to allow full root development (the soil type was heavy). Weeding is necessary every three months, which he considered fairly hard work: a half to one day each time for each of the three terraces. *Noko ni kisi* (otherwise unidentified) was one of the most annoying weeds.

The tendency for extant *vuci* to be operated by clan chiefs or their senior relatives was noted throughout Navosa, although this was not an interview question. Chiefs are expected to contribute well at local gatherings and ceremonies and contributions of *vuci* taro are highly esteemed, reflecting positively on the donor's social status. This association of *vuci* taro with social status is deeply embedded in local culture today<sup>15</sup>. Unfortunately, this has a negative side in that it may tend to restrict *vuci* development to chiefly families: commoners may not want to be seen to be upstaging the chief by presenting *vuci* taro at a ceremony, or even by growing it without the chief's permission.

Were these *vuci* systems otherwise resilient and sustainable? The question has both physical and sociocultural-politico-economic aspects. From a physical perspective, prehistoric terracing is still quite visible, especially in inland Viti Levu, today. Some terrace remnants appear relatively undamaged, especially when the many decades since the beginnings of disuse and the exponential increase in ungulate animals are considered. It appears that the maintenance of terraces was not too difficult and was a sustainable practice. The (usually riparian) water transport systems, however, are seldom visible, especially on aerial photographs, although the remains are often visible upon investigation at ground level. What has become apparent for most of the old *vuci* sites visited by the author is that floods have damaged access to the water intake. The creek

beds have been down-cut making impractical the rebuilding of the rock diversion weir<sup>16</sup> (*vono*, Noikoro dialect) in the original location and forcing either a new weir upstream or abandonment. In recent decades it is the latter option that has been taken. Aqueducts, traditionally, were made from the hollowed trunks of tree fern (*balabala*, *Cyathea lunulata*) and bamboo (*bitu*, *Schizostachyum glaucifolium*) but these have not persisted, except for a very few in current usage that are protected with fences. The relatively recent prevalence of ungulate animals (largely absent prior to AD. 1900), especially in the dry western region where cattle inhabit the shade of gullies, has had a major effect on fragile infrastructure such as riparian water supply systems which traditionally were not protected with fences. It is this ungulate-impact that the author believes to be a hidden reason (a consequence of colonial policy (King, 2004, pp. 86-89)) for the frequent abandonment of *vuci* from about the mid-20th century (King, 2012a).

The reference to colonial policy introduces the sociocultural-politico-economic element of resilience and sustainability. Agricultural systems adapt not only to geophysical forces but also to sociopolitical (Blaikie & Brookfield, 1987b; Thrupp, 1993), developmental (Brookfield, 1984) and economic ones (Earle, 1980). Many of the reasons for *vuci* decline can be attributed to sociopolitical and economic influences (Durutalo, 1985; King, 2012a, p. 157; Kirch, 1994; Perks, 1980, p. 70) that shape development, influence ecological transitions (Baines, 1989; Bennett, 1976) and alter the risk characteristics of agriculture and livelihood systems (Berkes & Folke, 1998). The type of technological change in agriculture within Fiji has been consistently over-determined by top-down forces associated with the history of British imperialism (McNeill, 2003) and more recently influenced by the political economy of trade and aid remittances from temperate countries (Belshaw, 1964; King, 2004, p. 351-353). There has been a long history of plans and putative improvements suggested by extralocal developers with very low adoption rates among local farmers, especially in recent decades<sup>17</sup>. At the centre of this 'adoptive conservatism' is risk. In general, extralocal developers are naive about the environmental and economic risks that Fijian farmers are very aware of, especially the risk of cyclone and flood damage.

## **CLIMATE CHANGE, ADAPTATION, RESILIENCE AND SUSTAINABILITY**

There is some suggestion that irrigation may go through periods of adaptive decline and renewal (King, 2012a; Walter & Tzerikiantz, 2012). An important question is: to what extent has traditional irrigation been influenced by environmental influences and especially by climatic factors? Is there a link between climate change and the indigenous development of irrigated terracing?

Nunn (2007) has argued that there are strong links between past climates, environment and society in the Pacific, especially in the prehistorically more recent late Holocene period. In particular, he has focussed attention on a period of climate change around AD. 1300 when there is evidence for increased precipitation and storminess (Nunn & Britton, 2001, p. 9). This period is associated with a Pacific-wide decrease in temperature of 1.4°C to 3.2°C within 100 years (ibid, p.120) between the Medieval Warm Period and the Little Ice Age. This time coincides with a likely development period<sup>18</sup> of irrigated terracing in Fiji (Kumar, *et al.*, 2006) and other places throughout the Pacific, and leads to the question: did the AD. 1300 'event' stimulate irrigated

agricultural terracing<sup>19</sup>? This question is more complex than it seems because there may have been many events and not just one associated with AD. 1300 phenomenon. For example, recent studies based on sulphate deposition at Law Dome in Antarctica indicate separate major volcanic eruptions just before and during the AD. 1300 period (Plummer, *et al.*, 2012). These eruptive events are likely to have caused a dramatic reduction in solar irradiance as well as lowering surface temperatures. My suggestion is that such conditions could have severely affected the culturally-preferred (Perks, 1980, p. 46) sunlight and temperature-sensitive yam (*Dioscorea spp.*) crops of the dry in the Sigatoka Valley, especially if combined with wet and stormy conditions (which penalise yams and favour taro); and forced a greater reliance on taro production at a time when population was increasing rapidly and putting pressure on carrying capacity and social boundaries. At this time, social conflict may have limited local access to the high-elevation moist, rainfed taro growing areas defended by the forerunners of highland clans such as Emalu<sup>20</sup> (Brewster, 1920), or more distant access to taro from the wet windward regions, thus forcing the construction of taro terraces at drier lower elevations closer to downstream settlements.

The development of larger-scale irrigation systems may also have been an adaptive response to erosion and land degradation occasioned by the regular burning of the landscape as Barrau (1961) suggested, and as King (2004) observed during the severe drought of 1998. However, the lack of site-specific evidence about chronological differences in land fertility make this claim hard to substantiate, despite the evidence for sudden onset of erosion in the sedimentary record after the date of initial settlement (Dickinson, *et al.*, 1998). Spriggs' (1985) suggestion, that early colonizers practised a type of landscape enhancement by cultivating on alluvium or colluvium washed from (intentionally) degraded hillsides, is subject to a similar criticism: there is a general lack of evidence about the fertility of soils before and after. The current observed tendency of cultivators in the dry of Fiji to plant on higher slopes rather than lower slopes also suggests that the assumption that lower strata sedimentary soils are more fertile is limited in applicability, and bears investigation. An important factor to consider here is the role of crop diseases such as *anthracnose* which tend to accumulate around and in the compacted and less-aerated colluvial soils at the base of lower slopes – limiting the cultivation of yams and other crops on these sites.

In summary, it is likely that irrigation has to a substantial extent been the result of adaptive processes between local communities and especially the climatic and physical environment but with differential levels of change over time, and that the development of irrigation maintained the resilience and sustainability of dry zone Fijian communities in times of duress.

The reasons given for decline of terracing (see King, 2012a) in many ways also reflect the role of adaptive processes including those having sociocultural and political origins. Change is ongoing: only some of the reasons for irrigation decline are relevant today and new reasons for irrigation expansion are appearing. There is no space to elaborate further upon the many social factors here, but I will point out that sociocultural-politico-economic influences, *contra* geophysical forces, can be reversed or modified to allow new adaptation possibilities to occur, for example, to support the adaptation of Pacific agriculture to climate change *via* the revitalization of irrigated terrace agriculture.

## DEVELOPMENTAL POSSIBILITIES AND PROGRESSING WITH THE PAST

In 2005, the author responded to a request for help to restore a traditional irrigated creekfield system damaged by flooding in the inland sub-province of Navosa on the island of Viti Levu, Fiji. The Ministry of Agriculture (MAFF) had been approached without success: unsurprising because the ministry was still partly a relic of its colonial foundation, informed by and practising strategies symptomatic of Eurocentric diffusionism (Blaut 1993), like many others elsewhere (Blaikie and Brookfield, 1987a); and subject to the whims of trade and aid deals which stifle locally-adapted innovation (Belshaw, 1964; Gupta 1989; Richards, 1985). For example, the Nacocolevu Agricultural Research Station in the lower Sigatoka Valley of Fiji has for decades hosted a stream of small vegetable-growing projects funded and managed by overseas donor partners introducing new agronomic technologies but without much interest from Fijian farmers (who pass by the research fields on every trip to Sigatoka town) or obvious signs of widespread adoption (new Papaya cultivars may be a partial exception). The suitability and economics of the experimental crops and technologies are, by and large, a poor fit for local farmers and it is easy (if a trite rhetorical) to conclude that the experimental research is of more benefit for the host nation than Fiji. By contrast, taro continues as one of the staple foods for Fijians and other Pacific Islanders (Wilson, 1984, p. 590), not just because of its locus with cultural identity (Pollock, 1992, p. 235) but because the taro cultigen (together with breadfruit, plantain and others) has a long history of successful agricultural adaptation which lowers the risk of food scarcity (as Pollock recognizes, *ibid*, p.231) to communities in the region.

As a response to a just and unfulfilled need, the author decided to develop a non-government organization (NGO) based on a model of 'progressing with the past' (Clarke, 1978), in order to satisfy the request for a restorative *vuci* canal project and to minimize land degradation through a focus on a developmental model based on sustainable livelihoods and environmental conservation. The justification was as follows. In Fiji, as in many other Pacific places, many rural communities are expanding (despite rural to urban migration) and village leaders are keen to find work for burgeoning youth populations. The prospect of refurbishing old terrace systems with secure water supplies and providing irrigation is attractive to village leaders, especially those villages with elders who remember growing irrigated taro in their own youth<sup>21</sup>. Other important factors include: the high market price of taro which provides an incentive for production, strong demand for irrigated taro corms for weddings and other ceremony (the taste of *vuci* taro is locally highly esteemed), irrigated taro is affected minimally by the taro beetle (*Papuana spp.*) pest if the corms are submerged under 5 cm of water, pesticides are not necessary and production is generally higher than rainfed cultivation and can be maintained throughout the year; all of which invokes the criteria of sustainable agricultural development.

The author has observed that gullies in the upper reaches of the Sigatoka Valley where valuable cash crops (typically *yaqona* (kava, *Piper methysticum*) and taro) grew together with agroarboricultural species were seldom burned by fire in droughts, unlike valleys without cash crops or agroarboriculture and where dominated by the introduced and invasive fire-climax *Pennisetum polystachyon* pasture. The author theorized that if similar agronomic practice was introduced at lower altitudes, aided by fences and irrigation, then some control on excessive



burning and land degradation could begin. This was the concept that suggested the renewal of traditional irrigation systems in valley locations and justified the development of the NGO *Vitokoni ni Vuci* – Friends of Sustainable Livelihoods and Environment (VNV-FOSLE), where *Vitokoni ni Vuci* means ‘friends of taro creekfields’, in Navosa dialect.

The author had observed two key things in 1998 about the extant irrigation systems. The first was that protection from ungulates was necessary, and the second was that water conveyancing needed to be robust and easy to maintain. About the first, protective fencing in Navosa is insufficient. Although three-wire fences are now fairly common, farmers’ complain that the high cost of materials is a bulwark to more secure enclosure. The existing fences mainly serve to keep free-ranging ungulate animals out, rather than keeping domestic ungulates in. In most cases the vulnerable valleys and old irrigated terraces are located at some distance from modern villages on, or adjacent to, steep land areas where free-ranging ungulates roam, thus necessitating the construction of strong fences in areas of challenging topography and where the cost of fencing is high. About the second point on water conduits, in 1998 the author observed the innovative use of polythene pipe as a gravity-fed aqueduct at an upland Navosa settlement, previously described, which allowed water to be conveyed in a reliable manner to a *vuci*, needing little maintenance and robust against the penetration of ungulate hoofs. It was an indigenous development (Maiava & King, 2007), and therefore already accepted and adapted to the agricultural system of which it was part, and thus highly suitable as a technological centrepiece together with protective fencing for development projects: an example of ‘progressing with the past’ (Clarke 1978). This model involves adapting a traditional practice to current conditions with the aid of labour-saving new technologies and is a more efficient way to develop livelihoods or attempt conservation than by using alien and poorly-adapted techniques driven by coercive politics and external control.

To date, VNV-FOSLE has completed some projects in the Navosa region in the period 2007-2012 (see Figure 3). The results of monitoring, evaluation and later assessments<sup>22</sup> indicate that projects have been most successful: (a) in communities with a purely farming mode of production, (b) where renewal of old terrace systems was undertaken, (c) where elders of the village previously practised the method in their youth, and (d) where a hereditary chief with uncompromised power supported the project. There are many hindrances: increasing evidence of social change and community fragmentation, inadequate assessments of water supply, contested village leadership, land tenure disputes, and instances of miscommunication and misunderstanding have been obstacles in addition to the logistical difficulties imposed by remote locations with difficult access and the usual set of financial and organizational problems associated with development projects.

It is hoped that the initiatives will help reinvigorate irrigated terrace agriculture in Fiji and lead to preservation of the indigenous knowledge and skills. The author has observed one case where *vuci* have been developed independently by a village farmer influenced by VNV-FOSLE project activities and it is hoped that the *vuci* learning workshops previously conducted together with the publication of *The Vuci Manual* (King, 2012b) will lead other farmers and communities to take-up and experiment with this locally-adapted method.

**FIGURE 3:** First planting of dalo (taro) in refurbished terraced vuci creekfield, Nakoro, Noikoro district, Navosa, Viti Levu, Fiji, 2012. VNV-FOSLE project. The clan chief in the lower-right, who planted this way when he was young, instructs the others. Note use of polythene pipe to reduce risk associated with the water supply, part of 'progressing with the past'. The taro beetle (*Papuana* spp.) cannot live 5 cm below water in creekfields like this and few weeds grow allowing high production despite vuci dalo taking longer to mature than rainfed dalo. This terrace, constructed on a steep slope during prehistory, has rich soil and was previously used continuously for decades with no fallow.



## CONCLUSION

The evidence suggests that the prehistoric expansion of irrigated creekfield ethnoagriculture of *Colocasia esculenta* in the Pacific Islands was an adaptation intended to account for changing environmental and social circumstances in the region. The advent of global warming-induced climate change impels us to consider a new era of environmental volatility in the Pacific. Agriculture must learn to adapt to changing environments and it is suggested that ethnoagriculture methods that were developed to enhance resilience during periods of past volatility will have a renewed importance in the future. The idea of progressing with the past, whereby the sustainable base of indigenous and local knowledge surrounding ethnoagriculture is amended with new technologies to further enhance adaptation to changed circumstances, is advised as a general strategy to develop production and more resilient livelihood systems in the Pacific Islands. The refurbishment and enhancement of disused creekfield systems minimizes risk while facilitating livelihood resilience, land conservation, agrobiodiversity and security.

Today, village populations, despite urban migration in some areas, are tending to increase across the Pacific. An important question is: will the type of agricultural development that has been practised in recent decades across many parts of the Pacific be resilient and sustainable in the future? Instead of relying on extralocal or imported ideas which frequently fail to be adopted

because of their poor adaptability in local conditions, it is suggested that we progress with the past using ethnoagriculture amended with technological refinements that reduce risk, enhance resilience and maintain sustainability.

## ENDNOTES

- <sup>1</sup> *In the refined sense of 'adjustments to reduce vulnerability' (Barnett & Campbell, 2010, p. 16).*
- <sup>2</sup> *A commonsense (or naïve realist) view would argue that there is ample documented evidence of indigenous irrigation strategies in niche communities that unequivocally indicate adaptation (e.g., see evidence in Spriggs, Addison & Matthews (2012)). Nevertheless, the question must be asked: are there alternative explanations about the origins of niche irrigation?*
- <sup>3</sup> *Alternative explanations include: attempts to gain tributary advantage and political power by being dominant in rituals involving the customary exchange of food resources, and attempts to increase gross agricultural production for financial profit.*
- <sup>4</sup> *Vure are distinct from the taro nursery beds (tanitani in Navosa) which can be observed alongside creeks and rivers (often near villages) in Fiji, especially where a dry season is manifest and before the beginning of transplanting to rainfed gardens at the start of the wet season.*
- <sup>5</sup> *Creekfield is the preferred term, instead of pondfield. Creekfield more accurately describes the need for a well-aerated water supply to grow taro (*Colocasia esculenta*) in submersed hydromorphic conditions.*
- <sup>6</sup> *An detailed list of islands with past irrigation systems is in Thaman (1984, pp. 105-106) together with references and other valuable information. Thaman, however, similar to other researchers of the time, tended to focus on the more visible larger systems and under-reported the small and scattered (often streamside) niche systems still in use in hilly or mountainous zones of the Pacific.*
- <sup>7</sup> *Perks (1980, p. 90) in Footnote 33 adds that the high extralocal demand for Fijian wage labour in the mid 20<sup>th</sup> century was also a factor. There is debate about the relative importance of labour requirements for vuci compared to rainfed cultivation. The general consensus is that extra (workgroup) labour is initially required to build the terraces and water conduits (the landesque capital) but thereafter labour requirements are less (e.g. less weeding and pest control is needed in flooded creekfields) (also see King, 2012b, p. 21) but local circumstances and techniques are variable and more research is needed.*
- <sup>8</sup> *Despite his overall focus on social-political influence in large-scale hydraulic societies, Wittfogel (1957) recognized that incipient and small-scale irrigation communities were exempt, at least initially, from these processes: he used the term 'hydroagriculture' (p. 3) to describe their innovation.*
- <sup>9</sup> *Robert Kuhlken produced an excellent video-recording featuring a local indigenous narrator with their vanua workgroup demonstrating the planting of taro in an irrigated creekfield at Ravitaki on Kadavu island of Fiji. The water source was a spring. The recording is called 'Laua ni Ravitaki: Terrace Farming in Kadavu, Fiji, 1992', University of the South Pacific, Suva.*
- <sup>10</sup> *The vuci at Natoka (690 m asl.) was maintained by the high clan (yavusa) chief himself with the help of his subclan. The vuci at Nawairabe (68 m asl.) was maintained by an elderly relative of the son of a former chief, until his passing about 2005.*
- <sup>11</sup> *Generally, there will be more suckers produced under irrigated cultivation compared to rainfed cultivation; but different cultivars vary in their production of suckers. VNV-FOSLE's experience suggests that traditional Fijian cultivars produce more suckers than the current hybrids and thus traditional cultivars are more suited to irrigated production because of their increased propagation potential – a very important agronomic factor where vegetative reproduction is necessary and local climate is limiting.*

- <sup>12</sup> Bayliss-Smith (1980) analysed several studies that researched 'wetland' taro in Hawaii and elsewhere and is worth further reading for more detail. Some of the Hawaii figures are from moderately large-scale studies reported by Plucknett and de la Pena (1971) and others.
- <sup>13</sup> Manner and Taylor (2010, p. 9) provide numerical estimates of the cultivated area of taro in various countries. I advise caution in the use of these statistics given the unreliable means of collection in many countries (Wang, 1983, p. 5). For example, in Fiji during 1998-1999, MAFF did not collect accurate production data from the hilly and difficult-to-access part of the Sigatoka watershed where I did my research, and limited their efforts to the downstream alluvial farms of the main Sigatoka Valley. There are many other factors that compromise accuracy including substantial (sometimes dominant) amounts of taro exchanged for livelihood and ceremonial purposes between community members that is not recorded because it does not go for sale to the market.
- <sup>14</sup> This stands as only a hypothesis, however, as the necessary historical and comparative research has not been done as far as I am aware.
- <sup>15</sup> Given the evidence for the prevalence of prehistoric irrigated terraces in the Navosa region, it is likely that the current elevated status of vuci taro, and its value as a social gift, is associated with its increased scarcity compared to a past abundance when vuci taro was commonplace.
- <sup>16</sup> Fijians do not traditionally build permanent 'vertical' dams, especially downstream, because of the risk of destruction in floods – a common occurrence in Fijian catchments. Instead, they build diversion weirs made from river stones, branches and other vegetation including rot-resistant ivi tree (*Inocarpus fagifer*) leaves and mud. These weirs are located at a wide, flat part of the creek and are easily reformed by a village work party after a damaging flood as long as down-cutting of the creek does not occur. Today, small irrigation dams (1-2 m from base) can be constructed in narrow creeks with the aid of modern materials (cement and piping); a common practice in providing potable water for villages. It can be noted that an invasive large tree, *Samanea saman* (originally promoted as an agroforestry tree and used for firewood), produces voluminous amounts of heavy debris that have been particularly damaging to large downstream culverts and bridges during floods of recent decades.
- <sup>17</sup> Some qualifications are needed. Iron tools were keenly adopted during contact with the first Europeans. There was a period in the early-mid 20th century when animal-drawn ploughs and other implements were introduced and adopted in areas of flat topography. However, in many upland communities today manual digging with iron spades is favoured over use of the plough because of the land-degrading slope erosion the latter causes. Various new cultigens have been adopted and add to the diversity of food crops grown today.
- <sup>18</sup> A difficulty is the lack of accurate dates to pinpoint terrace construction, as previously alluded to. Research is badly needed here.
- <sup>19</sup> Unfortunately, there are few proxy indicators to help with assessments of prehistoric climate variables for western Fiji.
- <sup>20</sup> Agricultural terraces have recently been discovered underneath previously-assumed undisturbed forest by survey research teams on the high-elevation Nadrau Plateau in Emalu territory of central Viti Levu (anonymous personal communication).
- <sup>21</sup> The time was the mid 20<sup>th</sup> century when many of the Navosa creekfield systems were retired (a post-apocalyptic time of low community populations and when taro had little market value). It coincided with the adoption of plough agriculture and new edible cash crops including cassava (*Manihot esculenta*).
- <sup>22</sup> In general, the process of monitoring and evaluation was very a discontinuous process, where data was gathered somewhat opportunistically and with less participatory monitoring than initially planned. There was a lack of funds for fully diagnostic and follow-up evaluations, partly because of the difficulty and expense of travel to remote project sites subject to the vagaries of weather and without all-year road access. A process involving adaptation to local conditions has figured highly in implementing this type of project work, and carrying-

out a conventional synchronic social and environmental impact assessment could be viewed as intrusive and disturbing given the arrangement of diachronic power-knowledge and social structure in remote Fijian villages where the local chief is also the caretaker of the vanua (land-people nexus). Instead, a less-direct indigenous Fijian 'conversational' style of evaluation and assessment with different community members was carried-out when opportunities arose. A follow-up assessment was completed recently at the author's expense. The outcome indicated a frequent demand for the construction of small dams to aid the irrigation water supply.

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