

PROBLEMS AND RESEARCH PERSPECTIVES ON THE AGRICULTURAL ENVIRONMENT IN THE TROPICAL AND SUBTROPICAL ISLANDS

CASE STUDY: Fiji*

ABSTRACT

General Background

The Republic of Fiji Islands is a small island nation with a multiracial population of 826,000 located south of the Equator, known as the hub of the South Pacific. It is surrounded by a group of over twenty neighboring small island nations, and to its south are its biggest trading partners, Australia and New Zealand. It enjoys a tropical maritime oceanic climate with an average annual rainfall of 2500 mm, distributed mainly in the warmer months from December to March and the cooler and drier months within April to September, with temperatures ranging from 15 to 31 °C. There are over 300 islands, of which 110 are inhabited. The two largest islands are Viti Levu and Vanua Levu. The main staple foods for Fijians are root crops and seafood; for Indo-Fijians, rice and curry; and a mixture of meat, seafood, rice and root crops for other races, although the dietary patterns of all ethnic groups continually change according to consumer preferences. The people of Fiji are the most cosmopolitan of all Pacific island countries, and despite many obstacles to development they are stabilized by a broad-based constitutional government comprising a bicameral parliamentary system headed by the President and governed by the Prime Minister and cabinet ministers.

Economic Performance - marginalized consideration of environmental issues

Fiji is a small island economy that faces obstacles in the development process that are not present in larger countries. It is inherently less diversified, which makes it vulnerable to both internal and external shocks. With a small population of 820,000, economies of scale are difficult to achieve in domestic markets, and investment in infrastructure is costly and often uneconomic. In addition to its problem of smallness, Fiji is relatively geographically isolated, prone to natural disasters, and operates under a land tenure system that constrains the availability of land and its productivity. But despite these constraints, the economy of Fiji, although structurally weak, has performed well in the two and half decades following her independence. However, in the face of seemingly intractable political and land tenure problems, the economy is now at a crossroads. Decisions taken now have fundamental implications for the management of the environment.

Performance of Resource-based Sectors

By the end of 1986 the economy had shown signs of growth, driven by the sugar and tourism sectors. However, after the military coup in 1987, the economy plunged, with tourist arrivals dropping and a sharp decline in sugar production. That period was also one of considerable environmental disaster as a result of widespread burning of sugarcane fields and pine plantations. There have been several encouraging economic developments over the past years, particularly in the resource-based sectors, which have had both positive and negative environmental implications. One example is the expansion of tuna exports for the

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[This paper was presented at the International Symposium organized by Okinawa sub-tropical station of the Japan International Research Center for Agricultural Sciences (JIRCAS) on March 11, 2005, Ishigaki City, Okinawa, Japan.]

sashimi markets. Taro has become Fiji's second largest agricultural export after sugar; however, the current production system, which is an offshoot of the subsistence system, relies heavily on the excessive use of herbicides. There has been significant growth in agro-processing. Fiji is now a significant exporter of fruit pur's produced by smallholders under a certified organic production system. A quarantine treatment facility is now in place that allows a range of tropical fruits and vegetables to be exported without being subjected to toxic and environmentally damaging fumigants. The importance of subsistence farming and traditional foods highlights a high degree of dependence on the environment for a sustained livelihood.

Management of Arable Land

Fiji is geographically isolated and carries out agriculture under a land tenure system that constrains the availability of land and its productivity. Due to these economic circumstances, Fiji has been negatively influenced and dominated by political factors; however, this has been sufficiently cushioned by adopting a broadly acceptable constitution aimed at achieving national unity and nationbuilding. This has effectively changed the political environment and removed one of the long-standing impediments to investment and economic growth. If it can be done for the constitution, a similar broadly acceptable resolution will be found to the other outstanding issue - the management of agricultural land leases and its productivity.

Sugarcane Monocrop Performance

The 1970s was a period of remarkable growth that was driven by the expansion of the sugar and tourism industries. During that decade, sugar production grew by 40%. Because of the inherent smallholder structure of the sugar industry, expansion was accompanied by high rates of new employment and high net additions to foreign exchange earnings. However, in the 1980s, the inherent fragility of the Fiji sugar industry became apparent as growth in the sugar industry began to falter following a series of natural disasters and low world prices. The economy plunged, with low tourist arrivals and declining sugar production. Due to this economic crisis, Government policy shifted from import substitution and self-sufficiency to export-led growth with special emphasis on agricultural diversification and private sector-led participation as a means and strategy for economic recovery.

Performance of Non-Sugar Agriculture

Despite the poor showing of economic indicators, such as growth, employment, and investment, Fiji, like many Pacific island economies, has hidden strengths in the value of its traditional subsistence and traded food crops. The contribution of these commodities to GDP is similar to that of sugar, an average of 40% of total agricultural GDP at current prices. Levels of imports to Fiji are still comparatively low, suggesting that domestic food supply has been able to expand with increases in demand from the growing urban population. The importance of subsistence and traditional foods highlights the degree of dependence among the population on the environment for a sustained livelihood and income.

Agricultural Productivity Perspectives

In small island nations, the scope for improving agricultural output by means of existing technologies and resources is still a challenge; however, there are limits to what can be achieved. Environmental considerations are also limiting rapid agricultural expansion, since further reductions in the area of land for pasture and forests are unacceptable in many countries, including Fiji. The development of technologies will be one of the key factors necessary to obtain substantial increases in food production required to feed the expanding populations of developing countries. The major challenge in agricultural research and development is to improve agricultural productivity within the scope of limited available resources. The application of new technologies to export commodities will improve their competitive strengths in the international marketplace.

INTRODUCTION

There are a little over twenty small island nations in the Pacific region. They are physically characterized by the relative smallness of their land area, isolation and remoteness of their locations and geographical distribution. Most of these developing island nations have gained independence and political sovereignty of government after decades of colonial rule. They include Fiji, Papua New Guinea, Samoa, Tonga, Vanuatu (formerly the New Hebrides), the Solomon Islands, Kiribati, the Cook Islands, New Caledonia, Wallis and Futuna, the Marshal Islands, Guam, French Polynesia, the Federated States of Micronesia, Northern Marianas, American Samoa, Nauru, Palau, Tokelau, and Tuvalu. They are surrounded by neighboring countries to the south, Australia and New Zealand, and to the north, the Asian countries. The east and the west are completely covered with the vast Pacific ocean, the largest ocean mass in the world.

2.0 CASE STUDY: FIJI

Geographically, Fiji is located between 15° to 22° latitude south and 177° to 174° longitude east. It is about 3,160 km north-east of Sydney, Australia, 2,120 km north of Auckland, New Zealand, and 8,000 km south-southeast of Japan (8.5 hours' flying time). Fiji is comprised of a group of 332 islands of which 110 islands are inhabited. Total land area is 18,333 sq. km, covering a total sea area of 1.3 million sq. km. The two largest islands are Vitilevu, with a land area of 10,429 sq. km, and Vanua Levu, with 5,526 sq. km.

Fiji has a tropical maritime oceanic climate, an eastern seaboard wet zone and a western seaboard dry zone prevailing on the two main islands with an average annual rainfall of 3,000 mm and 1,800 mm, respectively, and there is an intermediate zone prevailing on all the islands. The average annual temperatures range from 15 °C to 32 °C, and there are no distinct differences between the summer and winter seasons. However, rainfall is distributed into two main seasons: the wet, warm and humid season falls within November to April, and the dry and cool season falls within May to October.

Historically, Fiji became a British crown colony in 1874, gained independence as a dominion in 1970 and gradually became the sovereign Republic of the Fiji Islands in 1987, after one hundred and thirteen years of political and economic development. Originally, the first inhabitants of Fiji were indigenous people who had their own independent political system of government that had been based on a traditional aristocracy and chief system for thousands of years. Even today, this indigenous form of leadership and Government is deeply integrated in the constitution of Fiji.

Partly as a result of British colonization, Fiji has now become the most cosmopolitan of all the Pacific island nations, with a population of a little over 826,000 (2002) and an ethnic composition comprising indigenous Fijians (51%), Indo-Fijians (43%), and other races (6%). The indigenous people are a mixture of Melanesian and Polynesian features and descent; other races comprise of a mixture of Chinese, Europeans, part-Europeans, Rotumans and other Pacific Islanders. The Indo-Fijians first arrived in Fiji in 1880 from India as indentured labourers and traders to work in the sugar industry under the colonial regime and administration.

The main languages that are currently spoken in Fiji are Fijian, Hindustani (Hindi), and English. These languages are studied in the school system as compulsory subjects, and English is the official medium of communication in all the Government systems, although there are other languages which are offered as optional subjects in the educational system. There are altogether fourteen provinces in Fiji; each province has its own dialect which is derived from many district sub-dialects. They are all written using the English alphabet.

The Fijian culture, customs and traditions are the pride of the indigenous people and they are enriched with life-enhancing qualities such as friendliness, respect for others, hospitality, a very strong and resilient way of life, the traditional leadership system, and religious and social obligations. Despite the trend towards

individualism, economic status and globalization, communalism is still strong and intact in Fijian society and they take pride in that identity. The people of Fiji practice four major religions: Christianity (50%) with many denominations, Hinduism (40%), Islam (8%), and Buddhism and others (2%).

Fiji has a wealth of untapped land and marine resources. These natural resources are administered through Government and traditional laws and rulings. Fijian-owned native land comprises 83% of total land in Fiji, with 10% freehold land and 7% crown land. Approximately 16% is arable land.

Fiji has a bicameral parliamentary system consisting of an upper house, the Senate, with 34 non-elected members, and a lower house, the House of Representatives, which has 71 members who are elected every five years. The Prime Minister is the head of Government and the President is the Head of State.

RESOURCE-BASED SECTORS AND FIJI'S ECONOMY

Resource-based sectors contribute significantly to the overall growth of the national economy and are still the major source of livelihood for the people of Fiji. In 1999, the Asian Development Bank reviewed the Fijian economy and reported that the resource-based sector contributed 70% to total exports and comprised 30% of national GDP. This sector includes industries such as sugar, subsistence crop commodities, livestock, forest and timber, marine and fisheries, and minerals.

These industries utilize natural resources to produce, process, and market the various ranges of products overseas and to local markets. These natural resources, if managed at a sustainable level without eroding the environment, and if supplied a supporting infrastructure and institutional framework, can contribute substantially to increased growth. However, these resource-based industries, which are inevitably vulnerable to climatic changes and volatile international market prices, will continue to be the mainstay of Fiji's economy for the foreseeable future.

The overall Government policy for the sector is to provide support and incentives in promoting market-oriented competitiveness with the following strategies:

- agricultural diversification into high-value traditional crop commodities with niche markets and less reliance on sugar as the main export;
- enhancing the quality and consistency of production;
- safeguarding Fiji's freedom from pests and diseases through effective quarantine management;
- ensuring the protection of a clean environment;
- improving export market access;
- assisting the transformation of subsistence to commercial agriculture;
- improving technological progress in research, extension and industries;
- improving agricultural extension services;
- ensuring public investment in infrastructure, industries and farming businesses; and
- privatization of public enterprises.

Resource owners are faced with several generic problems which are currently under Government consideration to facilitate their participation. These problems, which generally led to the erosion of interests towards resource-based development, are:

- a lack of basic infrastructure in rural areas that contributes to low agricultural productivity; there are few farm roads, and electricity, cold storage facilities, telecommunications, marketing centers, and transportation are lacking;
- remoteness from commercial centers results in long hours of transportation, high overhead costs and deterioration of the quality of produce;
- supportive services provided to resource owners are generally ineffective;
- ineffective land use and management frameworks;

low agricultural productivity;
 an unfavourable land tenure system;
 over-reliance on the sugar cane monocrop system;
 poor agricultural project management;
 subsistence agriculture;
 poor farm management practices.

MANAGEMENT OF ARABLE LAND

The government recognizes that agricultural land use has been poorly managed for many years by both owners and tenants, and is committed to supporting policies for the sustainable management of these natural resources. This requires the enforcement of a sound land use framework for agricultural purposes and also the participation of resource owners and all stakeholders. The total land area of Fiji is 18,253 sq. km, is distributed over 320 small islands; 83% is native-communally owned land, and about 16% is regarded as arable land that is suitable for intensive agriculture. The distribution of land by tenure is presented in Table 2.10.

Table 2.10: Distribution of land in Fiji by tenure (1993)

Tenure Type	% Total Area
Native-owned land	82.39
State-owned Land	9.24
Freehold Land	8.12
Rotuman-owned land	0.25
Total	100
Total Land Area	4,519,875 acres or 1,829,909 hectares

Source: Ministry of Agriculture, Sugar and Land Resettlement, Fiji.

Numerous studies have reported that there is a general lack of applicability of the current land tenure system to sustained economic development. This is most pertinent in the sugar industry, where about 60% of native-owned land is leased for sugar cane production and is at risk of losing its economic base if these land leases are not renewed. In 2001, there were 668,068 hectares of native land leased to some 28,702 tenants, of which 89% was accounted for by agricultural leases that generated an annual rental income of F\$17.8 million (US\$ 10.5 m). The distribution of native leases is presented in Table 10.11.

Table 2.11: Distribution of native lease in Fiji (2001)

Lease Type	No. of Tenants	% Count	Area Leased (ha)	% Area Leased	% Rental	Rent Rate F\$/ha (US\$)
Agricultural	14,454	50.4	596,112	89.2	51.9	15.51 (9.15)
Commercial	1,337	4.7	27,613	4.1	18.5	119.11 (70.27)
Industrial	338	1.2	3,071	0.5	4.6	266.90 (157.47)
Other	1,607	5.6	31,673	4.7	8.1	45.46 (26.82)
Residential	10,966	38.2	9,597	1.4	16.9	313.41 (184.91)
Total	28,702	100.0	668,067	100.0	100.0	26.64 (15.71)

Source: Baseline Survey, Native Land Trust Board, Fiji.

The highest number of land leases are located in the western and northern parts of the two main islands of Fiji (Viti Levu and Vanua Levu), where sugar cane is grown. This is shown in Table 2.12.

Table 2.12: Distribution of land lease in Fiji by region (2001)

Division	No. of Leases	% Count	Area Leased (ha)	% Area	% Rental
Western	13,271	46.2	193,369	28.9	56.6
Northern	7,625	26.6	326,071	48.8	25.5
Central	7,411	25.4	144,062	21.6	17.4
Eastern	395	1.4	4,565	0.7	1.0
Total	28,702	100.0	668,067	100.0	100.0

Source: Baseline Survey, Native Land Trust Board, Fiji.

The Native Land Trust Board (NLTB) and the Ministry of Agriculture, Sugar and Land Resettlement (MASLR) are responsible for the administration and management of native land resources. There is very little participation by the resource owners. In 1999, the Government proposed the concept of a Land Use Commission in an attempt to improve the productivity of land and its sustainable management. This was perceived by resource owners as an attempt to dispossess them of their land ownership rights. The NLTB therefore has been empowered to perform these additional functions.

- promote native land development to productive use;
- establish an effective land-use framework;
- identify new land for commercial development;
- consolidate networking of information; and
- develop native land structures and incentives for development;
- ensure the protection and sustainability of environment.

SUGAR CANE MONOCROP CULTURE

Sugar is the principal export commodity, and generated the highest foreign exchange earnings for Fiji for over 100 years. The Government is committed to ensuring that the sugar industry maintains economic viability and sustainability, given its economic and historical significance in Fiji. It is equally important, therefore, that resource owners continue to participate in the development process.

Sugar production is important to the industry, since it contributes some 7% of GDP, generates about 22% of total domestic exports, accounts for 8.5% of total foreign exchange earnings, and provides direct and indirect employment to 41,000 people, including 21,000 growers, 3,000 employees of the Fiji Sugar Corporation (FSC), and 17,000 cane cutters and truck drivers.

The sugar industry is currently facing a period of crisis that could seriously impact the nation's macroeconomic and social stability. Production costs are high, the four sugar mills are running inefficiently, crop yields are low, and the FSC is insolvent, requiring a massive injection of investment to continue in operation. In addition, the industry lacks incentives to improve production efficiency, the smallholder farms operate at subsistence levels, and there is a high turnover of farmers due to expiry of land leases. The industry is currently undergoing a major restructuring process to reduce its size and production costs to adapt itself to the pending loss of preferential prices. Production over the last decade is presented in Table 2.13 by quantity and value.

Table 2.13: Sugar cane production in Fiji (1992-2001)

Year	Tonnes (million)	Value (F\$Million) (US\$)	Rate (\$/tonne) (US\$)
1992	3.53	194.3 (114.7)	55.0 (32.45)
1993	3.70	182.0 (107.4)	49.2 (29.03)
1994	4.06	207.2 (122.3)	51.0 (30.09)
1995	4.11	221.0 (130.4)	53.8 (31.74)
1996	4.38	196.3 (115.8)	44.9 (26.49)
1997	3.28	164.3 (96.9)	50.0 (29.5)
1998	2.10	165.7 (97.8)	79.0 (46.61)
1999	3.96	200.9 (118.6)	50.8 (29.97)
2000	3.79	159.0 (93.8)	42.0 (24.78)
2001	2.81	120.7 (71.3)	43.1 (25.42)

Source: Baseline Survey, Fiji Sugar Corporation, Fiji.

The Ministry of Agriculture, Sugar and Land Resettlement and FSC manage the farming assistance scheme, production and resettlement of evicted sugar cane farmers in an effort to sustain annual production at 3 million tonnes of cane.

The average size of smallholder cane farms is 4.6 ha, and all farming operations are done manually, with only some semi-mechanised. Agricultural inputs are provided on a loan basis and then deducted from the harvest proceeds. There are extension and research stations located in the cane belts that are respectively involved in providing advisory services and technology development. Production operations which are carried out by farmers include cane growing, harvesting, transportation of harvested cane to mills and subsistence cropping, while milling operations are carried out exclusively by the FSC-owned mills.

NON-SUGAR AGRICULTURE

The agriculture sector accounts for 43% of foreign exchange earnings. It provides 50% of the country's total employment and contributes 19% to national GDP. Fiji has only 16% of its total land area as arable land, of which 24% is under sugar cane, 23% coconuts and the remaining 53% under subsistence agriculture. There has been an improvement in sugar cane crop yields and cane quality through the effective use of fertilizers, improved varieties and favourable climate.

The coconut industry in Fiji is worth \$20 million, and around 40,000 households rely on coconut farming as their livelihood and source of income. There are 65,000 ha of coconuts growing in Fiji, of which about 60% are senile and produce low nut yields. About 15,000 tonnes of copra were produced in 1999, but production has declined to 8,000 tonnes in 2003. The Government has implemented a coconut rehabilitation programme to replant with high-yielding hybrids produced from the Taveuni Coconut Seedgarden with an average copra yield of 3 tonnes/ha as compared to the traditional Fiji Tall variety of less than 0.5 tonnes/ha.

The contribution of non-sugar agricultural commodities to GDP has remained unchanged at 8% over the past decades and is composed of a range of commodities. However, this subsistence sector plays a pivotal role in the economy and is regarded as the hidden strength of Fiji's agriculture. This conclusion is justified because of the large amounts of food surplus in the rural areas and the fact that rural communities can live off their land.

The latest programme in this sector in revitalizing agriculture was the Commodity Development Framework (CDF) which was designed with noble objectives to increase export earnings and rural employment and had mixed success. Many similar projects and schemes with development and research initiatives have been undertaken in the past decades but they have not performed according to expectations. These projects include rice, cocoa, banana, pineapple, citrus, beef, and horticultural crops. The details of this programme are presented in Table 2. 14.

Table 2.14: Performance of non-sugar crop commodities (1997)

Commodities	Area (ha)	Tonnes	Yield t/ha	Price F\$/t (US\$)	Return F\$ ('000) (US\$)
Coconut	1,176	588	1.0	3,000 (1,770)	1,764 (1,040.5)
Copra	7,517	11,276	2.0	390 (230.10)	4,398 (2,458.5)
Taro	8,216	23,350	10.0	1,100 (649)	25,2985 (15,154)
Tropical Fruits	29	4,764	14.0	1,500 (885)	7,251 (4,278)
Immature ginger	54	1,082	20.0	400 (236)	433 (255.5)
Mature ginger	50	1,601	32	700 (413)	1,121 (661.2)
Vegetables	2,533	21,132	8.0	1,000 (590)	2,113 (1,246.6)
Yaqona (kava)	1,263	3,310	3.0	25,000 (14,750)	82,750 (48,822)
Total	15,390	67,173		3,190 (1,882.2)	125,514 (74,053)

Source: Ministry of Agriculture, Sugar and Land Resettlement, Fiji.

There are, however, some success stories from the CDF period, and these include the vegetable growers of the Sigatoka valley, taro farmers in Taveuni, yaqona growers in the outlying islands, and women's involvement in selling agricultural produce in the local markets.

The future potential is with products where Fiji has a competitive advantage, such as in high-value niche exports and traditional food production. Products that give the best returns on labour and land resources include traditional food crops, fresh fruits, processed fruits, processed nuts, cut flowers, vegetables, spices, herbs and medicinal plants, handcrafted raw materials and certified organic products.

Ginger

Ginger has proved to be the most successful diversification crop to date. It has a high labour absorption capacity and contributes significantly to value added output. Ginger production has declined in recent years due to pests and diseases such as nematodes and fusarium wilt. Additionally, the lack of healthy planting materials is constraining the cultivation of good ginger crops. Prolonged wet weather early in the year affected planting. Ginger production is mostly concentrated in the central division, but has slowly extended to the northern, western and eastern divisions. The industry is coordinated by the Fiji Ginger Council as an example of private sector-led growth where all matters of production, processing and marketing can be handled by the Council.

Taro and Kava

Root crops such as taro, yams, cassava, and kava exports have increased over the years and there is potential for expansion into lucrative markets provided that consistency of quality supply is sustained and standardized for specific markets. The kava trade restrictions by some European countries and USA are having certain adverse results on Pacific Island producers and exporters. Taro exports have increased to some 23,000 tonnes in 1997 in Fiji; this is a result of the decline of the Samoan taro industry due to damage caused by *Phytophthora* leaf blight which is not present in Fiji.

Fruits and Vegetables

Tropical fruit exports such as pawpaw, mango and pineapple have increased rapidly over the past decade and have attracted the attention of the Government and private sector for rigorous promotion. Fruit processing such as banana, mango and guava purees for exports have also been successful.

Rice

Rice production has declined over the years due to low productivity and the high cost of production. The Government has deregulated the industry and allowed the import of cheaper rice overseas to meet the consumer demand for about 60,000 tonnes annually, of which about 20% is produced locally. The

Government is committed to improving production and marketing efficiency.

Copra and Coconut Oil

The coconut industry is one of the oldest industries in Fiji and has suffered a number of production and marketing constraints. The Government has embarked on a vigorous breeding programme to improve crop yields, control of rhinoceros beetle, alleviation of poverty and promoting diversification away from the coconut-based farming system. Recently, the Government has approved the privatization of the coconut industry to encourage greater participation by the private sector and to facilitate the development of value-added products. Copra production has declined dramatically as a result of low farm gate prices, low crop yields, senility, and devastation by natural disasters such as cyclones and drought. Coconut oil has attracted export markets for biofuel production. This would require further research and steady coconut production.

LIVESTOCK INDUSTRIES

Fiji has developed five major livestock industries. They include dairy, beef, poultry, pigs, and sheep. Dairy production in Fiji is presented in Table 2.15.

Table 2.15: Dairy production in Fiji (1990-1999)

	Unit	1990	91	92	93	94	95	96	97	98	99
Cream	TMFE	126	119	125	88	133	29	16.2	15	18	4.1
Ghee	TMFE	70	70	70	70	70	70	70	70	65	55
Milk	Tonnes	523	578	589	527	619	548	575	575	607	523
Price	F\$/L	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.37
Value	F\$m	13.5	13.2	13.3	12.8	14.3	4.95	5.2	12.9	13.0	14.3
Cons	TMFE	3618	4056	4974	3329	4968	6190	4725	4830	3643	3405
Self Suff	%	41	38	31	45	40	27	45	37	43	35
Farms		453	508	519	457	549	478	506	193	193	198

Source: Baseline Survey, Ministry of Agriculture, Sugar and Land Resettlement

Notes: 1 litre of milk = 0.413 kg milkfat equivalent

The dairy industry has been protected over the past two decades with tariff controls and subsidies on production materials; only recently has deregulation been enforced. Dairy production suffered prolonged dry weather in 2003, and this El Niño phenomenon appears to be showing a strengthening annual pattern.

The Beef Industry

The beef industry has gradually improved in production over the last decade and has also faced some constraints related to poor pasture, old stock, traditional breeds with low conception rates, climate variations, natural disasters, and poor management of farms. The Government has encouraged foreign investment in Fiji's beef and dairy industries and downstream processing.

The Pork Industry

The pork industry in Fiji is almost self-sufficient. Genetic diversity is very small and most breeds are exotic and introduced to Fiji. Production costs are high due to the high cost of imported feeds. Breeding for new stock has been very limited due to insufficient building of research institutions and little development on the part of the industry. There is potential for processing for exports and the tourism industry, but this has not attracted private sector investment due to lack of promotion.

The Poultry Industry

Fiji is 80% self-sufficient in poultry with additional imports to meet consumption demand. The main products are chicken meat and eggs. The long-term objective is self-sufficiency in all aspects of poultry production and a progressive reduction of imports. The broiler industry continues to be the foremost locally-produced meat. Feed costs are high, accounting for about 70% of the cost of production, and this is attributed to insufficient quantities of locally-produced raw materials. Most of the grains used for feed processing are imported.

The Mutton Industry

The mutton industry, which is in an early stage of development and commercialisation, comprised 206 farms with a total stock of 4,700 sheep in 1999, representing an increase of 18% in farm numbers and 38% in total stock and total mutton production of about 40 tonnes over the previous year. Imports increased to 11,000 tonnes over the same period, indicating an increase in consumer demand and consumption. Production breeds were imported and introduced to Fiji and a 'Fiji Fantastic' breed was proved to adapt well, promising good meat production yields.

2.15 CONSTRAINTS ON AGRICULTURAL PRODUCTIVITY

Agricultural production has up to now been heavily reliant on imported inputs such as machinery, fuel, chemicals, fertilizers, seeds, fencing materials, etc. The use and cost of these inputs are not compatible with the prevailing subsistence system of production, and this has resulted in low productivity and inconsistency of quality supply.

Agricultural productivity in small island nations has unique and dominant features that include substantial uncertainty due to weather and pests, sequential biological stages of production, temporal allocation of inputs among those stages, limited output predictability in the intermediate stages of production, great flexibility in output mix of land and technology allocation, substantial heterogeneity in farms and farmers, and fragmented technology progress and adoption.

The greatest problem facing these small island nations is whether their unique features have been adequately taken into consideration and analysed, and the choice of methodologies to address these problems because the potential for meaningful answers is largely limited by the choice of methodology; and the availability of data to analyse these chosen problems with chosen methodologies. Although public data availability is largely controlled by policymakers, agricultural researchers and economists can both influence the process and generate data directly through their own projects and surveys.

2.15.1 Agricultural Production Economics

One failure is that agricultural economists apply the methodology of general economics without adapting to these unique features of agricultural production. They have failed to fulfil opportunities to uncover knowledge about agricultural production and develop principles that guide choices of professional directions.

The economics of agricultural production in small island countries is one discipline which needs to focus its studies on the identification of the features of agricultural production that are different from other production systems and develop methodologies to effectively utilize appropriate data. The study of production in agriculture includes supply and demand as well as the study of technology, behavioral change, policy analysis, technical change and the environment. In each of these applications, knowledge of the technology alone is of little use without the knowledge of the behavioural preferences that translate technology into supply and demand. Unfortunately, in reality, agricultural production research has not been

able to effectively reach agreement on the basic concepts of producer behaviour with profit maximization and diversification. This also raises the issue of whether the research findings and literature have been allowed to contribute sufficiently to agricultural knowledge.

Agricultural production has its own biological realities, which are composed of time lags and sequential stages of growth, during which adjustments can be made to evolving crop conditions. Growing seasons are largely determined by climate, meaning that all farmers' crops are typically in the same stage of production at the same time. The resulting annual concentration of production contributes to price risk, because all of a farm's proceeds of a particular crop are concentrated in a small season in which supply outstrips demand and uncertainties prevail about demands over the following cropping season. Furthermore, because a crop is typically harvested at the same stage of production, farmers are vulnerable to a single extreme weather event or pest outbreak that can cause severe crop losses. Because of the annual seasonality of most agricultural production, economists have been largely content to work with production data aggregated temporarily on an annual basis. It is therefore meaningful to focus agricultural production research at the farm level rather than to demonstrate points and methodologies with aggregate data simply because they are available.

Agricultural Research - Methodology, Progress and Output

Agricultural research in Fiji has been chiefly influenced by regular changes in Government policies which have short-term objectives and by the climate, which largely affects the methodologies of research adopted and progress in technology; this has resulted in the diversion of research roles, erosion of technical data, and low technological progress and output.

Data availability is perhaps the biggest constraint, and prospects for improving public data availability in a comprehensive way are currently too slim to permit evolution and additive research in a continuous and on-going process of agricultural development. Non-government organizations offer possibilities of avoiding bureaucratic control of the research process and autonomy of management. Developing a comprehensive panel dataset is a huge task, considering the size of our professional institutions, but public funds should be provided with some assistance from external and private donor organizations.

Problems and research perspectives have been largely influenced by data availability. As a result, most research programmes have de-emphasized the long-term solutions for farmers' problems and their wellbeing, and behavioural departures from profit maximization are unlikely to be discovered. Relatively little research has focused on farm failures, restructuring of the agriculture sector, or the underlying issues of agricultural investment and resource management.

Data availability, problem focus and research methodology are highly interactive inputs determining overall quality of production research; and the generation of these inputs has tended to lack serious responses from current political concerns. As a result, the effort to build a comprehensive and institutional database framework will have to overcome some of the current thinking on agricultural research and breaking the molds of the present frameworks that have dominated the policymakers' thoughts over the last decades.

Need for Agricultural Researchers

The need for a clearly defined crop research programme stems from the major efforts being made in international and regional research organizations and in many other national research institutions. The results and, in some instances materials, from these global efforts are available to Fiji and may reduce the amount or change the nature of research work needed in Fiji. To effectively use them, however, requires well-trained and experienced researchers who have a thorough knowledge of the national situation and can also interpret the results of external research in the light of national needs. This is not an easy task, and calls for experienced staff and the availability of scientific equipment to process data.

Despite the availability of knowledge and materials from external sources, testing for location specificity in Fiji can only be done *in situ*, even though good approximations may be possible on the basis

of world information. For this reason, the research service should be strong enough and have enough senior researchers to fill both roles. The first task, interpretation of the world knowledge base, may be time-consuming, but it is efficient use of time if done well; generally it would need good communication support and travel funds. The second task, generation of locally-adapted technologies, requires the normal complement of research support staff and services. To do both parts effectively requires a larger complement of senior research staff and better facilities and funding than are currently provided. To be able to carry out these tasks effectively requires a continuous but evolving process, which needs qualified and experienced researchers for its effective implementation and whose contribution is fully recognized. The real strength of a research institution resides in the capacity of its staff, who need many years of experience to attain their full potential usefulness.

Staff distribution in the research division by discipline is presented in Table 2.16. and crop research programme distribution by discipline is presented in Table 2.17.

Table 2.16: Distribution of crop research staff in Fiji by discipline (2004)

Post	Discipline / Sections						Total	Filled	Vacant
	Agronomy	Plant Protection	Horticulture	Chemistry	Farm Services	Administration			
Director						1	1	1	
PRO	1	1	1	1			4	3	
SRO	5	3	3	3	1		15	6	
Engineer	1						1	1	
RO	2	1	1	1	1		6	0	
TO	3	2	2	1			8	2	
STA	8	5	5	5	1		24	20	
Total	20	12	12	11	3	1	59	33	26
AO						1	1	1	
AAO						1	1	1	
CO						10	10	10	
Total						12	12	12	
Unest	100	20	10	10	20	10	160	160	
Total	120	32	22	21	23	23	231	205	26

Source: Ministry of Agriculture, Sugar and Land Resettlement, Fiji.

Table 2.17: Distribution of crop research programmes in Fiji by discipline (2004)

Agronomy	Plant protection	Horticulture	Chemistry
Plant biodiversity	Fruitfly moth	Vegetables	Forensic analysis
Tissue culture	Taro beetle	Tropical fruits	Soil and plant analysis
Coconut seedgarden	Rhinoceros beetle	Foundation seeds	Feed analysis
Farm mechanisation	Kava dieback	Indigenous fruits	Food technology
Foundation seeds	Pest risk Analysis	Indigenous vegetables	Postharvest technology
Root crops	Mango weevil	Postharvest technology	Pesticide residue analysis
Wetland taro	Ginger rot	Pesticide registration	
Seed testing	Fruit sucking moth		
Postharvest technology	Postharvest technology		

Source: Ministry of Agriculture, Sugar and Land Resettlement, Fiji.

2.15.3 Research Perspectives on Traditional Exports

Production is considered under four major categories as emphasized in the national agricultural strategic plan:

- traditional exports (excluding sugar);
- crops and livestock to replace current imports;
- crops (excluding coconut) for existing export markets; and
- crops currently consumed locally but having potential for export.

Research must contribute to increased yields at low input costs to improve the competitive strengths of each commodity in the export market. It must therefore select specific ecological areas to effect high production at low cost and risk. Land tenure problems may limit crops grown in suitable areas and therefore increase the research burden and costs to address problems posed by growing crops in less favoured areas.

Traditional exports: coconut products

Coconuts represent a major food item and foreign exchange earner. Production is declining, and world prices for coconut oil as a bulk edible oil are not such as to encourage intensive replanting in an industry in which a substantial proportion comprises senile palms of low productivity.

Crops and livestock to replace imports

These include rice, vegetables (potatoes, onions, garlic), pulses, coffee, and maize, together with a smaller range of smaller group items. There are three livestock items: beef, dairy products, and mutton; there are nine separate items in this list, including feeds. The value of each item is not large enough to warrant a separate multi-disciplinary effort in research; yet each item requires research input as an integral part of the production package.

For rice, substantial support in the form of technological information and improved germplasm can be obtained from IRRI and other external rice research institutions. Processed meats are the next most important item. There is good potential for Fiji to produce good quality meat, provided high production efficiency is achieved. Increases in dairy production are feasible, although research is needed on feeding and management. Major advances have been seen in vegetable production and postharvest technologies for exports. There appears to be little research on root crop processing, even though there have been significant advances in crop germplasm improvement.

Crops (other than coconuts) for existing exports

This area is dominated by considerations of quality, consistency of supply and price, so that planned production at realistic cost is essential. At present there is a substantial market for ginger, fresh and processed, a modest and partially protected market for cocoa, and a small but exploitable market for mangoes, pawpaws, and pineapples. The ginger industry is facing a severe problem of losses in production, storage and transit. Vigorous and early research is needed to investigate the causes of the losses and devise control measures. Cocoa production is low but improved cultivars and practices are available for testing.

(d) Crops consumed mainly locally with export potential

Crops in this group are mainly tropical and sub-tropical fruits, root crops and indigenous vegetables. The main problem in developing these crops for export is the different nature of production at the subsistence level, packaging, and marketing requirements compared with the local market standards. Export markets in all of these are highly competitive, both in price and quality, and this is compounded by the problem of inconsistency of supply and volume. In the long term, the efficiency of the production process and improved post-harvest practices will be important factors in maintaining and increasing exports.

2.15.4 Research and Extension Linkages

Fiji, like many developing island nations, faces problems in communicating new techniques of crops and livestock production to farmers and other stakeholders. The problems arise from the absence of strong links between the research scientists, extensionists, agricultural economists and quarantine. This problem has been partly addressed by setting up a training and information section. However, this unit, located as it is at the headquarters of the Ministry of Agriculture, Sugar and Land Resettlement, is not in direct contact with the research scientists and is thus not able to harness scientific information for dissemination to the farmers and other stakeholders. It is important to establish an appropriate technology transfer unit in the research secretariat to process scientific information, monitor technology progress and act as the focal point for dissemination of technological information to all stakeholders.

2.15.5 Quarantine and Trade Facilitation

Fiji is a member of the World Trade Organisation (WTO) and recognizes its trade requirements with mixed challenges and opportunities under various agreements and conventions. In particular, Fiji has recognized the application of sanitation and phytosanitary (SPS) measures of the WTO in the promotion of agricultural trade in meeting both export and import targets, and the safe movements of plants and animals as required in the United Nations Food and Agriculture Organisation International Convention on protection of plants and animals. Fiji recognizes that its plant and animal quarantine legislation and procedures need to be updated in line with improvements in its institutional capacity to meet these international trade requirements. This has been partly addressed by setting up a quarantine unit with its secretariat located in Suva and three other stations in Nadi, Lautoka and Sigatoka. However, this unit is not able to harness scientific and trade information effectively for dissemination to stakeholders and policy directions.

The need for a clearly defined quarantine and trade facilitation programme stems from the major efforts being made in the international and regional organizations and in many other national institutions. The results and, in some instances materials, from these global efforts are available to Fiji and may reduce the amounts or change the nature of quarantine work needed in Fiji. To effectively use them, however, requires well-trained and experienced quarantine staff who have a thorough knowledge of the national situation and can also interpret the results of external quarantine in the light of national needs. This is not an easy task and calls for experienced staff and availability of scientific equipment to process data.

3.0 RECOMMENDATIONS FOR FUTURE PERSPECTIVES

Fiji, like many small island nations, is faced with unique problems that are different from those of larger countries. Despite these obstacles which have contributed to its weak and less diversified economic base and structure, it has performed well since its independence gained in 1970. Fiji has now taken the opportunity to diversify its economy from sugar and to rapidly develop its resource-based sector which has up to now marginalized environmental concerns. Therefore, the following recommendations should be considered for future development perspectives.

- assessment of the effects of resource-based sectors on environment degradation, particularly with respect to soil, water, and plant and animal genetic resources;
- assessment of resource-based productivity and efficiency of production in light of national needs;
- technology monitoring and transfer research unit as the focal point for technological progress;
- quarantine and trade research unit as a focal point for quarantine and trade information and dissemination;

training of researchers, quarantine, extensionists and agricultural economists on small island agriculture; networking of international, national and farming communities on information sharing and data processing through an institutionalized non-government framework.

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