Farm Productivity, Efficiency and Profitability in Fiji's Sugar Industry

Mahendra Reddy

Abstract

Fiji's agricultural sector, and within it, the sugar industry, has been the driving force behind the country's development. The sugar industry, however, is facing a number of challenges of which production efficiency is one of them. This paper examines farm productivity, efficiency and profitability in the industry. It suggests that without improving farm level efficiency and productivity the industry may not survive in a world free market for sugar.

Introduction

The agriculture sector of Fiji has played a very important role in the development process of the country. The importance of this sector can be explained both in terms of the standard development economic theories and by utilising empirical data.

The two important commercial agricultural crops in Fiji developed since political independence have been sugar and rice. Following the 1990's deregulation of the rice industry, domestic rice production declined sharply. A large number of rice farmers have moved into alternative ventures. The sugar sector, on the other hand, is quite unique. It is primarily an export commodity whose export earnings depend to a large extent on the preferential prices from trading arrangements. The prospect of the loss of access to higher priced markets as a result of the changes to the world trading

environment is looming large. Furthermore, at the domestic level, a large number of farmers are facing expiring land leases. A permanent solution to this has yet to be found.

It has been often stated by stakeholders and the government that without the preferential prices the industry would collapse as incomes derived by farmers and millers would be insufficient to sustain the industry. Since one key aspect of the industry is the viability of cane farms, this paper examines the productivity, efficiency and profitability in the industry.

Sugar and the Economy

Sugar is produced in 110 countries in the world. Fiji and Papua New Guinea are the two countries in the Pacific that produce sugar. Papua New Guinea is a small sugar producer, which began sugar production in 1982 producing around 45,000-50,000 tons each year. Fiji has relatively larger production base with annual sugar production up to 400,000 tons.

The industry in Fiji was first established in the late nineteenth century when Fiji was a British colony. In 1973, the Fiji government purchased the company thus assuming full control of the industry. It now owns and operates four sugar mills which purchase all sugar cane produced under contract from farmers. It has the potential to behave like a monopsonist. But the farmers are also well-organised and have a strong voice and impact on sugar industry decisions. The prices that the farmers face are determined on the basis of an agreed formula between the miller and the farmers.

The sugar industry contributes approximately 7% of GDP, brings in 22% of the total export earnings and 8.5% of total foreign exchange earnings, and provides employment to around 41,000 people consisting of 21,000 growers, 3,000 Fiji Sugar Corporation (FSC) employees and 17,000 cutters and drivers (Ministry of National Planning, 2002). The important contribution of the industry to the economy results from the preferential treatment it gets in the export market. The preferential treatment is through price support which Fiji is getting from the European Union (EU) under the Cotonou Agreement, and previously, under the Lome Agreements.

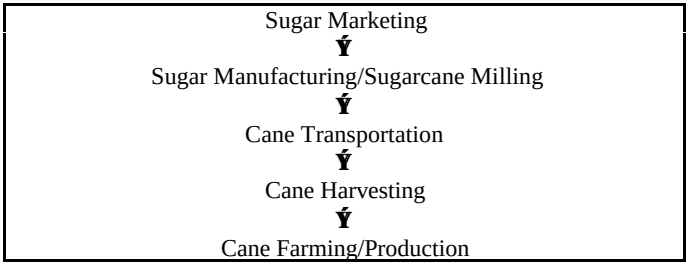
World Sugar Market and Preferential Agreements

The initial support for Fiji's Sugar Industry emanated from the Commonwealth Sugar Agreement (CSA) of 1950. The CSA was a preferential agreement between the United Kingdom and the Commonwealth countries in which UK guaranteed to purchase specified quantities of sugar for a negotiated price. The Sugar Protocol came into force in 1975 and was enshrined in Protocol 3 of the Lome Convention. Article 25 of the Lome Convention states that the European Community undertook 'to purchase and import at guaranteed prices, specific quantities of cane sugar, raw or white, which, originate in the ACP states and which these states undertake to deliver to it'. The prices are to be negotiated annually between ACP and European Union. Fiji has a quota of 165,348 tons of sugar, which is approximately 40% of Fiji's total sugar production.

It is now widely believed that due to the European Union's review of the Sugar Protocol of the Lome/Cotonou Agreements arising out of its undertaking to WTO, Fiji may eventually lose access to the higher priced preferential EU market. In the absence of any such preferential market, Fiji will have to sell all its produce in the lower priced world free market. In such an eventuality, the economic viability of the industry will depend on its ability to increase productivity by an amount sufficient to offset the negative output price effect on farm profit.

Productivity can be increased either by introducing new and better technologies at all levels of production that can reduce cost for the same level of production or by increasing efficiency at various levels of production in the industry. The various levels within the industry, which are vertically integrated, are depicted in figure 1.

Figure 1: Vertical Integration of Fiji's Sugar Industry



It is not within the scope of this paper to examine the efficiency and productivity status of Fiji's sugar industry at all the levels; instead this paper examines the farm level position only.

Farm Production and Productivity

Over the last two decades neither has the production of sugar cane improved, nor that of raw sugar. In fact, since the peak sugar production of 517,000 tonnes in 1994, production has fluctuated but has generally been on a downward trend; in 2001 production reached a low of 298,000 tonnes. Table 1 shows the trends in these two variables. The declining trend of sugarcane production can be attributed to low productivity and the gradual decline in land area under sugarcane cultivation.

Table 1: Sugarcane Production and Sugar Manufactured, 1983-2001

Year	Cane Crushed (000 tonnes)	Sugar Produced (000 tonnes)	Cane/Sugar	Partial Productivity*
1981	3360	396	8.48	27.1
1982	3931	470	8.37	26.7
1983	4075	487	8.37	16.9
1984	2202	276	7.98	29.2
1985	4290	480	8.94	19.5
1986	3042	341	8.19	26.6
1987	4109	502	7.38	20.2
1988	2960	401	8.78	22.7
1989	3185	363	8.90	26.4
1990	4099	461	9.84	26.2
1991	4016	408	8.69	21.2
1992	3380	389	8.28	22.1
1993	3704	442	8.38	22.7
1994	4064	517	7.87	24.8
1995	4110	454	9.04	25.3
1996	4380	462	9.65	26.9
1997	3279	354	9.44	20.3
1998	2098	259	8.21	16.7
1999	3958	383	10.5	27.9
2000	3786	348	10.8	25.7
2001	2824	298	9.47	19.2

* Partial productivity refers to output per acre of land.

(Source: Sugar Cane Research Centre Annual Reports, 1982-2001).

Fiji's sugarcane partial productivity is well below that of some of the other sugar producers. Table 2 shows the trends in partial productivity in selected sugar producing areas. It shows that in Hawaii productivity per acre is approximately four times than what it is in Fiji, though the Hawaii crop was a two-year crop. In Hawaii, sugar plantations have closed, primarily due to changes in trading arrangements and increasing production costs. This then raises some serious questions on the ability of Fiji's sugar industry to survive with such low productivity, in a changing global market.

Table 2: Sugarcane Partial Productivity Comparison for Selected Countries

Country	Partial Productivity (Tons/acre)	Productivity Differential (Fiji-Country X)	Tonnes of Cane/Ton of Sugar
Fiji (1997-01)	19.6	--	9.6
Mauritius (1997-98)	31.9	12.3	9.2
Queensland (1999/2001)	35.4	15.8	13.9
Hawaii (1997-99)*	43.8	24.2	7.9
Lousiana State, USA (1999)	31.3	11.7	11.0

* Hawaii had a two-year crop and the partial productivity is 87.6 tons/acre. The figure presented in the table is for one year crop for comparison purposes.

(Source: Mauritius Sugar Industry Research Institute (1998: 70); Bureau of Sugar Experimental Station (2001: 79); Hawaii Sugar Planters Association (2000: 140); Louisiana State University Agricultural Centre (2001: 203))

Factors Affecting Productivity Change

Over the last two decades, numerous high yielding, disease resistant crop varieties specific to a particular soil regime have been introduced into the industry. It was anticipated that an increasing trend in productivity would be observed. Instead, productivity in the industry has been stagnant. From basic primary and secondary data of the industry, the effects of various factors that may cause such productivity trend can be identified. Some of the key factors are land quality, ethnic production differential, ratoon age, cane quality and land tenure system.

Land Quality vs Productivity

In 1970, 15,542 farms were in operation. By 1993, the number peaked to 23,454. A large proportion of the increase in the number of farms was due to the development of the World Bank funded Seaqaqa sugar project. The general fertility of the average sugar cane land in Seaqaqa has been lower than the fertility in the older cane growing areas. In addition, responding to the better cane price which farmers began to get after the government took over the sugar milling operations, farmers tended to use progressively marginal land for production. The higher price of sugar, well above the world free market price, has attracted marginal land into sugarcane production (Grynberg, 1995).

Grynberg (1995) suggested a two-tier pricing system to overcorrect what he considered was the problem of the use of marginal land. Under this system, each farmer would get two quotas for supplying cane, one quota for the higher priced EU market and the other for the lower priced free market supply. The potential advantage under these systems is that farmers may plant and supply cane only for a quota equivalent to the higher priced EU market. They may then compare the returns from sugar using the free market price with returns from one or more competing crops. If the competing crop return were significantly higher than sugar returns, then the competing crop would be cultivated. This could lead to crop diversification, which stabilises fluctuations in farm net returns and also minimises risks from natural disasters, as well as utilisation of marginal land for other suitable crops rather than sugarcane farming.

The disadvantages under this system, however, are that the overall sugar export earnings could decline as farmers reduced total area under sugarcane by possibly shifting to other crops and restricting cane production for the high priced quota only; and second, that some farmers may sell their high priced quotas to other farmers in the area to make quick cash while retaining their lower priced quotas. This could go to counter the government's objective of attracting indigenous farmers into the industry. Thus, while the market could resolve the issue of who should remain in the industry, it may not help to foster a key social objective of the government, that being to increase ethnic Fijian participation in sugar cane industry.

Ethnicity and Productivity Differentials

Productivity differences between the two major ethnic groups are quite evident in Fiji's sugar industry. The sugar industry at the farm level comprises 25% ethnic Fijian farmers and 75% ethnic Indian farmers. The lack of participation by the indigenous population in the sugar industry has long been a concern to the government. This concern received further attention from policy makers when it was known that the indigenous farmers displayed a marked difference in productivity relative to the Indian farmers. Table 3 shows the results from primary and secondary data on productivity disparities.

Table 3: Productivity Differentials, Ethnic Indian and Ethnic Fijian Sugarcane Growers

Year	Sample size	Ethnic Indian (tonnes/acre)	Ethnic Fijian (tonnes/acre)	Differential (tonnes/acre)
1985*	2596	20.36	17.55	2.81
1986	2596	24.69	19.05	5.64
1987	2609	20.45	17.28	3.17
1988	2609	19.39	16.80	2.59
1989	2645	22.82	17.90	4.92
1996**	397	24.36	18.82	5.54

* *Data is from Fiji Sugar Corporation Research Centre Annual Report, 1989*
** *Data is from farm level survey conducted in Jan/Feb, 1997 (Reddy, 1998).*

Productivity differentials between the two ethnic groups have largely been due to differences in input the two ethnic groups utilise in production. Ethnic Fijian farmers, relative to the Indo-Fijian farmers, have demonstrated significantly lower input use, in particular labour, fertilizer, weedicide, and machinery (Reddy, 1998). These are very crucial inputs in cane output. Lower input use will certainly save costs. However, input use lower then the optimal mix will reduce productivity.

The inability of ethnic Fijian farmer to raise their productivity significantly will further reduce average farm productivity as more ethnic Fijians enter into sugarcane production while ethnic Indian farmers move out as their leases expire and as they lose confidence in the industry.

Ratoon Length vs. Productivity

Sugarcane crop is a unique crop in terms of cultivation. It is propagated vegetatively by planting sections of the stalk known as seed cane. Once the first crop, called plant cane, is harvested, the plant will grow back from the portion of the stalk left under the ground. The subsequent crops are known as ratoon crops. The age of ratoon has an inverse relationship with crop yield. Table 4 shows the yield for different crop age

Table 4: Crop Age and Crop Yield (tons/acre)

Year	New Crop	1st Year Ratoon	2nd Year Ratoon	Other Ratoons
1994	26.5	24.3	--	--
1995	27.2	25.7	22.9	20.8
1996	32.5	30.1	27.0	24.9
1997	--	--	--	--
1998	20.5	19.1	--	15.9
1999	30.9	29.6	--	29.0
2000	--	--	--	--
2001	24.0	21.9	20.0	17.9
Average 1994-01	27.0	25.2	23.3	21.7

-- Data is not available

(Source: Fiji Sugar Corporation Research Centre Annual Report, 1994-2001)

Over the last twenty five-years, as Table 5 shows, the percent of total area under new crop has been declining.

The declining proportion of land planted with new crop is a testimony to uncertainty created by the non-resolution of the land leasing matter. Given the inverse relationship between crop yield and ratoon age, the declining area of newly planted crop will imply a declining trend in productivity.

Table 5: Percent of New Crop, 1996/2001

Year	New Crop
1966/70	24
1971/75	24
1976/80	25
1981/85	22
1986/90	17
1991/95	15
1996/00	9
2001	5

(Source: FSC Research Centre Annual Reports, various years

Land Tenure and Farm Productivity

Lack of well-defined property rights is a major problem that is plaguing the sugar industry. In the sugar industry, approximately 73% of sugarcane farmers are cultivating land leased from landowners, through the Native Lands Trust Board. The leases on these lands were for a period of 30 years. The first batch of leases on these lands began expiring in 1997. Table 6 shows the cane lease situation in the country. To date, a significant number of leases have not been renewed.

Table 6: Status of Expired Leases, 1997-01

Year	Expired Sugar-cane Leases	Leases Renewed		Not Renewed
		Renewed to Existing Tenants	Issued to New Tenants	
1997	72	36	31	5
1998	157	45	107	5
1999	1073	350	511	212
2000	1708	311	469	928
2001	313	141	14	158
2002	457	na	na	na
Total*	3323	883	1132	1308

* Total is up to 2001 only. (Source: Native Land Trust Board, 2002)

Literature on land tenure shows that as land's income potential increases, the incidence of land disputes and land grabbing, and thus tenure insecurity, increases (see Clark, 1969; Baron, 1978; Tanabe, 1978; Tomosugi, 1980; Kemp, 1981; Feeny, 1982 and Gavin and Fafchamps, 1996). This seems also to be the reason for the call by the landowners in Fiji to have their land revert back to them. This call, amid the approaching expiry date of land leases, has created a great deal of insecurity and risk within the farming community in Fiji.

The insecurity and risk with regard to land leases has led to falling confidence in the industry. This has depressed farm investments, which has had a significant negative impact on farm productivity. The impact of insecurity and risk arising out of property rights is not specific to Fiji (see Feder, 1987 and Salas *et al.*, 1970). Ownership insecurity impacts farm productivity via its impact on the supply of investment capital available to farmers.

The impact of ownership insecurity on investment has been widely studied. Among these studies are Salas *et al.*, (1970); Villamizar, (1984); Bruce and Migot-Adholla, (1994); Atwood, (1990); Barrows and Roth, (1990); Green, (1987); Kille and Lyne, (1993) and Feder and Onchan, (1987). These studies suggest that land title can stimulate investment by means of collateral (or credit supply) effect. By turning land into a mortgageable, transferable commodity, farmers can use it as collateral to access credit needed for productivity-enhancing investments. This is the case with agricultural land under the Agricultural Landlords and Tenants Act (ALTA) in Fiji. However, in Fiji, the uncertainty with regard to the renewal of land leases has halted all major investments in the industry. Significant investments will not be made unless a permanent solution is put in place that would provide security to the interests of all parties concerned. With lack of investment in the industry, in particular at the farm level, it will have a direct negative implication on productivity. This arises not only from a fall in the supply of productivity-enhancing investments, but also due to a decline in the area under new crop and reduced farm improvements such as drainage and irrigation, and soil conservation practices.

Apart from the direct effect of falling investment (arising from insecurity of tenure) on land productivity, there are a number of indirect effects as well. The insecurity also leads rural to urban migration, which is a growing concern in developing countries. Fiji is no exception to this trend. During the 30-year period 1966-1996, the urban population in Fiji increased by 13%; a major cause of this was rural-urban migration (Reddy, *et. al.* 2003). The refusal to renew leases has not left much option to these farmers but to move to urban squatter areas in search of unskilled work. This movement out of the agricultural sector results in a major drain of skilled cane farmers and workers from the industry. This has a significant impact on farm productivity.

The younger generation moving into cane farming is relatively less committed to the industry. It moves into this industry either due to a lack of any alternative or to use it as a stepping stone to some other employment. The lack of commitment in the industry stems from a lack of long-term tenure security to which the new entrants could peg their future.

Tenure security emerges from a lease that is long enough to raise confidence of tenants to make productivity enhancing investments. It

should provide ways in which the tenant can reap the benefit of his/her investment without fear of losing it. The existing legislation, the Agricultural Landlords Tenants Act (ALTA) has been quite successful in doing this. However, the landowners feel that this legislation does not provide security to their property, or that it provides a good return to them. Therefore, they have proposed the Native Lands Trust Act (NLTA), as an alternative to ALTA. The two legislations have substantial differences with respect to security to tenants and landowners; Appendix 1 lists the differences between the two. The inability of the two parties to come to an agreement has had substantial negative impact on cane production, landowners rental income, foreign reserve and national income. The resulting non-renewal of leases have also resulted in increased poverty and associated social problems.

Cane Harvesting and Burning

There are two key problems encountered during the harvesting season, one being the shortage of cane harvesters and the other being the rush towards the end of the season to harvest all crop. A shortage of harvesters has led to increases in sugarcane harvesting costs. Some of the important reasons for shortage of cane harvesters are:

- More and more students are obtaining formal education in pursuit of white and blue collar jobs, leading to a lower number of entrants to the unskilled agricultural labour market;
- Cane harvesting is a seasonal job, thus jobs in the non-agricultural sector get better priority;
- Low incomes, averaging $1,500 per season, from cane harvesting, and
- Cane harvesters on some days are under-utilised due to lack of harvesting quotas, leading to a pay which is lower than the potential pay.

The rush to harvest all crop by individual farmers is due to a harvesting deadline set by the sugar mills which send panic signals. Rational farmers aim to get their entire crop harvested before the end of the season to avoid losses and wet weather. One way this could be possible is to jump the queue. The most prominent way in which farmers jump the queue is by burning their cane. Therefore, the rush to

harvest crop due by the set deadline leads to the problem of crop burning. Since the issue of cane being left standing on the field is only felt during the latter part of the season, burning also accelerates during the latter part of the season. The high supply of burnt cane has become a major concern in the industry. In the 1970s, burnt cane approximated 10% of the total cane crushed. It continued to increase gradually; in 1998 it peaked to a record level of 58%. The FSC argues that burnt cane supply in such magnitude could result in millions of dollars of loss. This is through reduction in crushing rates, increase in season's length extending to the wet season (thus incurring additional harvesting and transportation costs), loss of sugar in burning process that could otherwise have been manufactured, and additional costs associated with the use of chemicals in the manufacturing process.

Farmers lose directly in two ways; first, from extension of the crushing period into the wet season and, second, from the loss in sugar content from burning. Harvesting in the wet season results in additional costs borne by the farmers to transport cane from their farms. There is no credible estimate of the total revenue lost by the industry; nor is there any analysis of whether it is burnt cane which is the cause of the loss, or the inability of the mills to process burnt cane in an efficient manner. What is known is that the percentage of burnt cane being delivered has been rising; Table 7 shows the trend in burnt cane delivered for the period 1971-2001.

Table 7: Percent of Total cane Burnt, 1971-2001

Year	% of Total Cane Supplied as Burnt for Crushing
1971-75	14.8
1976-80	16.8
1981-85	18.3
1986-90	19.8
1991-95	36.5
1996-00	45.5
2001	42.9

Source: Fiji Sugar Cane Research Centre Annual Reports, 1971-2002

The burnt cane issue has not been systematically and impassionately addressed in Fiji. According to farmers, the reasons for them burning their crops are shortages of cane trucks and/or cane harvesting

quotas, limited capacity of the mill to crush cane during peak weather periods, and harvesting deadlines which provide signals to the growers that their crop might be left on farm to rot. A better milling capacity, and a more professional organisation of the industry would see a significant reduction in cane burning, and therefore, an increase in cane and sugar output.

Inefficiency at the Farm Level

The factors identified above lead to increased cost per unit of output and lower output per unit of land area, which leads to increased economic inefficiency. Econometric modelling to measure efficiency was stimulated by the seminal paper of Farrell (1957) who drew upon the work of Debreu (1951) and Koopmans (1951) to define a simple measure of firm efficiency, which could account for multiple inputs. Farrell's proposal explained that the efficiency of a firm was composed of two components: technical efficiency and allocative efficiency, which, when combined, is called economic efficiency. Technical efficiency refers to the ability of a firm to maximize output for a given level of input, while allocative efficiency refers to the firm's ability to make optimal allocation of the inputs given input prices. Estimation of the level of economic inefficiency can allow decision making units (firms/farms) to have an idea of the potential gain in productivity should this inefficiency be alleviated. Reddy (1998), utilising the stochastic frontier production function approach, estimated the level of technical efficiency to be at 85.3% and allocative efficiency at 48.2% in Fiji's sugar cane farms. These show that there are vast spaces for efficiency gains to be made. The root cause of suboptimal resource use, which results in declining productivity and increasing inefficiency, should be tackled if these inefficiency levels are to be converted into efficiency gains.

Farm Profitability and Farm Income

Profit per ton amongst Fiji's sugarcane farmers is quite marginal. Table 8 shows that sugarcane farmers make a profit of $13.14 a tonne. Based on a ten-acre farm, with a total production of 22 tonnes per acre, the total net income per year of an average farmer is $2,891. This

income is well below the poverty line income of $7000[1]. The farmers survive by substituting family labour for hired labour wherever possible, as well as by engaging in off-farm employment.

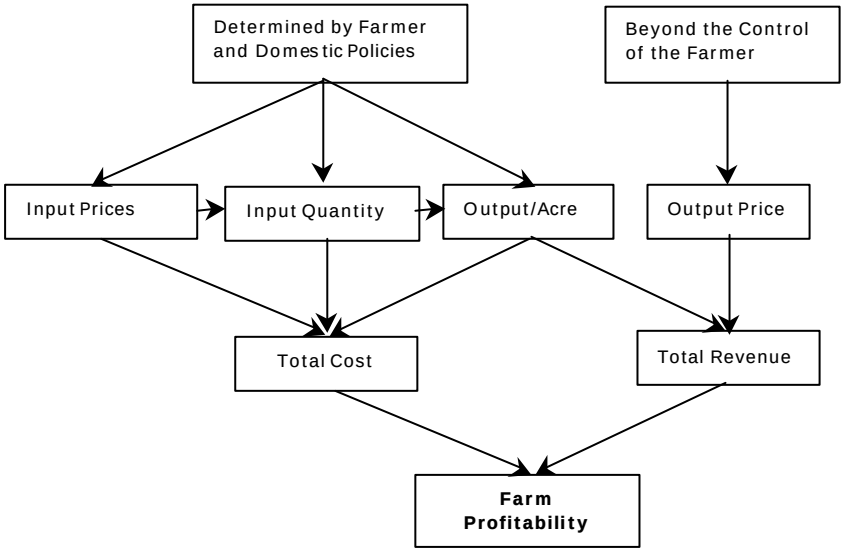
Table 8: Sugarcane Net Return Per Acre

Variable	F$
Gross Value (Price per ton)	51.14
Cost/acre ($25 farm production cost plus ($13/ton harvesting and transportation costs	38.00
Net return (Per ton)	13.14

Note: Cost/acre includes cost of all variable inputs as discussed in Reddy (1998). Price/ton is the average price paid to growers from 1995-2002. The 1998 price was not included in this calculation as it was an out-lier due to a drought where all sugar was sold in the preferential market.

Farm profitability can be affected by production cost changes or total revenue changes. Figure 2 shows the determinants of farm profitability.

Figure 2: Determinants of Farm Profitability



[1] See Asian Development Bank (2003: 67) for poverty line data.

The profit margin can be further squeezed if production costs rise, productivity declines or output prices fall. It is quite likely that the price subsidy Fiji receives will be gradually phased out. In such circumstances, farmers can raise farm profit if they manage the factors within their control as shown in Figure 2. These include raising farm efficiency and productivity, and reducing costs by using optimal levels of inputs.

Summary and Conclusions

The sugar industry has reached a critical stage where it has to make a number of crucial decisions in order to survive amid rising costs of production and falling output prices. Trade theories suggest that a country ought to produce and export those commodities which make intensive use of the factor(s) which are most abundant. The three most intensively used factors are capital, land and labour. The sugar industry is making losses and suffering serious capital shallowing; leased land is no longer abundantly available for use, while labour is moving out of the industry. The relative abundance of these factors were either artificially created decades ago or have been artificially eroded due to political agitation. Not only we have problems on this front, but also the output market is no longer as favourable as it used to be. While Fiji still enjoys price subsidies, it must respond now by working on factors that are within its control and raise farming (as well as milling) efficiency and productivity if it is to survive competition in the international market. Farmers must allocate resources optimally to ensure maximum profit whilst input suppliers, landowners in particular, must ensure that their resources are put to the best use for maximum returns.

Farm level efficiency can be raised if confidence is realised for better farm management practices and resource utilisation. Political instability and land tenure insecurity have affected both farm management practices as well as industry resource utilisation. While negotiations ought to continue at the international level to extend the expiry date of preferential prices further into the future, stakeholders must make every effort to address those factors which are within their control. A failure to do this may very well see the collapse of the industry in not too distant a future.

Appendix 1: Differences between ALTA and NLTA

Terms and Conditions	ALTA	NLTA
Lease Tenure	Minimum of 30 years	Not fixed
Basis of Rent Fixation	6 percent of Unimproved Capital Value (UCV)	No formula proposed
Renewability	Non renewable	Subject to NLTB's consent
At expiry-compensation	To be payable by landowners if capital improvements approved by NLTB	Payable by Government
Choice of land utilisation	Tenant's choice	Stipulated in NLTA
Subletting/Sharecropping	Illegal	Permissible, with NLTB consent
Settlement of Disputes	By Agricultural Tribunal	By an independent arbitration.

Source: Lal, Lim-Applegate and M. Reddy (2001: 18-24)

References

ADB (2003) 'Assessment of Hardship and Poverty: Strategies for equitable growth and hardship alleviation', Asian Development Bank.

Atwood, D.A. (1990) 'Land Registration in Africa: The Impact on Agricultural Production'. *World Development* 18(5): 659-71.

Baron, D. (1978) *Land Reform in Sub-Saharan Africa: An Annotated Bibliography.* Washington D.C.: Office of Rural Development, U.S. Agency for International Development.

Barrows, R., and M. Roth (1990) 'Land Tenure and Investment in African Agriculture: Theory and Evidence'. *Journal of Modern African Studies* 28(2): 265-97.

Bruce, J.W., and S.E. Migot-Adolla (1994) *Searching for Land Tenure Security in Africa: Review.* Dubuque IA: Kendall-Hunt Publishing Company.

Clark, R.J. (1969) *Problems and Conflicts Over Land Ownership in Bolivia.* Land Tenure Center, Reprint No. 54-55, University of Wisconsin, Madison, Wisconsin: University of Wisconsin.

Davies, J. (1998) 'The Causes and Consequences of Cane Burning in Fiji's Sugar Belt'. *The Journal of Pacific Studies* 22(1&2): 5-12.

Debreu, G. (1951) 'The Coefficient of Resource Utilization'. *Econometrica* 19(2): 273-292.

Farrell, M.J. (1957) 'The Measurement of Productive Efficiency'. *Journal of the Royal Statistical Society* 120(2): 11-290.

Feder, G. and T. Onchan (1987) 'Land Ownership Security and Farm Investment'. *American Journal of Agricultural Economics.* 69(2):311-320.

Feeny, D. (1982) *The Political Economy of Productivity: Thai Agricultural Development 1880-1975.* Vancouver: University of British Columbia Press.

Gavin, S and M. Fafchamps (1996) 'Land Tenure and Allocative Efficiency in Niger'. *American Journal of Agricultural Economics* 78(2): 460-471.

Green, J.K. (1987) 'Evaluating the Impact of Consolidating Holdings, Individualization of Tenure, and Registration of Title: Lessons from Kenya'. Land Tenure Center Paper # 129, University of Wisconsin, Madison.

Grynberg, R. (1995) 'The Impact of the Sugar Protocol of the Lome Convention on the Fiji Economy'. Economic Division Working Paper, Canberra: Research

School of Pacific and Asian Studies, Australian National University.
Hawaii Sugar Planters' Association (2000). *Hawaiian Sugar Manual,* Hawaii Sugar Planters' Association.
Kemp, J. (1981) 'Legal and Informal Land Tenures in Thailand'. *Modern Asian Studies* 15(1): 1-23.
Kille, G.S., and M. C. Lyne (1993) 'Property Rights to Land, On-Farm Investment and Farm Productivity: A Study of KwaZulu, South Africa'. Mimeo. University of Natal, Pietermaritzberg: South Africa.
Koopmans, T.C. (1951) 'An Analysis of Production as an Efficient Combination of Activities', in T.C. Koopmans, Ed., *Activity analysis of production and allocation,* Cowles Commission for Research in Economics, Monograph No. 13, New York: Wiley.
Lal, P, H. Lim-Applegate and M. Reddy (2001) 'Land tenure dilemma in Fiji—can Fijian landowners and Indo-Fijian tenants have their cake and eat it too?' *Pacific Economic Bulletin* 16(2): 18-24.
Louisiana State University Agricultural Centre (2001) Economic Research in Sugarcane in 1999. Lousiania State University Agricultural Centre.
Mauritius Sugar Industry Research Institute (1998) *Mauritius Sugar Industry Research Institute Annual Report, 1998* Mauritius Sugar Industry Research Centre.
Ministry of National Planning (2002) 'Rebuilding Confidence for Stability and Growth for a Peaceful, Prosperous Fiji: Strategic Development Plan: 2003-2005'. Parliament Paper No. 72 of 2002.
Queensland Bureau of Sugar Experimental Station (2001) *Annual Report 1999/2000.* Queensland Bureau of Sugar Experimental Station
Reddy, M. (1998). 'Production Economic Analysis of Fiji's Sugar Industry'. Unpublished Ph.D Dissertation, Department of Agricultural and Resource Economics, University of Hawaii.
Reddy, M., V. Naidu and M. Mohanty (2003) 'The Urban Informal Sector in Fiji: Results from a Survey.' *Fijian Studies*, 1(1):127-154.
Salas, O., F. Knight and C. Saenz (1970*) Land Titling in Costa Rica: A Legal and Economic Survey,* San Jose: University of Costa Rica Law School.
Tanabe, S. (1978) 'Land Reclamation in the Chao Phraya Delta'. in Y. Ishii (ed), *Thailand: A Rice Growing Society* (trans. By P. Hawkes and S.Hawakes), Honolulu: University Press of Hawaii, pp. 171-91.
Tomosugi, T. (1980) *A Structural Analysis of Thai Economic History: A Case Study of a Northern Chao Phraya Delta Village* Tokyo: Institute for Developing Economies.
Villamizar, F. (1984) 'IBD Financing in Land Administration Programs'. Paper presented at the International Workshop on Land Tenure Administration, Salvador, Brazil, August 22-24.

Mahendra Reddy is Senior Lecturer in Development Economics, Development Studies Program, Pacific Institute of Advanced Studies in Development and Governance, University of the South Pacific. email: reddy_m@usp.ac.fj