

The Economic and Nutritional Importance of Household Food Production in Papua New Guinea

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Abstract

Nationally representative household consumption data from 1996 are used to form estimates of the aggregate value and per capita quantity of production for 19 major foods and of the consumption of 36 major foods. The consumption estimates are disaggregated into rural and urban sectors and are also reported in terms of the share that each food has in aggregate calorie availability. Some of the major results are that the total quantity of sweet potato production is three times higher than for the next highest food, while its consumption value is approximately twice as high as for any other food item. The aggregate value of household food production was approximately K1.3 billion in 1996, which appears to be considerably larger than the estimate made by the National Accounts. In total, locally produced foods appear to provide 80 percent of available calories.

Acknowledgements:

The data used in this paper were originally collected as part of a World Bank poverty assessment for Papua New Guinea, for which financial support from the governments of Australia (TF-032753), Japan (TF-029460), and New Zealand (TF-033936) is gratefully acknowledged. All views in this paper are those of the author and should not be attributed to the World Bank.

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Introduction

Food planners and agricultural scientists in Papua New Guinea have to allocate a small research budget over a wide range of crops and farming systems. Although they may wish to set priorities with the goal of poverty alleviation in mind,² the reality is that they cannot even use the aggregate economic or nutritional importance of each food crop as a criteria for decision-making due to a lack of data on food production and consumption in Papua New Guinea. Such prioritising is probably needed, because the existing (albeit, dated) evidence is that there is little relationship between the economic importance of crops and the research done on them. For example, Shaw (1985) reports that with the exception of sweet potato the number of field trials on various food crops was almost in inverse proportion to their economic importance in Papua New Guinea. Instead of concentrating on the traditional staples (bananas, root crops and sago), most field trials were for cereals and exotic vegetables.

The tendency to understate the potential of root crops when setting agricultural research priorities is not restricted to Papua New Guinea. Previous international projections of food demand have predicted large shifts away from the root and tuber crops, and this may have made planners unduly pessimistic about the future demand for these crops. The traditional food crops may also be less attractive candidates for research by private seed companies, because it may be difficult to capture royalties from breeding plants with vegetative propagation. But the most recent studies suggest that roots and tubers may become somewhat more important in the future, relative to other food and feed crops (Scott *et al.*, 2000). These revised projections of the future importance of root crops are partly due to better international data on production and consumption.

In addition to a lack of data on the importance of each food crop, Papua New Guinea also suffers from a lack of data on the aggregate size of the food production sector within the national economy. The national accounts of PNG, from which the commonly reported Gross Domestic Product figure originates, include a non-market component for the agriculture, forestry and fishing sector. However, this figure is almost entirely notional and is updated in some extrapolative fashion each year. According to the national accounts reports, the output of smallholders is estimated on the basis of export statistics (i.e., for the treecrop industries) and on estimates of the consumption of domestically produced foodstuffs. However, until recently, there have been no large scale surveys of food consumption, so it is difficult to believe that the national accounts estimates of smallholder output are a realistic guide to economic activity in the rural sector (outside of the treecrops sub-sector). Other estimates of total PNG food production, such as from the FAO *Production Yearbook*, are also likely to be unreliable because they appear to be extrapolations from the 1961-62 Survey of Indigenous Agriculture, which used only a one per cent sample and had standard errors of over 25 per cent (Allen, 1987).

In this paper data from a nationally representative household consumption survey of Papua New Guinea in 1996 are used to report production estimates for 19 major foods and consumption estimates for 36 major foods or food groups. These consumption estimates are reported in terms of aggregate values and per capita quantities and are also disaggregated into rural and urban sectors. The share of each of these foods in aggregate calorie availability is also reported.

² See, for example, Byerlee (2000) for a discussion of incorporating poverty alleviation into research priority setting methods in national agricultural research systems.

Data and Methods

Data used in this paper come from the 1996 Papua New Guinea Household Survey (PNGHS), a nation-wide consumption survey conducted as part of a World Bank poverty assessment. The survey covered a random sample of 1200 households, residing in 73 rural and 47 urban Census Units, selected from the 1990 Census sample frame, stratifying by sector (urban and rural), by environmental conditions (elevation and rainfall), and by the level of agricultural development.³ Weights adjust for the difference in sampling rates between sectors, the variation between the Census estimates of the size of each cluster and the actual size found in 1996 and the deviation of the actual number of households surveyed in each cluster from the target number. The results reported are estimated from the 1144 households who had complete information on their consumption, with 830 of these households in the rural sector and 314 in the urban sector. All results below take account of the clustered, weighted and stratified nature of the sample.

The survey interviewed households at least twice, with the start of the consumption recall period signalled by the first interview. The average length of time between interviews was almost two weeks and the recall covered all food (36 categories) and other frequent expenses (20 categories), including items such as firewood that are produced or gathered by households. The reported expenditures include the imputed value of own-production, net gifts received, and food stock changes, so they should be a comprehensive monetary measure of consumption.⁴

In addition to estimating the value of food produced and consumed, the survey also recorded and measured food production quantities, with respondents given the choice of several different units for these reports. At the start of the survey respondents were given an empty 25 kg rice bag, with three graduations ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$) marked on the outside, and were asked to put their garden produce into it during the recall period. This was the recommended unit for bulky crops. The other units were “bunches and heaps”; “kilograms”; and “singles”, which were recommended for items like coconut, betelnut, and livestock. Average conversion factors for kilograms per “rice bag” and “single” unit were calculated on the basis of repeated weighing in different villages and are reported in Table 1. The coefficient of variation in the observed kilograms per rice bag was approximately 0.3, and in kilograms per “single” often exceeded 0.5. Hence, there will be considerable random error surrounding the estimate of food production quantities for any individual household, but these errors should cancel out in the aggregate. The conversion of “bunches and heaps” into kilograms was more difficult because of the non-specific nature of this unit, so cross-checks were made by using the median values reported by other respondents in the same Census Unit to convert values into quantities – this procedure mainly applied to bananas, aibika, and “other greens, vegetables and nuts”.

³ Data from the survey and all survey documentation are freely available on the internet, at: www.worldbank.org/lsmc/country/png/pnghome.html.

⁴ The imputed values of food production were based on the opinions of the survey respondents (i.e., the food producers) but the aggregate results are roughly the same if these respondent-reported values are replaced by Census Unit average market prices (Gibson and Rozelle, 1998).

Table 1: Conversion Factors Used for Measuring Food Production and Nutrient Availability

	Kilograms per		Calories/kg	Edible fraction
	25 kg rice bag	Single		
Sweet potato	19	0.45	1144	0.84
Cassava	16	0.7	1295	0.87
Taro and Chinese Taro	16	0.6	1117	0.84
Yams	16	0.7	1140	0.81
English potato	20	0.1	750	0.80
Bananas	12	0.16	1165	0.65
Sago	30	n.a.	3313	1.00
Sugar cane	20	2.5	678	1.00
Other fresh fruit	12	0.8	433	0.83
Coconuts	18	1.3	3837	0.65
Peanuts	8	0.01	5516	0.69
Aibika	4	0.06	350	0.50
Other greens, vegetables, nuts	10	0.4	521	0.74
Rice	20	n.a.	3830	1.00
Lamb and mutton	15	20	3780	0.84
Chicken	15	1.5	2040	0.72
Pork	15	30	3290	0.84
Other meat (incl. bush meat)	15	3.0	1604	0.80
Fish (fresh, dried, shellfish)	15	0.5	1398	0.74
Eggs	15	0.06	1470	0.89
Betel nut	19	0.03	1100	0.40

Source: Gibson and Rozelle (1998)

Data on the quantities of food purchased, gifted, and consumed out of stocks was also obtained. In conjunction with the data on consumption from own-production, these food quantities were converted into nutrient availabilities using the Pacific Islands Food Composition Database and estimates of the edible fraction for each food (see Table 1). One item where food quantities were not available was cooked meals eaten out of the home; calories from this source were derived as the average “price” each household paid for all other calories plus a 50 percent premium to reflect processing margins.

Results

The dominance of sweet potato in local food production is evident from Table 2. The quantity of sweet potato production is three times higher than the next highest food, bananas, and it is also the most valuable food crop. The other important foods in terms of quantity are taro and Chinese taro,⁵ coconut, sugar cane, yams, cassava, and the residual category of vegetables. In terms of value, pig production was second to sweet potato, followed by bananas, taro and Chinese taro, and betelnut. The aggregate value of food production was approximately K1.3 billion (standard

⁵ These items were, unfortunately, combined as one on the food recall item list used by the survey.

error of K114 million). If the value of firewood and tobacco production was included, the total value of household production would be almost K1.6 billion per year.

Table 2: Estimates of Annual (Household) Food Production in Papua New Guinea

	Quantity			Value	
	'000 t	<i>std. error</i>	kg/person	K (mil)	<i>std. error</i>
Sweet potato	1286	151	264	290	38
Cassava	124	25	25	32	6
Taro and Chinese Taro	314	52	64	97	13
Yams	143	31	29	47	12
Bananas	413	46	85	150	17
Sago	95	22	19	26	8
Rice	0.6	<i>n.a.</i>	0	0.02	<i>n.a.</i>
Coconut	195	21	40	30	4
Pork	60	11	12	243	47
Chicken	4	1	1	20	7
Other meat (incl. bush meat)	16	4	3	26	7
Fish (fresh, dried, shellfish)	50	12	10	60	17
Sugar cane	190	19	39	29	4
Other fresh fruit	59	10	12	21	4
Peanuts	21	8	4	56	27
Aibika	40	5	8	18	3
Other greens, vegetables, nuts	264	30	54	71	10
Irish potato	10	4	2	5	2
Betel nut	49	9	10	78	18

Source: Gibson and Rozelle (1998)

This survey estimate of the value of household food production suggests that the national accounts of PNG may seriously understate the contribution of agriculture. The national accounts estimate of gross product for agriculture, forestry and fisheries in 1996 was K1.8 billion (in current prices). The breakdown of this into market and non-market components has yet to be published, but in the most recent year available (1993), the non-market component comprised 41 per cent of the total.⁶ Applying this fraction to the 1996 total for the agricultural sector yields an estimate of non-market production of approximately K750 million. Hence, the national accounts may understate the value of household agricultural production by almost one-half.

Table 3 contains the estimates of food consumption, in terms of both aggregate values (in 1996 currency values) and per capita quantities. These consumption estimates include food that has

⁶ The non-market component relates to the production of output by rural village households for consumption in the rural villages, and includes: production of food, expansion of food gardens used in own-account production, collection of firewood and services of owner-occupied dwellings. The National Accounts bulletin of the NSO also notes, under "Data Sources" that "the output of smallholders was estimated on the basis of the consumption of domestically produced foodstuffs", which should be similar to the methods used to calculate the estimates in Table 2, although the lack of previous consumption surveys raises doubts about the National Accounts estimates.

been obtained from imports and from the local commercial sector, and they should also incorporate the value of any marketing margins, so they are not directly comparable to the production estimates.

Table 3: Household Food Consumption in 1996

	Total Value (K million)			Quantity (kg/person/year)		
	PNG	Rural	Urban	PNG	Rural	Urban
Sweet potato	299	285	14	260	299	42
Cassava	32	28	3	25	27	9
Taro and Chinese Taro	105	92	13	62	68	23
Yams	49	45	3	28	31	9
Banana (cooking and sweet)	158	137	22	83	90	47
Sago	34	25	8	23	21	33
Coconut	36	27	9	44	42	51
Rice	149	105	44	31	24	66
Lamb and mutton	59	36	24	5	4	10
Pork	162	158	5	11	13	2
Chicken	113	72	42	6	5	13
Bush meat and other unspecified meat	33	27	6	5	5	3
Fish (fresh, frozen, dried, incl. shellfish)	60	34	26	10	8	21
Sugar cane	31	28	2	35	40	10
Fresh fruit (excluding bananas)	27	19	8	14	14	16
Peanut	22	20	2	3	3	1
Aibika	25	18	6	11	10	14
Other greens, vegetables and nuts etc	78	68	10	61	68	20
Potato	8	5	3	3	3	6
Betelnut, lime and mustard	115	93	23	11	11	10
Flour	34	24	10	7	5	14
Tinned meat	68	37	31	2	1	7
Tinned fish	63	44	20	3	2	7
Milk (liquid, powdered, canned)	22	11	11	0	0	1
Sugar	38	27	10	4	3	8
Bread	27	6	21	3	1	13
Biscuits	32	20	12	2	1	4
Butter, margarine, oil & dripping	34	23	11	1	1	3
Other diary and cereal products and eggs	14	4	10	1	0	3
Tea, coffee and milo	22	14	9	0	0	1
Snack food (Twisties, chewing gum)	13	7	6	0	0	1
Salt, pepper, spices, sauces	13	9	4	1	1	1
Soft drink	51	31	21	4	3	12
Beer	121	75	46	4	3	15
Alcoholic drinks (except beer)	16	12	4	n.a.	n.a.	n.a.
Meals consumed away from home	88	51	37	n.a.	n.a.	n.a.
TOTAL	2253	1717	536	n.a.	n.a.	n.a.

Source: Author's calculation from 1996 Papua New Guinea Household Survey data.

There are two items where consumption values were less than production values (pork and peanuts), and this may indicate a tendency to report the value of gifts received as greater than the value of gifts given (or under-reporting of gifts given), the value of sales as less than the value of purchases (or underreporting of sales) or food stock reductions as greater than stock increases. Nevertheless, in both cases the per capita consumption and production quantities were within one kilogram of each other.

In terms of aggregate value, the major foods consumed are sweet potato, pork, banana, rice, chicken, and taro and Chinese taro. The aggregate value of consumption of both beer and betelnut also exceeded K100 million in 1996. The value of sweet potato consumption was approximately twice as high as any other food item, which indicates the centrality of this crop to food and nutrition in Papua New Guinea. The breakdown of the consumption estimates into rural and urban sectors indicates the substantial differences in diets. The unevenness of market penetration by imported foodstuffs into rural areas and the offsetting flows of locally produced foods into the urban areas are also apparent. For example, rural consumption levels of rice are approximately one-third as high as urban consumption levels while wheat products are more restricted to the urban areas. The per capita consumption of locally produced fruits, vegetables and root crops in urban areas is approximately one-half to one-third the level in rural areas, except for sweet potato where it is only one-sixth and for sago where urban per capita consumption appears higher.⁷

Table 4 contains the calculated shares of available calories provided by each food, both nationally and for the rural and urban sectors. The dominance of sweet potato is again apparent, providing just over one-quarter of national calories and 30 per cent of calories for rural households. This calorie contribution is almost three times higher than that of the next most important foods. In total, locally produced foods appear to provide four-fifths (79.7 per cent) of the available calories, where this estimate is based on the assumption that cereals, lamb, tinned meat and tinned fish, dairy products and processed foods are entirely imported, while meals consumed away from home have a 50 per cent import content. Under these assumptions, locally produced items contribute over five-sixths (84.4 per cent) of the available calories in the rural sector, while in the urban sector they contribute just under one-half (49.5 per cent). Once again, there are no similar estimates from previous years with which to compare these results for 1996. Although Shaw (1985) reports that at a maximum, imports provided one-quarter of food energy in 1983, these calculations used aggregate import data and an *assumed* level of calorie availability so they are not comparable with our current estimates.

Conclusions

Sensible planning requires timely and reliable data so that the priorities identified in research and investment plans match the needs of the population. Food planners and agricultural scientists in Papua New Guinea have been hampered by a lack of information on the economic and nutritional importance of each food crop. This lack of information also affects those agencies charged with the management of the overall economy because current estimates of the total value of the food production sector – in which the bulk of the population are engaged – appear to be little better than guesswork.

⁷ In part, these patterns reflect the high level of sweet potato consumption in the highlands, where urbanisation is least advanced, and the consumption of sago on the coast where urbanisation is most advanced.

Table 4: Share of Total Calories Provided by Each Food

	PNG	Rural	Urban
Sweet potato	26.7	30.1	4.7
Cassava	2.8	3.1	1.0
Taro and Chinese Taro	6.6	7.3	2.2
Yams	2.4	2.6	0.7
Banana (cooking and sweet)	6.9	7.4	3.9
Sago	6.5	6.3	7.6
Coconut	11.1	10.9	12.0
Rice	11.8	9.4	27.6
Lamb and mutton	1.5	1.1	3.5
Pork	2.7	3.0	0.7
Chicken	1.0	0.8	2.2
Bush meat and other unspecified meat	0.6	0.7	0.4
Fish (fresh, frozen, dried, incl. shellfish)	1.1	0.9	2.3
Sugar cane	2.9	3.2	0.8
Fresh fruit (excluding bananas)	0.6	0.6	0.7
Peanut	1.0	1.1	0.7
Aibika	0.2	0.2	0.3
Other greens, vegetables and nuts etc	2.6	2.8	0.9
Irish potato	0.2	0.2	0.4
Betelnut, lime and mustard	0.6	0.6	0.5
Flour	2.1	1.6	5.0
Tinned meat	0.5	0.3	1.6
Tinned fish	0.6	0.5	1.4
Milk (liquid, powdered, canned)	0.2	0.1	0.9
Sugar	1.7	1.4	3.8
Bread	0.7	0.2	3.6
Biscuits	0.6	0.5	1.7
Butter, margarine, oil & dripping	1.4	1.1	2.9
Other diary and cereal products and eggs	0.2	0.1	0.8
Tea, coffee and milo	0.0	0.0	0.1
Snack food (Twisties, chewing gum, etc.)	0.1	0.1	0.5
Salt, pepper, spices, sauces	0.0	0.0	0.0
Soft drink	0.2	0.1	0.7
Beer	0.2	0.1	0.7
Alcoholic drinks (except beer)	0.0	0.0	0.1
Meals consumed away from home	2.0	1.8	3.1

Source: Author's calculation from 1996 Papua New Guinea Household Survey data.

This paper has used nationally representative household consumption data from 1996 to report estimates of the aggregate value and per capita quantity of production of 19 major foods and of consumption of 36 major foods or food groups. The consumption estimates are disaggregated into rural and urban sectors and are also reported in terms of the share that each food has in aggregate

calorie availability. The procedures used to gather the data and the inherent variability in PNG agriculture mean that there are reasonably wide errors (of both sampling and non-sampling nature) surrounding the estimates. Nevertheless, the production and consumption estimates reported here may be compared with the findings from more qualitative or smaller-scale quantitative studies to give a broad picture of the importance of the food sector, and of particular foods within that sector, to Papua New Guinea. It is also important to emphasise that the estimates refer to a snapshot in a single year, and there is no similar survey with which to compare them. Hence, it may require a similar survey in the future to identify any trends in the changing relative importance of particular foods.

With these caveats in mind, there are three major results from this study: the dominance of sweet potato, the likely under-valuing of the household food production sector in the National Accounts, and the high share of locally produced items in the supply of dietary energy. More specifically: The total quantity of sweet potato production is three times higher than for the next highest food, while in terms of consumption value it was approximately twice as high as for any other food item. The aggregate value of household food production was approximately K1.3 billion in 1996, which appears to be considerably larger than the estimate made by the National Accounts. In total, locally produced foods appear to provide 80 percent of available calories.

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