

A Review of Papua New Guinea's Red Meat Industry

David Vincent and Sue Low



Canberra 2000

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GPO Box 1571, Canberra, ACT, Australia, 2601

David Vincent and Sue Low 2000. A review of Papua New Guinea's red meat industry. ACIAR Monograph No. 66, xii + 71p.

ISBN 1 86320 288 9

Cover illustrations courtesy David Vincent, Centre for International Economics
Final layout for press: Arawang Communication Group, Canberra, Australia

Foreword

The Australian Centre for International Agricultural Research (ACIAR) has brokered a successful collaborative program of agricultural research for development between Papua New Guinean and Australian research institutions since 1983. This program has seen over 30 projects completed representing an investment of over \$13 million. The focus of these projects has been primarily in crop sciences, reflecting the importance of small holder cropping systems to the PNG economy and well being of its people. A secondary area of importance has been agricultural development policy and farming systems management. To date, less attention has been given to problems in animal health and husbandry.

PNG has had a low level beef industry since the 1930s mainly based on the natural grasslands of the Ramu and Markham valleys with limited penetration into the highlands. The activity was initiated by expatriates on broad acre holdings and has had only limited uptake by local farmers, as there was no tradition of managing large animals such as cattle in traditional farming systems. More small holders are now involved in the industry and currently have about 20 per cent of the stock running on 40 per cent of the land utilised for this purpose. Stock numbers are low, even declining, and productivity and out-turn also low. Somewhat paradoxically, consumer demand, however, is very high and this is satisfied by a vigorous meat import sector supplemented by the development of a commercial chicken industry.

One previous ACIAR project has had an impact on the PNG beef industry. Actually both Australia and PNG have benefited from the transfer of technology from an ACIAR project conducted in Indonesia which developed a diagnostic test for *Trypanosoma evansi*. The methodology for the identification and diagnosis of this protozoan which can infect a wide range of domestic animals, has been adopted under the tripartite quarantine agreement among PNG, Australia and Indonesia. In another animal-based project, new insights have been obtained into the complex relationships between honey bees and their parasitic mites. This is timely given the recent incursion of the Asian bee into northern Australia and the importance of the honey industry in the highlands of PNG and in Australia.

At the Consultations in 1990, PNG authorities raised with ACIAR the need for research into constraints to cattle reproduction and the integration of crops with livestock and forestry in the highlands. At the Consultations in 1995, pasture development, alternative feedstuffs, management and trade policies relating to the livestock industry were raised as priorities for R&D. However, it was agreed that before any further investments be made in R&D, a critical analysis of the whole sector should be undertaken to determine the constraints to industry development across the commodity chain and to identify those issues amenable to R&D interventions for their solution.

This study of the red meat industry, funded by AusAID under special funding arrangements with ACIAR, provides this much-needed analysis. It was undertaken by David Vincent from the Centre for International Economics, Canberra, and Sue Low, until recently lecturer in animal nutrition and management at the University of Technology, Lae, PNG. The study involved extensive participation of stakeholders in the industry-smallholder farmer groups, major commercial producers, processors and marketers, and R&D providers. ACIAR facilitated a seminar in Lae in March this year at which the findings of the study were debated vigorously by these stakeholders and after which this report was finalised. Its major findings were presented to the PNG Food and Nutrition 2000 Conference in Lae in June.

The National Agricultural Research Institute (NARI) now has the mandate for R&D in the livestock sector. ACIAR hopes that NARI, the Department of Agriculture and Livestock, provincial authorities and the industry find this report useful in planning the way ahead for revitalising the beef industry which has the potential to be a significant contributor to agricultural and industrial development for the benefit of PNG.

D.I. Bevege
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International Agricultural
Research

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Summary

PAPUA NEW GUINEA'S RED MEAT PRODUCTION (which is mainly beef) has failed to keep pace with demand. Consumption of beef, sheep and goat meat has trebled over the past two decades to reach 52 000 tonnes per year, but annual beef production for most of the period has been between 2000–2500 tonnes. Imports (mainly of sheep meat) have increased to fill the gap.

While expansion of production would lessen import requirements and save foreign exchange, such expansion must represent an efficient use of Papua New Guinea's resources for it to improve country living standards. The key issue addressed in this review is the scope for efficient production expansion and how it might be achieved. In addressing this issue we have undertaken a review of Papua New Guinea's red meat industry. Our review covers consumption, slaughtering and processing, production, government policy influences, prospects for beef industry development and initiatives that might be considered to facilitate it.

Our findings are as follows.

Consumption patterns are changing

Red meat is consumed in a range of market segments, each catering to a different income group. Segments differ markedly according to the type and cut of meat consumed and their reliance on domestic production and imports. Retailers influence meat availability to consumers by always switching to the cheapest source and cut of meat. This reflects the need to market a basic cheap meat protein source to the bulk population of low purchasing power households.

Per capita consumption of meat in total has been constant over the last decade. But the composition of this consumption has changed, with more sheep meat and poultry meat consumed at the expense of beef. Sheep meat now accounts for 38 per cent of meat consumption, poultry meat 39 per cent and beef 17 per cent.

Slaughtering and processing

Most cattle are slaughtered at government owned abattoirs. Their capital is old and rundown and they are struggling to keep basic equipment in working order. Throughput is low and variable. None have boning out facilities. Byproduct recovery is poor and none of the abattoirs is accredited for exports. Abattoir charges are insufficient to fund new investment. An industrywide approach to abattoir construction and utilisation is needed to ensure the maintenance of facilities of sufficient standard.

Production (cattle and beef)

Papua New Guinea has substantial areas of grasslands suitable for cattle production, but there is no tradition of ruminant livestock grazing systems in village agriculture. Encouraged by the Australian administration in the 1950s and 1960s and with funding support by the World Bank (for smallholders) and the Papua New Guinea Development Bank, the industry expanded rapidly. Cattle numbers peaked in 1976 at about 153 000 head, with one third on over 1000 smallholder projects. Cattle numbers have since declined sharply to between 75 000 and 90 000 now. About 80 per cent of these are on largeholder ranches, occupying 113 000 hectares of grazing land. The remainder are on 550 smallholder farms on 78 000 hectares of land. A further 300 000 hectares of customary land is judged suitable for cattle grazing. Much of this land is unsuitable for other forms of agriculture.

The decline in cattle numbers is generally attributed to poor management, the withdrawal of government support (particularly extension), ownership disputes, poor financing arrangements, law and order problems and better returns from alternative enterprises. For the industry as a whole, both pasture productivity and the productive performance of the herd (fertility, calving percentage, growth rate) appear to be low, though numerical evidence on performance was not collected in this survey.

Production of competing meats

Commercial production of poultry meat has grown rapidly with protection from imports to reach around 17 500 tonnes in 1998. When estimates of village fresh and subsistence poultry production are included, annual production is around 41 000 tonnes. Commercial pig meat production is around 1000 tonnes per year, with perhaps a further 5000 tonnes of village production. These figures compare with an estimate of total beef production of around 2900 tonnes in 1998.

Commercial poultry and pig meat production are heavily dependent on imported feeds. Value added (the net income accruing to Papua New Guinea) per million kina of production value is low. By contrast, value added per value of production for beef is high.

Despite heavy support from foreign aid for more than 20 years, a commercial sheep meat production industry has failed to develop. Goat numbers in the highlands have increased steadily, though there has been no real attempt to view goats as an industry. Goats have proven suitable for village agriculture and a study of their potential in Papua New Guinea and how to achieve it is warranted.

Government policy

The beef industry has no priority within government. Until recently, the industry was hindered by high tariffs on imported inputs. The current tariff regime still provides substantial encouragement to poultry production relative to beef. NARI, the government's agency for agricultural research, has recently reached agreement with DAL to take over responsibility for R&D into large livestock. This will provide an institutional base for beef industry R&D and there is currently no R&D agenda in government to support it. The government no longer provides extension services to smallholders and no effective alternative provision has developed.

The industry is a big user of transport services and slaughter facilities, which have traditionally been provided by government.

Prospects for the beef industry

Although the industry has struggled over the last decade, during which general economic conditions were generally adverse for it, the industry has proven to be a long term survivor in Papua New Guinea. It has a well established production base of largeholders and a persistent core of smallholders. The industry's strengths include its positive base, the absence of major diseases, the ready availability of feed supplements and labour, strong local demand for beef with considerable scope for import substitution and great potential for productivity catch up.

Offsetting these strengths are a number of inherent weaknesses, which retard the industry's ability to grow. These include the customary land system (which makes it difficult to parcel land into efficient grazing areas), the low productivity of native pastures, the poor road infrastructure, the lack of extension support to smallholders and institutional support within government, the lack of an R&D support base, the poor information flows within

the industry and the difficulties in securing livestock from theft and feral dog attack.

On balance, the prospects for the beef industry are now encouraging. The domestic macroeconomic environment is becoming more favourable with the recent emergence of a competitive exchange rate and the removal of tariffs on imported inputs. Global beef prices are increasing. There are now strong incentives for import substitution. But the industry's immediate growth prospects will be constrained by the low fertility of the herd, the rundown of breeder cattle and the lack of quarantine facilities to handle imported breeder cattle.

Facilitating beef industry development

An effective agenda must capitalise on the strengths of the industry and take advantage of the opportunities it faces while addressing its weaknesses. It must also take on board the lessons of past endeavours to foster industry development, which have not set the industry on a sustainable growth path.

We set out an agenda that meets these requirements. The agenda is organised around the need to:

- establish an information base
- enhance smallholder production capacity
- improve industry supporting infrastructure and its operating environment
- improve the general economic environment in which the industry operates.

1 Introduction

CONSUMPTION OF RED MEAT (BEEF, SHEEP AND GOAT MEAT) in Papua New Guinea has trebled over the past two decades to its current level of about 52 000 tonnes (cwe) per year. However, recorded production over this period from commercial enterprises has remained around 2000–2500 tonnes of beef per year. By far the major source of red meat produced in Papua New Guinea is beef. Production of sheep meat and goat meat is considered insignificant. Red meat demand is being increasingly met by imports. Imports of beef and sheep meat in 1998 reached 41 800 tonnes (shipped weight), involving an outlay of around PGK130 million.

Expansion of red meat production would lessen import requirements and save foreign exchange. However, expanding production will only improve Papua New Guinea living standards if it can be done efficiently. To be efficient, the value to Papua New Guinea of the additional red meat produced must at least match the value that the resources (land and pastures, labour, etc.) devoted to achieving this additional production could earn for the country in alternative activities. Whether it is in Papua New Guinea's national interest to expand its red meat production is not clear cut. From a national viewpoint it may make good economic sense to place increasing reliance on imports of red meat to satisfy the growing gap between demand and production if such imports can be obtained cheaper than the resource costs needed to expand production. Making this assessment requires an analysis of red meat production prospects relative to those for competing meats, particularly poultry, consumer preferences toward different sources of meat protein and the influence of government policy and regulatory arrangements on both production and demand for red meat and competing meats.

The commercial production of red meat is directed toward Papua New Guinea nationals and expatriates with the ability to generate income to pay for it. These consumers do not have to choose beef to satisfy their meat protein requirements. How much beef they choose depends on their incomes, their lifestyle and location, their meat preferences and whether beef provides value for money vis-à-vis competing meats.

Similarly, farmers do not have to produce cattle. Within biological and agronomic constraints, customs, land attributes and location allow for a range of alternative forms of land use. These may yield higher monetary returns or

better fit in with lifestyles than beef. Whether or not their land is used for income earning activities is not important to many landholders. Possession rather than income earning ability is still of major importance in many areas.

Both producer and consumer choices are influenced by government policies and customs. Trade policies in particular exert considerable influence over both the incentives to produce different types of meat, the availability of imported meat and relative retail prices of beef and competing meats. Policies toward research and development and extension services can also favour one type of meat relative to others. The difficulties of assembling broad area farming enterprises under Papua New Guinea's customary land ownership system, together with the lack of a tradition in open range grazing, have long been recognised as inhibitors of the development of livestock industries, especially beef.

Our focus in this report is on the beef industry and its prospects for efficient expansion. Despite considerable past investment in research for pasture development, disease control and beef cattle management, beef production has failed to increase and cattle numbers have progressively declined.

Our study is concerned with the reasons for this decline, what needs to be done to assist the industry to reverse the decline and whether it is in the best interests of Papua New Guinea for renewed efforts to be made to encourage beef industry growth.

2 Meat consumption

Key drivers of commercial meat production

Consumption of commercial meat production in Papua New Guinea is driven by per capita income and price. Over the past 25 years the growth performance of the Papua New Guinea economy has been poor. Real GDP per capita in 1998 was lower than in 1973. Consumption patterns differ significantly according to income level. Primal cuts of beef are consumed only by expatriates and nationals in the high income bracket. Their price puts them beyond the reach of most nationals. While there is a strong preference for beef among nationals, the bulk of the beef consumed by nationals consists of trimmings and the cheaper cuts such as brisket. Relative prices between different types of meat are key determinants of consumption patterns among low income consumers. The results of retail outlet price comparisons conducted for the review show that this puts beef at a distinct disadvantage relative to competing meats (table 2.1).

Consumer preferences of Papua New Guinea nationals between meats and between cuts of an animal are quite different to those of Australians and reflect preferred cooking methods and lifestyle. For example, in the case of poultry, legs, feet, cocktails and wings are more sought after than is breast meat. This preference is reflected in the relative price structures.

Meat consumption fluctuates considerably according to the availability of income. In Port Moresby beef demand is constant throughout the year, reflecting the income security enjoyed by salaried employees of government and private businesses. In the Highlands, beef consumption is more seasonal, reflecting the uneven availability of cash from tree crop harvest payments especially coffee. Similarly, in other areas, income from copra and oil palm influence the ability to purchase meat.

2.1 Meat price survey, October 1999 Kina per kilogram

Cut of meat	Goroka		Madang	Lae	
	Best buy	Bitangor	Andersons	Best Buy	Andersons
Beef					
Hamburger mince	8.98	8.90	9.45	8.57	6.99
Diced beef	9.00	9.90	8.99	9.67	8.99
Sausages	6.33	7.80	6.80	6.25	6.49
Rump steak	12.95	13.20	11.90	14.38	13.99
Scotch fillet	17.95	16.90	16.90	17.59	14.89
Sheep meat					
Lamb flaps	4.30		4.95	4.14	5.49
Forequarter chops	6.95	5.50	5.99		6.99
Neck chops	6.86	5.57	5.26	4.99	4.99
Legs	15.61		16.80		14.99
Pig meat					
Bacon	15.96		18.60		
Fillet	10.95	11.00	15.50	14.05	16.90
Shoulder chops	9.50	10.50	9.50	8.75	9.99
Trotters	2.94	4.50	4.99		6.95
Sausages	6.33	7.80	6.95	6.25	6.49
Butterfly chops	14.00	10.90	12.80	12.99	16.99
Chicken					
Breast fillet	14.35	13.50	11.99		14.99
Wings	8.73	7.90	8.99	8.56	8.69
Cocktails		9.80	7.50	9.10	8.97
Feet	3.84		4.99	4.74	
Breast	7.49	6.90	9.50	7.49	Fresh 8.99 Frozen 7.13
Kwik kai	6.65		8.05	8.56	8.56
Prima/Pelgen packaged sausages	13.38	13.80	11–13.00		13.32

Source: Survey conducted for red meat review.

Marketing and retailing

The beef marketing chain from producer to consumer is short and involves few players. Major retailers also undertake their own processing, small goods manufacture and distribution, and, in some instances, also have extensive farm production enterprises. Stock is purchased by retailers before slaughter on an over-the-hooks basis with a fee per animal deducted to cover slaughter costs. Ownership passes directly from producer to seller. There are no agents and saleyards for the sale of cattle of any class. The information network

between producers, processors and retailers on availability of stock and prices is poor.

There are a number of potential advantages in having a direct link between producers and sellers. Transaction fees are reduced and there is a ready opportunity to convey clear signals on market requirements from seller to producer to provide a basis for premiums and discounts. But few in the industry are capitalising on this opportunity. There is no formal carcass classification system. Nor is there a graded payment system. Meat quality is variable with carcass weight appearing to be the defining parameter.

There is virtually no market research done on consumer requirements and how to meet them. The usual approach is trial and error. A marketing initiative is trialled and, if successful, is retained. In general, Papua New Guinea consumers are product/package loyal and alterations to either product type or appearance are not readily accepted.

There is no accurate picture of the size of the market for different cuts and by location. This deficiency is a major one. The economics of beef production depends heavily on being able to maximise the total value of the carcass by selling each part into the market segment prepared to pay most for it. Although Papua New Guinea has a high import dependency on beef (see later), most imports are of the cheaper cuts. There is a range of views within the industry about the capacity of the domestic market to absorb an increase in supply of primal cuts (which account for about 15 per cent of the carcass) if beef production were to increase. Import statistics by cut (see appendix C) show that substantial amounts of primal cuts of beef are imported by Papua New Guinea. This suggests considerable room for domestic production to substitute for imports.

Market segments

Beef competes for the consumer's kina in a range of retail segments (table 2.2).

The highest unit return segment is hospitality and catering. A substantial component of this is to meet the demands of mining projects. This segment has exacting requirements for quality consistency, consistency of supply of a particular cut and uniform portion size. With its low production volume and variable quality and supply, the local industry is finding it hard to stay competitive against imports of cut specific boxed beef.

The urban supermarket segment provides the major outlet for domestically produced primal cuts. The supermarket segment caters to expatriates and the high income cohort of the national population. Total demand for primal cuts

of beef in this segment is reasonably stable. While expatriate numbers are steadily decreasing, more and more nationals are moving into this segment of the market. Supermarket demand for quality beef cuts outstrips the capacity of the local industry to supply these cuts. At the current exchange rate (November 1999), domestic supplies are highly competitive against imports in this segment. Supermarket retailers could absorb a significantly greater volume of domestic supplies if they were available, at the expense of higher cost imports. The rate of supermarket development in Papua New Guinea is driven by the rate of per capita income growth in the market economy. The segment's growth has been curtailed by the poor recent performance of the economy, but will resume should sustained economic growth be achieved.

Beef is also sold through trade stores and wholesale cash and carry outlets. These stores retail the cheaper cuts demanded by the bulk of the population. These stores also trade high volumes of cheap sheep meat imports such as lamb flaps and lamb trim. The segment is growing steadily, underpinned by a high rate of population growth.

2.2 Beef retail segments

Segment	Requirement	Comment
Hospitality and catering	<ul style="list-style-type: none"> ▪ Highest return market. ▪ Least price sensitive. ▪ Demands high and consistent quality cuts and uniform portion sizes. 	<ul style="list-style-type: none"> ▪ Segment not being serviced adequately by Papua New Guinea beef industry because of variations in quality and portion size and inability to provide sufficient volumes regularly of nominated cuts. ▪ Small beef domestic production base makes it hard for local industry to meet segment requirements.
Urban supermarket	<ul style="list-style-type: none"> ▪ Bias toward higher quality cuts ▪ Good presentation required — considerable service component attached to product 	<ul style="list-style-type: none"> ▪ Segment is stagnant, reflecting the stagnant state of the Papua New Guinea economy — but growth will resume in line with growth in Papua New Guinea per capita incomes. ▪ Strong demand for beef cuts by expatriates and those nationals on high incomes. ▪ Bulk of population do not have the purchasing power to purchase beef in this segment.

(Continued on next page)

2.2 Beef retail segments (continued)

Segment	Requirement	Comment
Trade stores and wholesale cash and carry	<ul style="list-style-type: none"> ▪ Cheap cuts of lower quality. ▪ Supplier of bulk protein meat to low income consumers. 	<ul style="list-style-type: none"> ▪ This segment expanding the fastest — driven by rapid population growth and demand for meat protein. ▪ Most beef sold through this segment, but primal cuts excluded because of high price.
Kai bars ^a	<ul style="list-style-type: none"> ▪ Cheap meat for basic quality hot meals. 	<ul style="list-style-type: none"> ▪ Demand for kai bar meals tracks availability of 'cash in pocket'. ▪ Highly price sensitive. ▪ Type of meat served changes according to price — high rate of price induced substitution between cheap portions of fish, mutton, beef, chicken.
Sing Sing ^b	<ul style="list-style-type: none"> ▪ Cash payment for live animals ex-farm gate 	<ul style="list-style-type: none"> ▪ Sing Sing trade an important outlet for both smallholder and large scale beef producers (takes up to 80 per cent of smallholder beef production and between 10 and 30 per cent of large scale beef production). ▪ Supplies the customary celebration/feast market ▪ Major sales at the end of crop harvests (for example, coffee); price is not of major importance ▪ Some of Sing Sing purchases find their way on to the retail market through kai bars and other outlets.

(Continued on next page)

2.2 Beef retail segments (continued)

Segment	Requirement	Comment
Cannery	<ul style="list-style-type: none"> ▪ Cheap cuts of beef and fish. 	<ul style="list-style-type: none"> ▪ Canned meat is becoming increasingly expensive on a per meat content basis relative to other meats such as chicken. ▪ To maintain sales, smaller cans are being marketed. ▪ Government price controls operate — have forced temporary closures of canneries when prices unfavourable. ▪ Despite its high price relative to other meats on a meat content basis, cannery demand is being sustained by the lack of meat storage and refrigeration in most areas.
Manufacturing – small goods	<ul style="list-style-type: none"> ▪ Cheap cuts of meat. Different meats blended according to availability and price. 	<ul style="list-style-type: none"> ▪ Regulations governing the use of meat in smallgoods manufacture provide considerable flexibility to the manufacturer.

^a Convenience shops providing cheap basic hot meals at fast food outlets. ^b Traditional get-togethers and celebrations.

The kai bars also retail beef from time to time, but only when its price is low. Kai bars substitute rapidly between sheep meat, fish and beef in their menus as local prices of the cuts of these species change. Kai bar menus gravitate to the cheapest meat. They also alter the proportion of meat to other food in each meal as relative prices change. Kai bar demand is highly seasonal depending on the availability of cash in the pocket.

The Sing Sing or customary market is a major segment for beef sales. Estimates are that at least 80 per cent of smallholder beef production on customary land and between 10–30 per cent of the largeholder cattle production is sold at the farm gate for the Sing Sing trade. The customer supplies the transport and pays cash. It is suspected that some of the beef purchased in this way finds its way onto the retail market through kai bars and other outlets. This market is currently regarded as an illegal market — all meat kills must be processed through a licensed works.

The cannery segment is a major user of cheap cuts of beef, most of it imported. Meat and tins are imported duty free and value added to Papua New Guinea from the canneries is low. The demand for canned meat is sustained by the remoteness of much of the population from retail centres and their lack of refrigeration and storage facilities. Despite its duty free status,

canned meat is becoming increasingly expensive on a per meat content basis relative to other meats such as chicken. The economics of the segment and consumer purchases are influenced by government price controls, which from time to time disrupt production and demand.

Beef is also used in smallgoods manufacture, often blended with sheep meat and pork. This segment uses the cheaper cuts (especially trimmings). Beef's share of the blend draws heavily on its price relative to substitute meats. Poor regulations allow considerable scope for manufacturers to alter their input mix between different species of meat and between meat and other filling, while still qualifying as a specified product. An extreme example is pork sausages, which can be manufactured and sold under that label with a zero content of pork!

Meat availability

Because of the lack of home refrigeration, shopping for meat is on a daily basis. Despite the low incomes of most of the population, Papua New Guinea consumers show a high degree of brand loyalty. This is exploited by processors of chicken, pork, tinned meat and smallgoods — but not the beef industry. No attempt is made to retail cuts of beef under brands backed by consistency of packaging, size and quality.

Marketing is heavily dictated by the need to sell a basic cheap meat protein product to the bulk population of low purchasing power households in a form that is consistent with their preferred cooking method (pot boiling). This explains the enormous appeal of lamb and mutton flaps in simple packaging. Packaging and presentation at supermarket outlets is good and butchering standards are high. But few citizens can afford to pay the price for primal cuts plus the supermarket service component.

Retailers determine the availability of meat to consumers in the cheap meat protein market by always switching to the cheapest source and cut of meat. This in turn is governed by the need to supply affordable product. Changes in government policy such as tariffs on competing meat imports and changes in import prices for meat caused by events elsewhere in the world (for example, an increase in demand for mutton flaps in Africa) can cause marked shifts in the availability of particular cuts to Papua New Guinea consumers.

Meat packaging and labelling arrangements adopted by retailers often obscure the price of a unit of meat in the package. Consumer awareness of value for money in meat purchases is low.

Consumption patterns

Patterns of meat consumption and how they have changed since 1980 are set out in table 2.3 and chart 2.4. The estimates include commercial consumption (commercial production plus imports less exports) and total consumption. The results for total consumption include estimates of subsistence production for consumption (see later). Total meat (excluding fish) consumption has increased from 44 000 tonnes in 1980 to 97 000 tonnes in 1998. The major part of the increase is represented by imported sheep meat. Consumption of poultry meat also increased substantially. The FAO figures suggest that consumption of fish fell significantly over the period, though the reliability of these estimates is open to question.

The results in chart 2.4 show virtually no change in per capita consumption of meat (excluding fish) since 1990. The composition of this consumption has, however, changed with more sheep meat and poultry meat being consumed at the expense of beef.

Chart 2.5 compares the level and composition of meat consumption in Papua New Guinea with those in two countries of similar per capita income (Indonesia and the Philippines) and with Australia.

Papua New Guinea's meat consumption shows a much stronger preference toward sheep meat and to a lesser extent beef than is the case in Indonesia and the Philippines.

Imports and self-sufficiency

Papua New Guinea's meat imports are shown in chart 2.6.

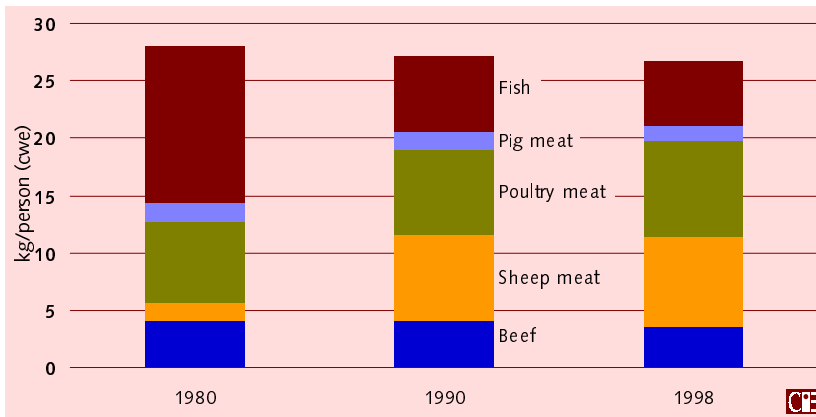
Imports of beef in 1998 were 30 per cent above their 1980 level. Over the same period, self-sufficiency in beef (ratio of domestic production to consumption) has fluctuated between 15–18 per cent. Imports of sheep meat have grown enormously over the same period, with domestic production remaining negligible. Poultry meat production has expanded steadily, while imports have been virtually eliminated by the operation of an import ban initially and later a prohibitive tariff. Self-sufficiency has also been achieved in pig meat production.

2.3 Changing meat consumption in Papua New Guinea Tonnes cwe

Product	1980	1990	1998
Beef			
▪ Consumption of official production plus imports	12 266	15 100	15 850
▪ Consumption of Sing Sing sales	284	295	360
Total	12 550	15 395	16 210
Sheep meat			
▪ Consumption of imports	4 753	28 710	36 190
▪ Consumption of subsistence production	5	15	15
Total	4 758	28 725	36 205
Goat meat			
▪ Consumption of subsistence production	9	9	9
Poultry meat			
▪ Consumption of commercial production plus imports	12 318	11 485	16 489
▪ Consumption of village fresh production	3 760	11 389	16 489
▪ Consumption of subsistence production	5 760	5 760	5 760
Total	21 838	28 634	37 738
Pig meat			
▪ Consumption of commercial production plus imports	223	1 000	1 018
▪ Consumption of subsistence production	5 000	5 000	5 000
Total	5 223	6 000	6 018
Fish	42 251	25 169	25 607

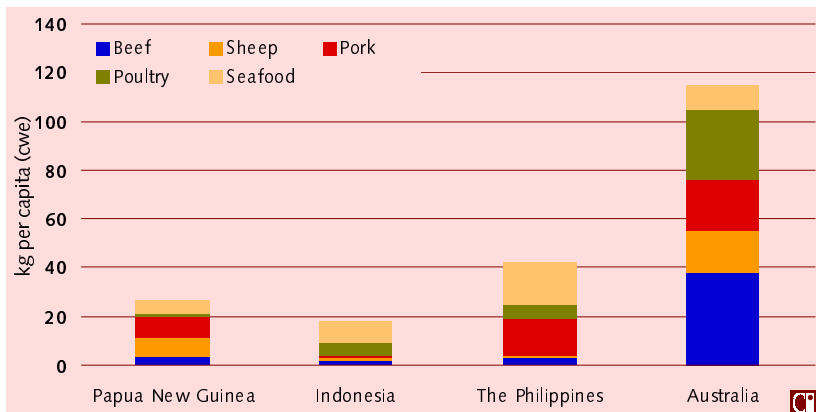
Source: Data for fish from FAO. Data for commercial beef from LDC. Beef Sing Sing sales estimated by Papua New Guinea cattle producers. Data for sheep meat from National Statistical Office (earlier years) and from Australian and New Zealand export statistics to Papua New Guinea (1998). Data for commercial poultry meat from LDC (earlier years) and from the Poultry Industry Association of Papua New Guinea (1996). Estimates of village fresh poultry production from Mark Low of Niugini Tablebirds. CIE estimates of subsistence poultry production (see text). Data for commercial pig meat production from LDC. CIE estimates of subsistence pig meat production (see text).

2.4 Changes in per capita consumption



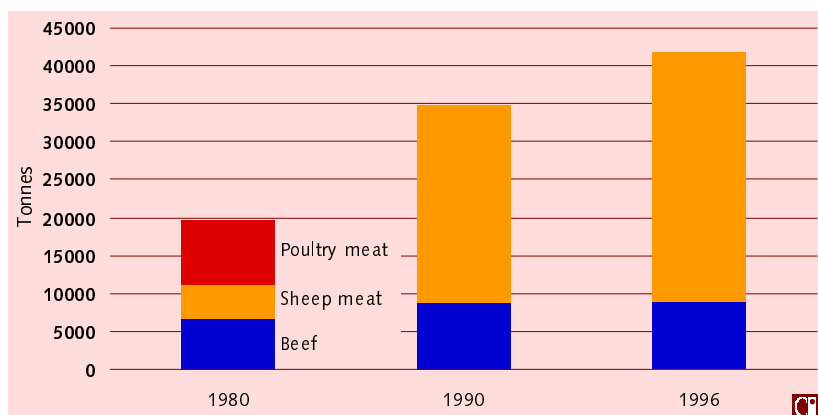
Data source: Data for fish from FAO. Data for commercial beef from LDC. Beef Sing Sing sales estimated by Papua New Guinea cattle producers. Data for sheep meat from National Statistical Office (earlier years) and from Australian and New Zealand export statistics to Papua New Guinea (1998). Data for commercial poultry meat from LDC (earlier years) and from the Poultry Industry Association of Papua New Guinea (1996). Estimates of village fresh poultry production from Mark Low of Niugini Tablebirds. CIE estimates of subsistence poultry production (see text). Data for commercial pig meat production from LDC. CIE estimates of subsistence pig meat production (see text).

2.5 Meat consumption in Papua New Guinea compared with selected other countries



Data source: Global Meat Industries database.

2.6 Imports of meat Shipped weight



Data source: Livestock Development Corporation; Global Meat Industries database; Australian Bureau of Statistics (beef exports to Papua New Guinea); Meat New Zealand.

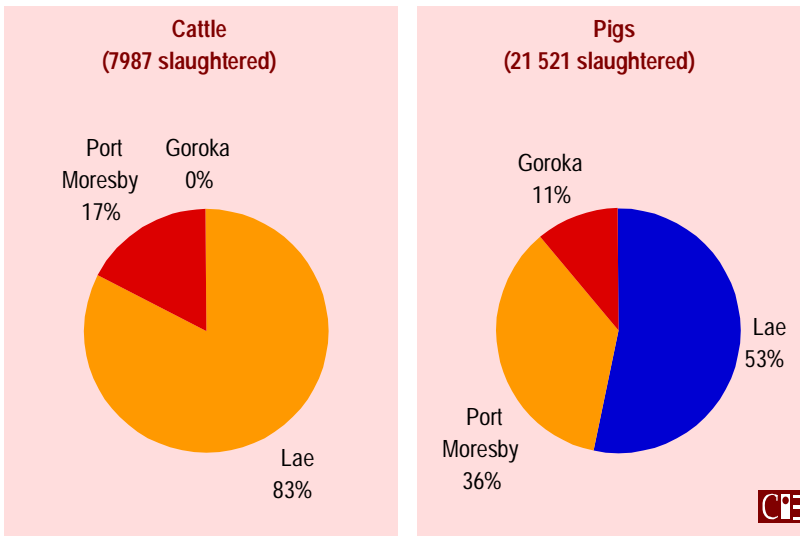
3 Slaughtering and processing

MOST CATTLE ARE SLAUGHTERED at government owned abattoirs administered by the Livestock Development Corporation. There are three main government owned abattoirs — Lae, Port Moresby and Goroka. All are multi-species abattoirs, slaughtering cattle, pigs and sheep, though the sheep kill is negligible (as is the cattle kill at Goroka). There are also other smaller government owned abattoirs with a very small throughput of cattle. An example is the Kavieng abattoir, which has averaged about 130 cattle slaughtered annually since opening in 1981 (Thorold 1999).

By far the largest abattoir is Lae, which accounts for more than 80 per cent of cattle slaughtered and more than 50 per cent of pigs slaughtered (chart 3.1).

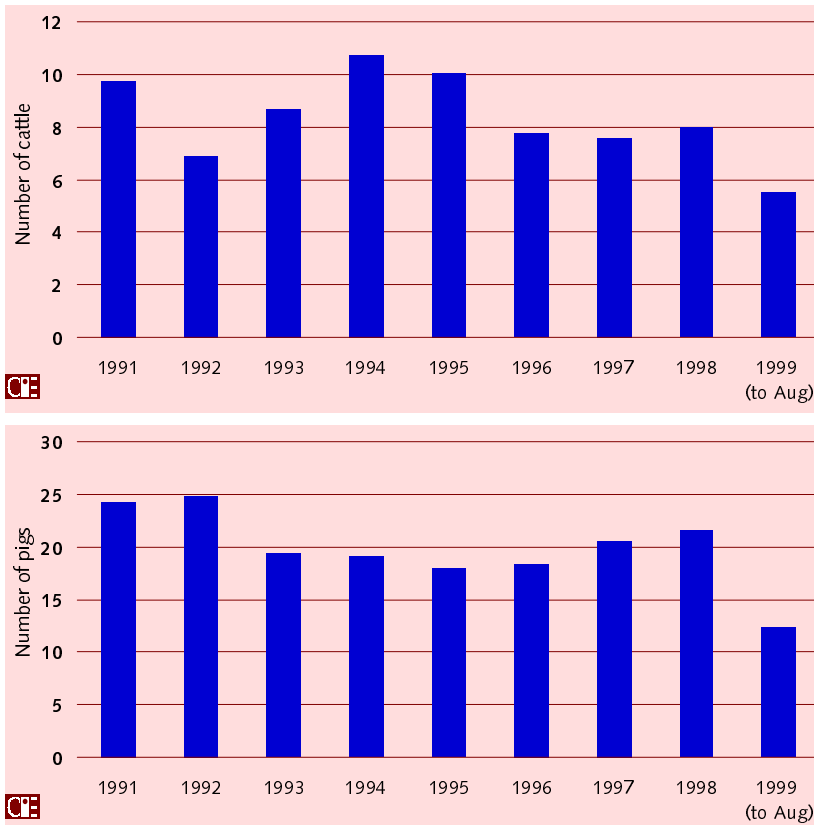
The number of cattle slaughtered by government abattoirs has fluctuated between 8000 and 10 000 per year over the 1990s (chart 3.2).

3.1 Red meat slaughter by abattoir, 1998



Data source: Livestock Development Corporation.

3.2 Cattle and pigs slaughtered, 1991–99



Data source: Livestock Development Corporation.

The average carcass weight of cattle slaughtered in 1998 was 209 kilograms, yielding 1667 tonnes of beef. For pigs, the average carcass weight was 47 kilograms, yielding 1013 tonnes of pig meat.

By Australian and New Zealand standards, Papua New Guinea abattoirs are extremely small. Their capital is old and rundown, and they are struggling to keep basic equipment in working order. Throughput is low and variable.

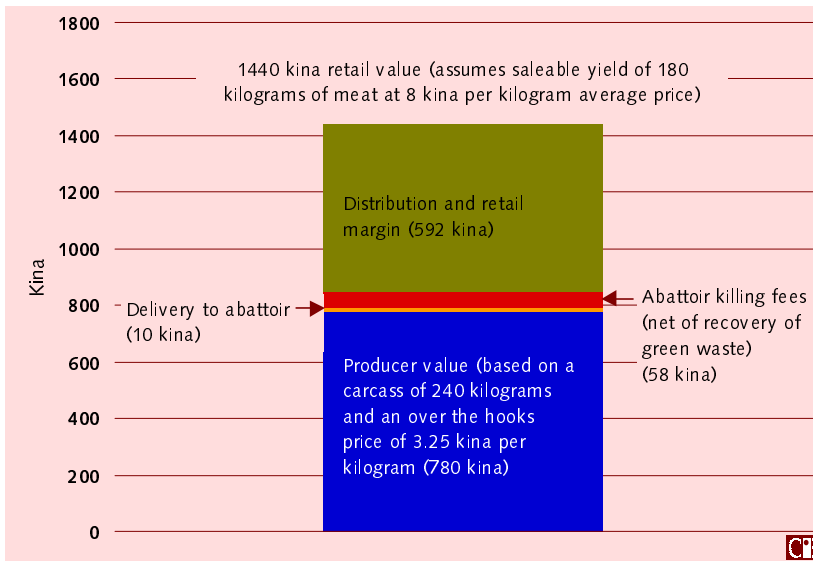
None of the government owned abattoirs have boning out facilities. Whole carcasses leave the abattoir. Carcasses are hung for varying periods of time at butchers and/or retail premises then broken down and sold. Byproduct recovery is poor at government abattoirs, which reduces the value of the animal. At Lae, for example, there is no longer a functioning rendering plant (though 'green waste' is sold at the abattoir gate). None of the abattoirs is accredited for exports. As a result, all parts of a carcass must be absorbed on

the domestic market. This invariably leads to price discounting of some cuts, reducing the value of the carcass and hence the producer price of cattle. And, without export accreditation, canned beef which uses domestic products cannot meet export market requirements.

Despite these shortcomings, the government abattoir sector is not at present constraining the expansion of the cattle industry. The abattoirs are under-utilised. They could accommodate a significant expansion in cattle production without new investment, though more attention would need to be given to maintenance of existing plant. Slaughter fees of 58 kina per animal are not excessive as a share of producer value of a carcass (around 800 kina) — see chart 3.3.

There are also several private abattoirs. Ramu Sugar has constructed a modern abattoir, complete with boning out facilities, storage space and full byproduct recovery systems, and another is planned as part of the Vanimo project. The major economic problem for the Ramu abattoir is insufficient cattle throughput. The Ramu abattoir has the potential to process 40 000 head per year, but the 1998 kill was only 3500. Unlike the government abattoirs where the capital costs have long been written off, a new private abattoir must generate a return sufficient to cover both capital costs (including a return on that capital) plus current operating costs. Unless high

3.3 Abattoir costs in a typical cattle–beef value chain October 1999



Data source: Figures provided by Papua New Guinea cattle producers.

rates of capacity utilisation can be achieved, modern private abattoirs are unlikely to be economic.

The issue of how best to supply the cattle industry with abattoir services over the longer term needs careful consideration. Cattle producers, processors and retailers require that slaughtering and boning room costs be kept as low as possible relative to the value of the product. To achieve this requires high capacity utilisation, high byproduct recovery and export accreditation to maximise sales flexibility and value. Abattoir owners (whether they are producers, processors or government) require that returns (slaughter costs charged or imputed) be sufficient to cover operating costs, depreciation and a commercial return on capital invested. The industry cannot continue to run down public sector slaughtering capital indefinitely. Slaughtering must be seen as a profitable activity for it to attract and maintain facilities of the required standard to service the industry. Failure to achieve this will eventually lead to the demise of the local cattle industry to competition from imported beef.

Abattoirs are expensive. They can only be economic if they achieve a large throughput of cattle. The ideal solution would seem to be a few strategically located modern abattoirs, each achieving a high rate of capacity utilisation. There is little evidence that this ideal situation will occur through market forces. And Papua New Guinea's geography is unfavourable to such a situation. Because of the highly dispersed pockets of cattle production and the poor or non-existent transport infrastructure connecting them, it is difficult to achieve effective utilisation of abattoir capacity. This in turn will severely constrain the economic development of cattle production in some regions.

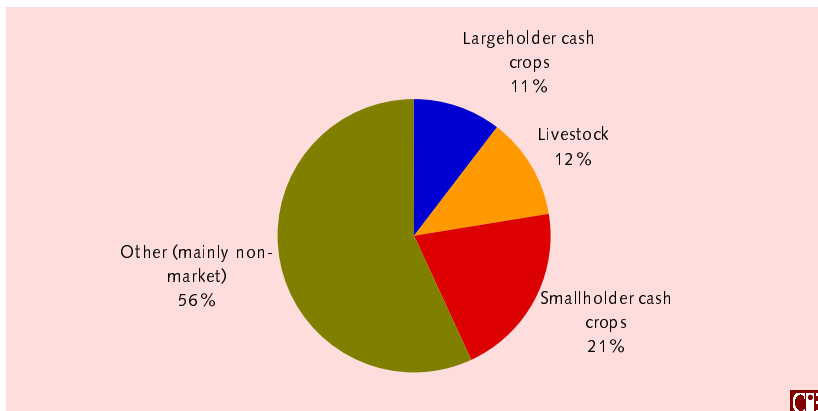
Major beef exporting countries such as Australia and the US are moving toward fewer larger abattoirs as a means of achieving economies of scale and reducing slaughter costs. With impediments in road transport systems it is economic for cattle to be transported larger distances to slaughter. But this option is not practical for Papua New Guinea, where the challenge is to achieve efficient utilisation of small scale abattoirs. In this context, producers at Sialum are now questioning the economics of slaughtering at the local abattoir and distributing beef from it. A more cost efficient alternative for these producers might be to ship live cattle by barge to Lae for finishing and slaughter.

There are various plans within government to build new abattoirs in regional centres. One such plan involves a new abattoir for New Ireland (Namatanai) to supply meat for Lihir (Thorold 1999). But there is no evidence of sufficient cattle production potential to allow for economic operation of such abattoirs.

4 Meat production

AGRICULTURE (INCLUDING LIVESTOCK PRODUCTION) accounts for about 25 per cent of national income (GDP) and occupies about 80 per cent of the workforce. Agriculture is dominated by smallholders producing food crops and tree crops. Livestock (mainly pigs and chickens) are raised for customary reasons, food and cash. There is no tradition of ruminant livestock grazing systems. These were introduced by early white settlers and missionaries. Chart 4.1 shows that commercial livestock value added represented about 12 per cent of agricultural GDP in 1998.

4.1 Livestock in agricultural GDP, 1998



Data source: Estimates provided by DAL.

Livestock production includes beef cattle, poultry, pigs, sheep and goats. The availability of official statistics on livestock production has diminished greatly since 1990. The following estimates are derived from a range of sources including official Papua New Guinea sources, the Food and Agricultural Organization (FAO) and industry officials.

Cattle numbers

Estimates from a variety of sources suggest that Papua New Guinea has about 500 000 hectares of natural grasslands suitable for cattle production. About

78 000 hectares of this is in Morobe province, 43 000 hectares in Madang province and 55 000 hectares in Central province. The development of a commercial beef cattle industry was actively encouraged by the Australian Administration after World War II.

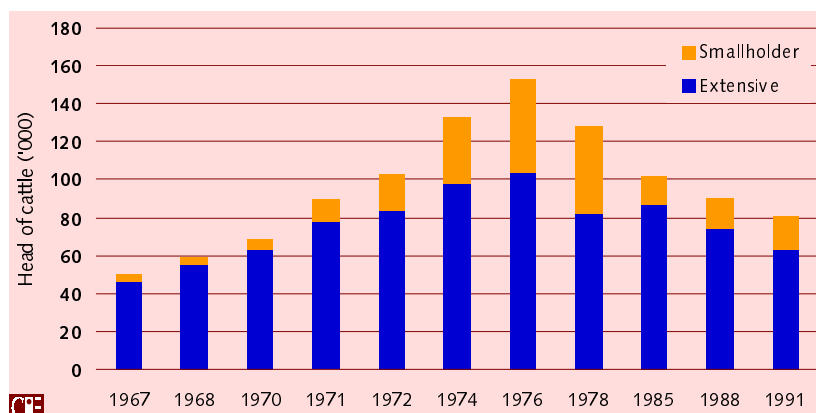
In the early 1950s the Beef Cattle Research Centre was established at Erap in the Markham Valley, four breeding centres were established and various input subsidies were introduced to encourage production. Production began on largeholder ranches alienated by the administration and leased to expatriates. Expansion was initially successful. By the early 1960s the Markham Valley had ten privately owned ranches, with the Morobe district accounting for about 40 per cent of Papua New Guinea cattle. By the end of the 1980s there were around 30 ranches producing more than 90 per cent of the country's beef.

In the early 1960s a World Bank report endorsed and provided funding for smallholder cattle development. The government supported this development through a major expansion in extension training and research into genetic improvement, animal production and nutrition, and pasture improvement issues.

Loans from the Papua New Guinea Development Bank were also instrumental in financing beef production between the late 1970s and 1983, though developments funded during this period experienced a high failure rate over the next decade.

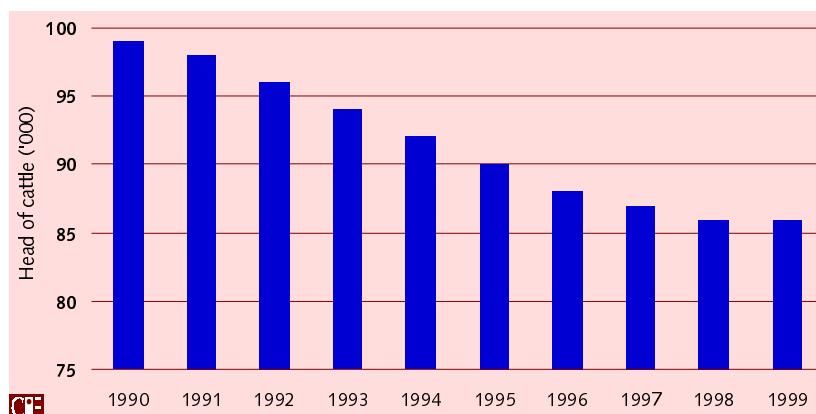
Cattle numbers peaked in 1976 at around 153 000 head with more than 1000 smallholder projects running a total of 50 000 head (charts 4.2 and 4.3). They have since declined sharply in both largeholder and smallholder sectors. By 1991 cattle numbers had fallen to around 80 000 with less than 20 per cent on smallholder farms. Accurate estimates of cattle numbers are no longer collected. Current estimates by beef industry personnel suggest a national herd of between 75 000 and 90 000. About 80 per cent of these cattle are on largeholder properties occupying 113 000 hectares of grazing land. The remainder are on 550 smallholder farms on 78 000 hectares of grazing land.

4.2 Cattle numbers are declining



Data source: Estimates from Sue Low.

4.3 FAO estimates of cattle numbers



Data source: FAO statistical database.

The decline in cattle numbers is generally attributed to:

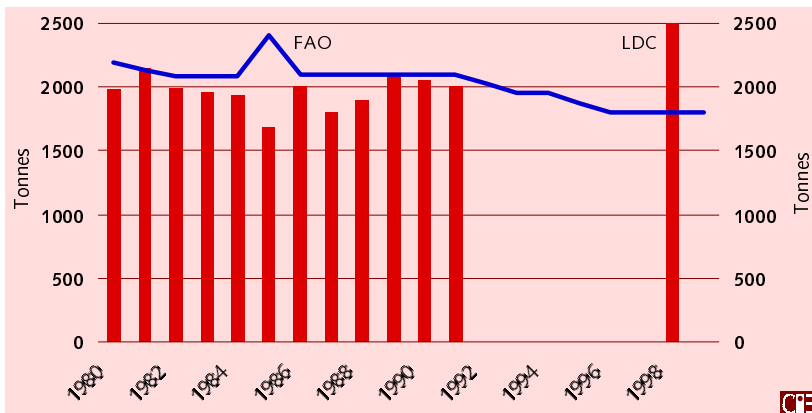
- poor management and poor skills in animal and pasture management on both largeholder and smallholder properties, which resulted in low animal and pasture productivity;
- the withdrawal of government support, particularly extension support to smallholders who lacked experience in cattle production;
- ownership disputes because of uncertainty of land tenure;
- poor financing arrangements with loan repayment periods too short;

- increasing law and order problems, which made it difficult to secure grazing animals; and
- better returns from alternative enterprises.

Beef production

Estimates of beef production from LDC and FAO are shown in chart 4.4. These estimates suggest that annual production has been virtually static for the last two decades at around 2000 tonnes, though production appears to have increased in recent years through a higher turnoff rate and higher carcass weights. LDC estimates for 1998 suggest between 11 500 and 11 800 cattle killed with average carcass weights of about 200 kilograms per cow and 220 kilograms per steer. This gives about 2500 tonnes of beef (carcass weight equivalent or cwe), yielding about 1200 to 1300 tonnes of beef on a retail weight basis.

4.4 Beef production in Papua New Guinea



Data source: LDC; FAO.

These estimates do not include slaughter of cattle for the Sing Sing market. Such slaughter is illegal and goes unrecorded. If we assume that 10 per cent of largeholder production and 30 per cent of smallholder production is sold for cash at the farm gate for the Sing Sing trade, then total production in 1998 is estimated at about 2860 tonnes.

Productive performance

Cattle are grazed on both native grasses and improved pastures. Tropical pastures are generally of low quality with low nitrogen content, high fibre

content and low digestibility. Growth rates on native pastures are very low — around 0.1 to 0.2 kilograms live weight gain per animal per day. Extensive research has been undertaken (in Papua New Guinea and elsewhere) into the performance of improved species of grasses and legumes and how they should be managed to maximise animal performance. The results suggest live weight gains of around 0.7 kilograms per animal per day can be achieved on improved pastures.

Pasture improvement is expensive. While there has been substantial investment in improved pasture species on the larger properties, there remains considerable scope for further investment and for the adoption of better grazing management of improved pastures. The payoffs in terms of increased meat production from supplementary feeding to improve animal nutrition are known to be large. Papua New Guinea has an abundance of cheap and effective supplementary feeds from agroindustrial byproducts — molasses, copra meal, oil palm kernel cake, millrun and brewers grain. These are currently greatly underutilised by the beef cattle industry, with most being exported as stock feed. The critical need is not for more research, but for a wider dissemination and higher rate of adoption of the results from completed research.

There is little hard evidence on the productive performance of the cattle herd. Information on performance indicators is not collected from the industry. The overall impression is one of low, though improving, productivity — turnoff rates are increasing and age to reach slaughter weight is declining. These improvements are usually on the largeholder ranches; improvements on the smallholder ranches are limited.

- Herd fertility is low — between 50–60 per cent.
- Calf survival percentages are low — only about 50–60 per cent of calves born are reared to maturity, with losses from wild dogs being a major problem.
- Average growth rates of weaner cattle are low and time to reach slaughter weight is long — less than 50 per cent of steers reach the desired slaughter weight of 220 kilograms by three years of age under rangeland conditions.

Most cattle are brahman and brahman-cross. After years of inbreeding, much of the herd is urgently in need of genetic improvement for it to achieve a higher productive performance.

The industry would benefit greatly from the recording and dissemination of performance indicators such as fertility rate, calving rate, calving interval, percentage of calves reared to maturity and carcass weight by age. Such information would allow individual producers to benchmark their

performance as well as providing a guide to movements in overall industry performance.

Sheep meat production

German settlers brought sheep to Papua New Guinea in the late 1800s as a source of meat. It is thought that these animals were possibly of Javanese origin. Imports of sheep of European breeds occurred before World War II.

In 1975 the New Zealand Bilateral Aid Program (now the New Zealand Overseas Development Agency or NZODA) began a project to support sheep industry development. The project ran until 1996 and involved expenditure of around NZ\$15–18 million. The objectives of the project were to:

- develop an alternative income source for smallholders
- improve the nutritional status of village people
- generate income earning potential for women through use of byproducts
- provide a means of import substitution.

More than 3000 animals were imported from New Zealand under the project. The imported animals were located at Menifo Sheep Research Station in the Eastern Highlands province. Initial problems occurred with reproduction due to the different day lengths found in tropical regions. A major crossbreeding program was then established with the aim of producing a suitable dual purpose animal for meat and wool. The crossbred that was developed was known as the 'Highland halfbred' (HH).

The aid program also provided a manager for Menifo Research Station, training programs in New Zealand for staff and farmers, a sheep training officer based at the Highlands Agricultural College, project vehicles, payroll support and many other extension and development inputs. Three Department of Primary Industry (DPI) centres acted as multiplication sites and distribution centres of breeding stock to provincial and district centres. These provincial centres were to be the suppliers of stock to the smallholders.

In 1992 it was estimated that there were more than 1800 sheep on government and provincial stations and more than 10 000 sheep in the country. Around 8000 head were on smallholder properties. Lambing percentages on the government stations averaged 86 per cent and weaning percentages varied from 56–85 per cent. More than 500 animals were distributed in 1990, 1449 in 1991 and 719 in 1992 from these centres. The low numbers distributed reflected general poor management on the stations, with losses between 30–40 per cent occurring from deaths and stealing.

The New Zealand sheep had a number of problems from the outset in addition to low reproduction rates. Animals suffered from major internal parasite burdens and were highly susceptible to footrot, causing lameness. Low quality feed was a major problem, especially for the imported breeds. The HH appeared to be more tolerant of poorer feed. Pasture improvement was not feasible without available credit. Initially, lambing percentages were below 35 per cent, but improved management and feed quality has raised this to close to 100 per cent. Weaning percentage is now around 62 per cent, with substantial losses due to dog attacks and screwworm.

A 1989 review reported that:

- sheep are suited to the highlands of Papua New Guinea;
- meat production is of high priority, while wool is low priority;
- sheep production is suitable for smallholder farmers provided the level of management is adequate;
- industry growth to this point of time is inadequate for meeting requirements for breeding stock; and
- the HH is more suitable for the highlands than coastal areas.

The review concluded that the project had only moderate success in meeting its objectives. The growth in sheep numbers could be attributed directly to imports rather than to increased domestic capacity. Production of breeding animals through the provincial livestock centres was expensive with stock costing between PGK500 and PGK1000 per head. Extension services failed to provide the smallholder with required support and advice due to inability to define problems and develop strategies as well as too few resources. Farmers trained in New Zealand were unable to adapt knowledge and practices to the Papua New Guinea situation. Further training schemes were considered inappropriate. There was no real market for wool and the development of local cottage industries was slow. A financial study at that time revealed that sheep farming was of doubtful viability.

Further funding since 1989 was directed to the development of in-country training and the development of extension packages for smallholders by officers of DAL. NZODA also encouraged the development of large scale private commercial farms as the government farms had not been able to make much impact on sheep numbers after a period of 18 years.

Experience from the project (Milligan 1999, personal communication) was that flocks of less than ten ewes were not physically viable, although they could be profitable. Larger, semi-commercial flocks (30–50 ewes) were physically and financially viable. Sheep could attract high prices from the ceremonial (non-commercial) markets (up to PGK120–150), especially in the coffee season. But problems with footrot have continued.

The project was terminated in 1996 after problems with the implementation of a number of NZODA proposals. Lack of cooperation by DAL in the establishment of commercial operations contributed to the termination.

The 1994 government *White Paper on Agriculture* supported privatisation of breeding and distribution centres. In addition, the government provided policy statements that supported the selection of additional tropical breeds suitable for village farming systems and aimed to increase the number of sheep within village farming systems.

Sheep meat imports have risen dramatically since the inception of the project with more than 35 000 tonnes being imported annually in 1997 and 1998. Sheep numbers are believed to be stable at around 10 000 head. Sheep meat production is believed to be around 15 tonnes per year. It is unlikely that the sheep industry will make a significant contribution to meeting Papua New Guinea's red meat requirements.

Goat meat production

Goats were introduced into Papua New Guinea along with sheep and other domestic livestock in the late 1800s as a source of meat. Further imports occurred after World War II. Goats were distributed to missions and small village communities. Government support for a goat industry has always been lacking, partly due to perceived environmental problems.

In 1985 goat numbers were estimated at around 5500, with most (3500) in Simbu province. Goat meat production is considered to have greater potential than sheep meat production.

- Goats are able to do well on lower quality feeds including browse (shrubs and bush) and do not require improved pastures.
- They tend to be more prolific, even under poorer nutritional regimes, producing more twins than sheep.
- They are less susceptible to internal parasites (partially due to their tendency to browse above ground level) and footrot than sheep.
- They fit into village lifestyle more easily than sheep and can be handled by women and children.
- They are suited to a lower level of management than sheep and are often able to escape predation because of their speed.
- They could be used to produce milk and improve nutrition of village children.
- Goat meat appears to be readily accepted as a protein source and could readily substitute for sheep meat.

Herd numbers vary, with many owners having more than 50 goats. In 1985 a project in the Sialum area had more than 100 head. Management in many areas involved free range grazing. Tethering was practiced in some areas due to the threat to gardens. In 1985 perceived problems with goats included high kid mortality (due to predation and chill factors), poor milk production (due to poor nutrition) and low turnoff rates (as a consequence of high kid mortalities).

Goat meat is easily sold and seems to be preferred in many areas despite its low fat content. Demands for breeding animals are high and goats are being accepted into villages as part of the social structure, as well as part of a livestock production system. This is more apparent in areas where the Seventh Day Adventist religion is strong. This religion does not accept the pig as a food source, nor does it allow its followers to have any contact with pigs. As a result, the goat seems to be taking the place of the pig in the traditional value system.

Serious study on the potential of goats in Papua New Guinea has not taken place. There has been some research projects looking at reproduction rates, but no real attempt to look at the goat as an industry. Goat production seems to have grown due to local interest and to religious direction. In 1987-88 a program at Bena Bena aimed at improving the genetic base of goats began imports of bucks from Australia and New Zealand. Distribution of goats (as with sheep) from this program has been through the Village Livestock Development Project (VLD), but has been limited by the lack of credit facilities for such projects. The project was not considered a success because of low production attributed to poor feed and high mortality due to internal and external parasites.

Estimates in 1992 were that, in spite of no government support, there were approximately 17 000 goats in the country (double that of sheep), with more than 90 per cent being held by smallholders. The *White Paper on Agriculture* (1994) included goats in with 'other livestock species', yet noted that goats have an important role in village farming systems. In this paper the government stated its commitment to the establishment of an identified genetic base and introducing production recording for the purpose of increased genetic gain. A drive through the Eastern Highlands province in 1999 saw many villages with goats free ranging along the roadside; very few sheep were seen. The goats appeared to be in good condition and either pregnant or with kids at foot. The FAO estimated goat meat production in 1998 to be 9 tonnes. This estimate looks low when compared to the number of goats.

Goats have proven to be suitable for village agriculture and have the ability to produce meat and milk for local consumption. Animal numbers are too low to

expect any impact on meat imports. Further investigation of goat production in Papua New Guinea is warranted.

Poultry meat production

A modern commercial poultry industry has grown up since the early 1980s under an umbrella of protection from competing imports (there was initially an import ban, which in 1992 was replaced by a high specific tariff). A smallholder scheme based on rural villagers within a certain radius of the parent poultry company growing out the broilers on their own land has been the backbone of this growth for the largest company (Niugini Tablebirds). The products enter the Papua New Guinea frozen and fresh chicken market.

Under the smallholder scheme, growers initially erect simple sheds for broilers. The company sells day old chickens and feed to the growers with a promise to buy back fully grown chickens for processing. Upon processing, the grower receives the net proceeds from the price to the processor less the cost of feed, chickens and services. The company also supplies extension officers to teach growers the most modern methods of growing chickens.

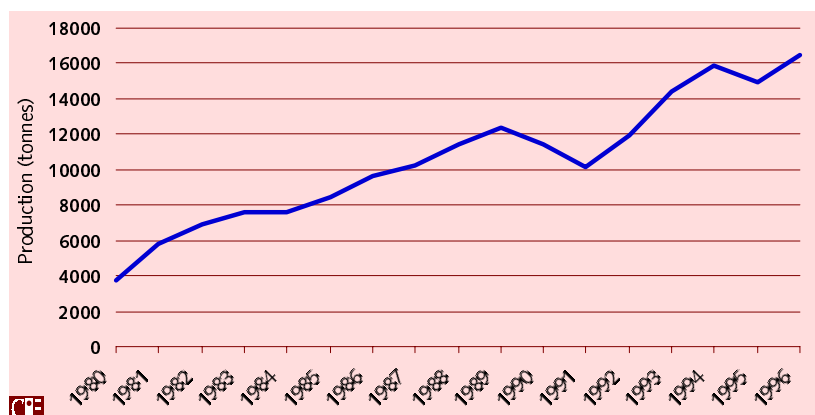
The company may subsequently recommend to the Rural Development Bank that a grower be given a loan to build a larger and more substantive shed. The company becomes loan guarantor and deducts loan repayments for the bank before profits are distributed. There are now more than 250 smallholder growers.

In addition to the fresh and frozen commercial chicken market there is an ever increasing demand for day old chickens to be grown by villagers for fresh meat. At present, around 120 000 live day old chickens are sold per week in lots of 50–1000. These chickens are sold as live chickens at local markets for between 10 and 14 kina each. Production from this source is estimated to match the commercial production of frozen chicken.

A third source of poultry meat production is village bred chickens for subsistence consumption. An Asian Development Bank estimate in 1989 put the number of village free range chickens at 1.5 million. Assuming that on average one village chicken of 0.8 kilograms carcass weight is consumed each month by each family (600 000 families), poultry production from this source could amount to 5760 tonnes per year.

Estimates of poultry meat production by processing companies are shown in chart 4.5. If we add to frozen chicken production, production of fresh chicken by villagers growing out day old chicks and subsistence production from village free range chickens, total poultry production could be in the order of 45 000 tonnes per year.

4.5 Poultry meat production by processing companies



Data source: Poultry Industry Association.

Pig meat production

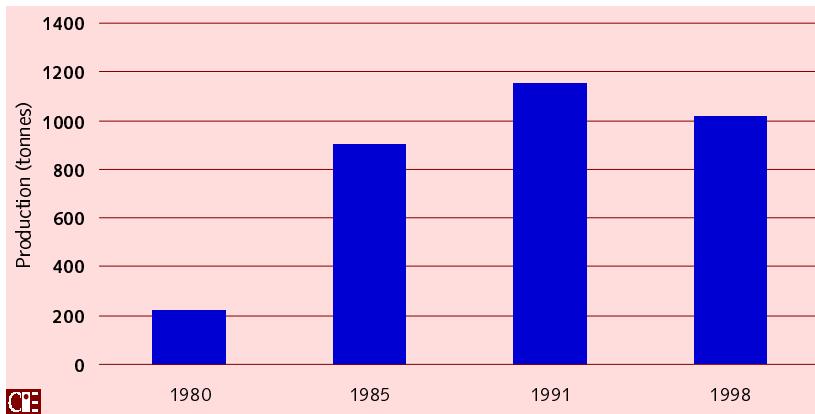
Pigs are of major cultural significance in most tribal groups, but particularly in the highlands where they are used in exchanges as well as for feasting. Village pigs are good scavengers and represent a significant though underutilised source of meat protein. Under the colonial administration research was conducted to improve the genetics and feed utilisation of village pigs, but this ceased in the early 1980s with the emergence of a commercial pig meat industry.

Village pig numbers are estimated to be between 1.5 and 2 million. There are no estimates of annual production of village pig meat. If we assume a turnover rate of 10 per cent with an annual carcass weight of 30 kilograms, annual production from this source would be between 4500–6000 tonnes.

A commercial pig meat industry developed rapidly under a ban on pig meat imports introduced in 1983. The industry is based around a small number of large scale piggeries (Pelgens, Rumion and Koita – Ora Boroma) located on the outskirts of the major cities. Production is based on commercial feed formulation and strains of imported pigs with high feed conversion ratios. The industry has a high dependence on imported feed.

Production grew rapidly from 1983 (chart 4.6) before stabilising in the early 1990s at between 1000–1200 tonnes per year. Although Papua New Guinea is virtually self-sufficient in pig meat, this reflects protection against imports rather than any comparative advantage in production.

4.6 Commercial pig meat production



Data source: Livestock Development Corporation.

Production of canned meats

Papua New Guinea has a long history of canned meat production involving canned beef and canned fish.

Canned beef

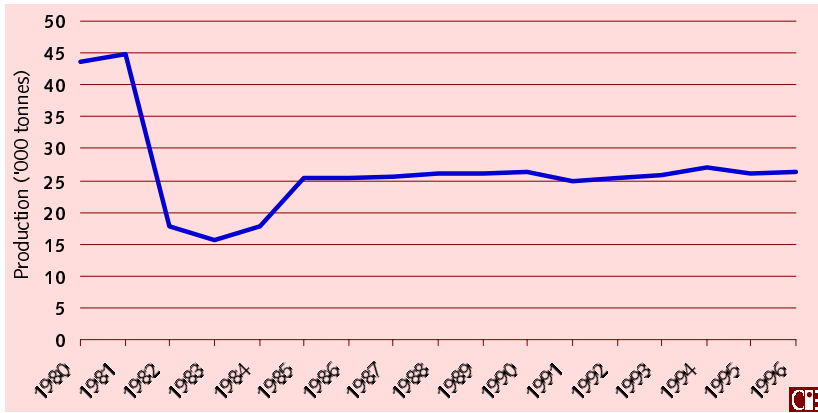
The canned beef industry is highly dependent on imported beef and imported cans, both of which enter duty free. Value added from this activity is low.

Of the 8900 tonnes (shipped weight) of beef imported into Papua New Guinea in 1998, 87 per cent was brisket and trimmings, which are the main cuts used for canning. About 10 per cent of the beef used by the two canneries is higher quality cuts from cull cows and bulls. The local industry supplies about 800 tonnes of beef per year to the canneries. About 70 per cent of beef imported into Papua New Guinea is for use by the canneries.

Canned fish

We were unable to obtain estimates of local production. About 15 000 tonnes of fish are believed to be imported each year for canning. Fish caught locally are also canned.

4.7 Estimates of fish production



Data source: FAO.

Fish production

Papua New Guinea is rich in fish stocks. Subsistence coastal fisheries are an important source of animal protein for coastal villages. There is a small onshore coastal fishery and a large offshore fishery dominated by tuna taken by foreign boats. A foreign owned tuna export processing facility began operations in 1997.

FAO statistics (chart 4.7) show domestic production of fish of 26 200 tonnes in 1996, of which 25 591 tonnes were consumed locally.

Rabbit production

A village based rabbit production scheme recently commenced. It is estimated that there are currently around 1800 rabbit farmers located in village schemes. The meat is either consumed within the village or traded for other items. The scheme shows great promise as a source of cheap meat protein at the village level, but production to date is negligible.

Opportunities for boosting beef production through live cattle imports

Beef production can be increased at a faster rate than that achievable through the domestic breeding herd by imports of feeder cattle for fattening in feedlots before slaughter. Since the early 1990s, a number of Asian countries — in

particular, Indonesia, the Philippines and Malaysia — have developed substantial lotfed beef industries based on imports of live cattle from northern Australia — which is virtually the only suitable source of such cattle.

In 1996-97 live cattle exports from Australia reached 858 000. About 50 per cent of these went to Indonesia, 28 per cent to the Philippines and 8 per cent to Malaysia. Considerable infrastructure development has been undertaken in Australia and importing countries — handling yards, port facilities, dedicated live cattle ships — to handle the trade efficiently. Northern Australia pastoral systems have been revamped to produce even lines of animals of the required breed, weight and age specification. The information networks — brokers, agents, etc. — to support the trade have also developed significantly.

Beef production through live cattle imports operates on fine margins. Key determinants of these margins are:

- the Australian price of live cattle, which depends on the buoyancy of north Asian and north American markets for beef;
- the exchange rate with the Australian dollar;
- transport costs from Australia;
- the tariff equivalent of border arrangements including any tariffs, import licence fees and quarantine compliance costs; and
- the cost and conversion efficiency of feed in the feedlot.

Purchased input costs represent a high proportion of the ex-feedlot value of the fattened animal. As a consequence, small changes in input costs can have a big effect on the profitability of the activity. For these reasons, capacity utilisation in feedlots varies substantially over time with feedlots often closed for substantial periods when prices, costs and exchange rates are unfavourable.

A proposal has been developed to establish a beef production enterprise at Vanimo based on imports of live cattle from northern Australia. Project planning is well advanced with a market survey and feasibility study undertaken and financial support for the project currently being sought. The National Executive Council has now approved the project. The project represents a welcome innovation from outside for the Papua New Guinea beef industry. It contains a good deal of lateral thinking and has thrown down a challenge to existing practices and performance in the beef industry. Even if the project does not proceed to implementation, it will have left its mark on an industry urgently in need of new ideas and performance benchmarks, and a shake up of how things have been traditionally done.

The proposal involves a feedlot with about 4000 head capacity buying two year old steers at a feedlot entry weight of 230 to 300 kilograms, turning off

about 1000 finished cattle per month at around 400 kilograms after about 90 days on feed. The feedlot is planned as a virtual quarantine station. Feed will be based on forage grown in the region by local villagers and mission stations. A modern abattoir will be built to USDA standards. All parts of the carcass will be utilised — primal cuts, secondary cuts, high protein byproducts for human consumption and byproducts for other uses.

The Vanimo project seeks to maximise the value of all parts of the carcass through byproduct recovery and through sales to an array of market segments in Papua New Guinea and overseas. Current estimates are 20 per cent of production to be sold on the domestic market and the remaining 80 per cent to be exported. Existing processing facilities in Papua New Guinea cannot achieve this for several reasons.

- They do not have USDA accreditation, which effectively precludes export sales. The wider the array of market segments available, the less the need for discounting to shift all cuts from the carcass.
- Most abattoirs do not have boning out facilities.
- Byproduct recovery is invariably low at government owned abattoirs.

However, the project may also entail competitive disadvantages relative to beef production enterprises using Papua New Guinea bred feeder steers. There are two key sources of potential disadvantage.

- The first relates to the cost of obtaining feeder steers from Australia into the feedlot after the Australian purchase price in kina, the costs of transport and quarantine, and other entry costs have been met. To the extent that these costs exceed the cost (value) of equivalent Papua New Guinea bred feeder steers, the commercial attractiveness of the project will diminish.
- The second relates to the cost of slaughter. A new, privately funded abattoir to USDA standards will need to show a commercial return on that capital. This will require a large and continuous throughput of cattle for slaughtering costs per animal to be minimised. Slaughter costs for existing producers are already low. This reflects the rundown state of government owned abattoirs — capital costs have already been written off so charges need only cover current costs — and the lower priority government ownership assigns to commercial returns.

5 Government policy toward the beef industry

THE GOVERNMENT INFLUENCES LIVESTOCK industry development through a number of avenues:

- its institutional arrangements through which it expresses its general policy stance toward agricultural development;
- its trade policy stance — in particular, the barriers it erects to imports of competing meats and barriers to imported inputs to production;
- provision of infrastructure, particularly processing facilities and transport;
- support for and involvement in research and development (R&D); and
- provision of extension services and other input assistance such as concessional credit facilities.

Under current arrangements policy and planning matters for agriculture are the responsibility of the Department of Agriculture and Livestock (DAL), which reports to the Minister for Agriculture. There is little support within DAL for the beef industry, a situation that has existed for many years. DAL owns a research station formerly known as the Beef Cattle Research Centre at Erap, though it is thought that this is soon to be handed over to the National Agricultural Research Institute (NARI). However, beef cattle research is no longer undertaken at Erap. The centre is currently being used as headquarters for a grains and rice project and the FAO Food Security Program. Although DAL traditionally had responsibility for agricultural extension, this responsibility has over the last ten years been passed to provincial administrations who in turn have outsourced it to private providers.

Responsibility for public research into agriculture has now passed to NARI. NARI was created in 1997 with AusAID funding to research agricultural production and resource management issues with a particular emphasis on production technologies for smallholders. Since its existence, NARI has faced a funding crisis and has not had much opportunity to 'put runs on the board'. Proposed funding for 2000 does not allow for any real change in the status quo. NARI has no research agenda for livestock in general and in particular the beef industry at present.

Responsibility for livestock quarantine issues rests with the National Agriculture Quarantine and Inspection Authority (NAQIA), which was established in 1997. This responsibility was previously handled by DAL. NAQIA has a user pays policy to fund its operations. Prospective importers of live cattle for breeding and for lotfeeding purposes must pay all the costs incurred by NAQIA in ensuring that such cattle involve minimum risk of introducing harmful pests and diseases.

The Livestock Development Corporation (LDC) was created as a corporatised entity in 1991 to undertake government functions of livestock breeding and abattoir operations. The LDC has since sold off its breeding centres, though it continues to run two commercial abattoirs on a cost recovery basis. (The Madang abattoir was recently closed.) Apart from this, the LDC plays no role in livestock production. In fact, it seems more interested in horticulture development.

The government receives advice on agricultural policy matters through the Rural Industries Council (RIC). RIC consists of a grouping of nine Papua New Guinea growers' associations. Beef industry issues are represented by the Papua New Guinea Cattleman's Association. The Poultry Industry Association is also represented on the RIC. RIC's role is to raise the profile of agriculture in Papua New Guinea, especially at the government level.

Chart 5.1 shows the links between these organisations.

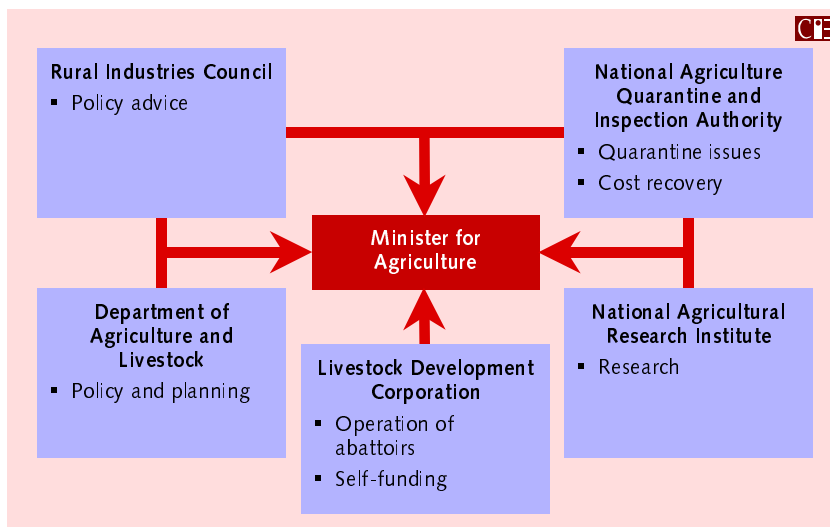
Trade policy toward beef

The government has used tariffs, temporary import quotas and bans on imports to foster the development of livestock industries. The extreme example is the poultry meat industry, which grew rapidly under a ban on imports introduced in the early 1980s and converted to a prohibitive specific tariff in 1992. Tariffs on competing meats have fluctuated somewhat from year to year. A new tariff regime was introduced in July 1999 (table 5.2).

This tariff regime still provides substantial encouragement to poultry production relative to production of competing meats. And the tariff of 30 per cent on beef compared with zero on sheep meat encourages (imported) sheep meat consumption at the expense of beef consumption.

Beef industry development has been hindered by high tariffs (55 per cent), inflating the cost of key inputs such as star pickets and barbed wire. In July 1999 these tariffs were removed. Yet, in October 1999, all cattle producers interviewed believed that these high tariffs were still in place.

5.1 Institutional arrangements



5.2 Current tariffs on competing meats

Product	Unit	Tariff rate
Beef	%	30 ^a
Sheep meat	%	0
Goat meat	%	0
Pork	%	30
Poultry	PGK/kg	3.15 (tariff equivalent around 70 per cent)
Meat for canning	%	0
Canned fish	%	30–70

^a Under the Melanesian Spearhead Group Agreement beef from Vanuatu can be imported duty free. Small quantities of beef are imported from Vanuatu from time to time.

Source: Internal Revenue Commission.

Infrastructure provision

The sparse road system and the poor condition of some roads results in considerable difficulty and cost in getting cattle to abattoirs. It also makes it difficult to have a few strategically located abattoirs, each operating at sufficient throughput to keep unit costs down. The high cost of coastal shipping services also makes it expensive to get copra and oil palm expeller to the key cattle producing regions.

There are no easy solutions to these problems. Freight subsidies are not the answer — they must be paid for somehow and by someone in the economic system. The long term solution is to bring about a higher rate of general economic growth — which in turn will justify, and be accompanied by, road network development.

The abattoir ‘problem’ should be viewed as a comparative disadvantage the beef industry must live with at this stage of the country’s and industry’s development. It is unrealistic to expect governments (or aid donors) to fund the construction of regional abattoirs with no thought to recovery of the capital costs involved. There is, however, considerable scope for achieving a better utilisation of existing abattoir capacity (both LDC and privately owned) and cost effective improvements to LDC abattoirs through closer cooperation and planning between the producing and slaughtering and processing sectors, and government.

Support for R&D

NAR has recently reached agreement with DAL to take over responsibility for R&D into large livestock. This will provide an institutional base for beef industry R&D but will need funding. There are no institutional arrangements within the industry (such as producer and processor levies) to help fund industry R&D. An agreed beef industry research strategy will need to be developed with planning and prioritisation of industry research needs.

As noted earlier, the Beef Cattle Research Centre at Erap no longer functions as such. Responsibility for public research into agriculture has now passed to NARI. NARI was created in 1997 with AusAID funding to research agricultural production and resource management issues with a particular emphasis on production technologies for smallholders. Since its existence, NARI has faced a funding crisis and has not had much opportunity to ‘put runs on the board’. However, NARI has no research agenda for the beef industry at present.

With the government having effectively withdrawn from R&D funding and provision, the industry is dependent on donor funds and privately funded research to meet its research needs. There are only two current research projects as follows.

- The ACIAR leucaena project — ‘New leucaenas for South-East Asian, Pacific and Australian agriculture’ (recently completed). This project looked at the suitability of various leucaena varieties for region specific livestock production (including resistance to psyllids).
- A study (nearing completion) of the suitability of signal grass (the major improved species of grass in Papua New Guinea pastures) for weaner

cattle. This study (being conducted by Sue Low as a PhD thesis) investigates the presence of plant toxins (steroidal saponins) in the grass, their effects on animal growth and some of the factors that might affect the presence and level of these toxins.

ACIAR is well advanced in planning of a project on biological control of *Sida* spp. with Ramu sugar. This project has application in pasture management.

There are a number of private development projects being conducted as part of livestock production systems on some ranches. An example is the work on cell grazing being conducted at Ramu.

Proposed research

NARI has not yet developed proposals for research into any red meat livestock, including beef. Traditionally, external donors such as the World Bank, the Asian Development Bank, the European Union and the Food and Agriculture Organization (FAO) have shown an interest in livestock R&D projects and have supported a number in the past. Country aid agencies such as AusAID and NZODA have also funded projects. But few proposals are currently on the table for beef. The FAO's Food Security Program (DAL, Erap) has proposed a PGK16.1 million project over ten years named Beef Cattle Industry Development. The project involves:

- genetic improvement through the establishment of a 'breeding farm'
- improvement of feed supply — pasture production and supplements
- veterinary services and disease surveillance
- upgrading and modernising slaughtering facilities
- extension services
- training of extension staff and farmers.

The proposal is currently under consideration and some consultation has been carried out with cattle producers about its content.

A proposal has also been submitted to ACIAR for a second leucaena project titled, 'Using leucaena to increase smallholder livestock production in the Markham and Ramu valleys'.

Trukai Industries, one of the largest cattle producers in Papua New Guinea, has proposed and set aside funding for a number of research programs including two beef production programs to operate from 2000 to 2005. These are:

- a pasture improvement program involving the use of demonstration sites to assess pasture and animal production and an investigation of the causes of liveweight loss in cattle during the dry season; and

- a bull import and exchange program — to increase the genetic potential of the national herd.

These programs are part of an agricultural research program including the areas of rice and peanut production, weed control, milling operations and machinery evaluation (24 projects in total).

A study team review (AIDAB (now AusAID) 1993) compiled a large number of cattle industry development projects identified by DAL for Australian assistance (box 5.3).

In addition to these proposals, the AIDAB report also lists a number of project proposals arising from field discussions (table 5.4).

The AIDAB report identified the following priority areas for assistance (table 5.5). Draft terms of reference for feasibility studies to develop projects in each of these areas were developed.

5.3 Projects listed by DAL in 1993 for Australian assistance

Project (tentative priority ranking)

- Rehabilitation of the Agriculture Quarantine Inspection Service.
- Develop–modernise the Lae abattoir.
- Rehabilitate run down private sector livestock companies.
- Improve animal health and extension delivery system at provincial level.
- Establish national institute of animal health and production.
- Support Papua New Guinea bovine tuberculosis eradication program.
- National scheme for staff education and training in livestock health and production.
- Establish national database management system for animal health and production at the National Veterinary Laboratory.
- Training of higher degree students in specialised animal health and production.
- Improved system for preventing clinical and subclinical disease of imported farm animals.
- National survey of domestic and wildlife for exotic and zoonotic diseases.
- Establish national tertiary education in animal health and production management at UPNG, Port Moresby.

5.4 Project proposals listed in the AIDAB (1993) report

Project	Type	Donor	Proposer
National Livestock Project (phase 3), beef cattle <ul style="list-style-type: none"> relocate Lae abattoir at Erap and modernise Port Moresby abattoir (both to export standard) train nationals to operate small butcher stores improve herd productivity (assist research and extension services to establish pasture research and extension services, set up national herd recording scheme, establish artificial insemination (AI) centre at Erap) 	Loan, TA	ADB, AIDAB	DAL
Mobile extension officers, cattle industry <ul style="list-style-type: none"> provide assistance to smallholder cattle projects in husbandry, management, mustering, marketing, branding, control of feral cattle and wild dogs train extension staff in cattle project management 	TA	AIDAB	Cattleman's Association of Papua New Guinea/DAL cattle group
Target 20: a five year research plan <ul style="list-style-type: none"> to improve cattle productivity by improving reproduction coefficients and nutrition, and to increase beef cattle numbers by 20 per cent within five years components involve effects of feed supplementation and reproductive efficiency of breeding cows, fodder tree – shrub legume evaluation and genetic improvement using AI 	na	Not stated	DAL, Erap
Beef cattle genetic improvement project <ul style="list-style-type: none"> establish national AI centre to improve cattle reproduction via high genetic sires 	Aid	AIDAB	DAL
Agriculture Quarantine Inspection Service <ul style="list-style-type: none"> strengthen capability by improving facilities and surveillance 	Aid, TA	AIDAB	DAL

(Continued on next page)

5.4 Project proposals listed in the AIDAB (1993) report (continued)

Project	Type	Donor	Proposer
Livestock information improvement <ul style="list-style-type: none"> ▪ to improve information on livestock husbandry to provincial extension staff 	na	na	DAL
Feral animal control and eradication <ul style="list-style-type: none"> ▪ assess problems of feral deer and control of buffalo 	na	na	DAL
Agriculture Quarantine Inspection Services <ul style="list-style-type: none"> ▪ disease monitoring on Irian Jaya border, staff development in veterinary field services, country animal health status database, control of feral cattle and buffalo, upgrade AI program 	na	na	DAL
Livestock (cattle) extension <ul style="list-style-type: none"> ▪ extension requirements, marketing system for smallholders, relocation and upgrading (to USDA standards) of Lae abattoir 	na	na	DAL
Animal nutrition research <ul style="list-style-type: none"> ▪ feedlot production using local feed sources 	na	na	DAL

Source: AIDAB (1993).

5.5 Priority areas for assistance in AIDAB (1993) report

Priority	Area
1	Enhancement of quarantine capacity
2	Rehabilitation of smallholder cattle projects
3	Coarse grains, village feeds, browse shrub and pasture research — Markham/Ramu
4	Agricultural census and database
5	Integration of livestock in sustainable agricultural production systems

Source: AIDAB (1993).

Of the projects identified and proposed in the AIDAB report, only the eradication campaign for feral animals, the creation of NARI and the quarantine enhancement project (involving the creation of the National

Agriculture Quarantine Inspection Authority or NAQIA) were put in place. Funding for NARI and NAQIA was withdrawn in 1998, one year after both began operating. Some funding was restored in 1999. The funding for NARI for 2000 is the same (1.8 million kina) as for 1999. This is only sufficient to cover skeleton staffing.

The ACIAR-Papua New Guinea consultation in October 1995 listed five priorities for animal production:

- farming systems development, particularly for red meat industries;
- pasture development;
- alternative feedstuffs;
- management (animal husbandry); and
- trade policies and marketing (domestic and international).

The present review of Papua New Guinea's red meat industry is designed to assist in shaping these priorities further.

Extension services

The very high reliance of smallholder producers on extension services and the inadequacy of current services are recurring themes in previous reports on livestock development in Papua New Guinea and in fieldwork discussions conducted for this study. An effective means of providing and funding extension services needs to be found for smallholder cattle production to prosper.

The era of large scale government provision of agricultural extension services through public sector employees is past. Governments no longer have the financial resources to fund them. And the public provision of such services to assist private enterprises is no longer seen as an appropriate role for government.

The new national government appears well aware of the need for a more extensive program of extension services to livestock producers and sees its role as facilitating the provision of such services through the establishment of a network of community providers (Minister for Agriculture address to the Papua New Guinea Cattleman's Association Forum in Lae, 11 October 1999).

Extension services to agriculture are currently being provided by a range of organisations employing different structures and methods. There is a need for a serious review of the best way to provide extension services to farmers.

Activities of the Smallholder Rural Projects Management Company (SRPM)

An example of a quasi-private provider of extension services is SRPM. SRPM was established in 1980 as a non-profit company by the Rural Bank as a means of improving the recovery of bank loans, principally for coffee in the highlands. It has since diversified into the provision of extension services and current services 125 cattle projects in the Markham Valley, Sialum and Menyamya.

The approach of SRPM is to focus on the farmer — developing his skills and business sense — as well as his enterprise. By contrast, the livestock development programs of the 1970s were enterprise based with little focus on the farmer and his potential.

In 1996 SRPM was contracted by the Morobe provincial government to implement the Morobe Provincial Rural Development Program. This program includes the implementation of smallholder cattle projects. SRPM receives its financial support from the Papua New Guinea Banking Corporation, the Morobe provincial government and management fees of PGK100 per client per loan year. While the SRPM model has shown promise as a means of achieving the private provision of extension services, the organisation is struggling to fund its activities.

Other providers of extension services

Various church missions provide an array of agricultural support services in specific areas. None appear to be designed specifically for cattle producers. They do, however, provide interesting models for how extension services might be provided. One prominent example is the Lutheran Development Service, which has developed and sponsors the Yangpela Didiman, a self-help movement began in 1973 (box 5.6).

The Smallholder Support Service Pilot Project (SSSPP)

The ADB has agreed to fund a pilot project (commencing in late 1999) to facilitate the establishment of contract agricultural support services in Morobe and the Eastern Highlands. The project aims to build on the capacity of organisations and individuals to provide these services.

5.6 Yangpela Didiman (YD)

- YD trains and maintains a network of volunteer development workers who serve as contacts in bringing new or updated information into village agriculture. The priority is to develop sustainable subsistence farming systems. They also work with the YD supply office to bring farm and other inputs to the villages. YD has extension officers, who support the development workers.
- YD has training centres, which provide courses leading to a motivators certificate, and also operates Wokabaut Schools, which provide training opportunities for communities in more remote areas.
- Currently there are more than 1760 motivators working in 576 villages. Wokabaut schools operate twice yearly with short courses being run throughout the year for farmers and the general public.
- YD is firmly committed to the concept of local ownership of its programs and some local contribution to funding is required, but most funding is provided by the Lutheran Church.
- The YD program is held in high regard for its effectiveness. It is cost effective, broadly based and appropriate to the needs of rural communities. Its most powerful advantage is that it uses trained and highly motivated Papua New Guinea nationals who are members of the target communities (Caven 1999).

Provision of extension services within the industry

A number of the large cattle properties provide informal extension services to their regional neighbours on an informal basis. This model of service provision has considerable potential. However, the large scale landholders may need financial assistance to provide such services on a continuing basis.

6 Prospects for beef industry development

ALTHOUGH IT HAS STRUGGLED over the last decade, the beef industry has proved to be a long term survivor in Papua New Guinea. It has a well established production base of largeholders and a persistent core of smallholders. This survival has occurred despite extended periods of adverse economic conditions — in particular, a strong kina (supported by massive foreign exchange earnings from minerals) and a government policy environment of benign neglect toward beef — and has provided significant assistance to the production of competing meats such as poultry. That the industry has maintained a significant production base throughout this period reflects its considerable natural strengths.

Beef industry strengths

These are as follows.

- A strong pasture base of 500 000 hectares of grasslands suitable for livestock grazing and much of which is not well suited to gardens or cropping. Soil fertility in the grazing areas is adequate for a wide range of introduced pasture species and leguminous trees capable of supporting high stocking rates. Water is generally available due to high water tables in the valleys although the cost of access can be high.
- The industry has great potential for productivity ‘catch up’ — there is considerable scope for improving stocking rates and livestock productivity by better attention to nutrition, fertility and pasture management.
- The country is largely free of cattle diseases and there are effective procedures to minimise the threat of disease entry.
- There is a ready availability of plantation byproducts (copra meal, palm kernel meal) and molasses, rice pollard and mill run for supplementary and opportunity feedlot strategies. Much of this is currently being exported for use in stockfeeds in Australia.
- Current production falls well short of domestic demand. This provides considerable scope for import substitution (against imported beef and also against imported sheep meat). There are strong sales prospects for beef in

the mainland urban centres of Port Moresby and Lae, and also in highlands and islands markets, reflecting a strong preference for beef among Papua New Guinea consumers.

- Most of the industry's production is located close to the major consuming centres and to abattoirs and ports.
- The long history of cattle production has resulted in the build up of considerable expertise in the industry and a core of experienced expatriate and national managers.
- Smallholders are mostly located around the largeholder ranches, providing a potential network system to foster development along nucleus estate lines. Interest in cattle production on smallholdings is increasing.
- There is a reasonable appreciation among industry participants of the mistakes made in the past and what changes are needed to achieve growth.
- Labour is readily available — with the big real depreciation of the kina, wage costs are now low — and nationals are readily trained in livestock and pasture management as well as in butchering techniques and make excellent butchers.

Beef industry weaknesses

Offsetting these industry strengths are a number of inherent weaknesses which retard its economic performance.

- The customary land system provides barriers to extending freehold ownership. Cumbersome and time consuming processes must be followed to parcel land together into efficient grazing areas and land disputes are common. The largeholder properties on freehold land are not able to expand readily so industry expansion will need to be through smallholders on customary land. Much of the potential grazing land is customary land and currently not utilised.
- Production expansion on customary land must be preceded by costly investment in fencing and water storage. Bores are required to access groundwater and are expensive. Animal handling facilities such as yards, which are costly, are also needed.
- Most smallholder grazing areas are native pastures capable of sustaining only low pasture and livestock productivity. More appropriate pasture species need to be introduced to improve productivity. Pasture improvement is expensive. Poor pasture management has led to significant weed problems, especially in the lower Markham Valley. The failure of individual farmers to control weeds has imposed costs on neighbouring properties — there is no institutional control program.

- Road transport infrastructure is poor, which restricts the ability of all farmers, especially those away from the major roads, to move cattle. Trucks are generally provided by largeholders, but are not always available and roads may be impassable.
- Most abattoirs are old and in need of upgrading. None are built to export standards. This may lead to discounting of some cuts to clear all parts of the carcass on the domestic market. Existing abattoir capacity is poorly utilised — this reflects issues of government versus private ownership, pricing of abattoir facilities, location and road infrastructure, and the inability of all parts of the industry to work together. Byproduct recovery is poor so a potential source of income is lost.
- Extension and animal health services are poor and under-resourced — smallholder production is heavily dependent on extension services for production and marketing. Many smallholders have limited skills and knowledge of cattle management, nutrition and production. Some largeholders provide management support, usually at their own expense.
- Credit schemes have not been geared to cattle enterprises — loan repayment periods are too short and there is no microcredit system.
- There is no effective system for rewarding producers for quality — quality is inconsistent and often poor. The market is price driven, which makes it difficult to capture premiums for quality. Smallholders have trouble finishing cattle. A selling system based on carcass weight alone provides no incentive to the smallholder to finish cattle.
- The small volume of production accentuates inconsistent quality and results in an inability to bulk supply uniform size and quality portions for the high return domestic food service segment.
- There is a history of poor institutional and technical support within government for livestock in general and the beef industry in particular — beef is not a priority. The Cattleman's Association of Papua New Guinea is not a strong lobby group with government and lacks the full support of key producers.
- The industry has a poor R&D support base and lacks an institutional capacity for commissioning and funding research of relevance to all players. Virtually no research in livestock production (particularly grazing ruminants) has occurred since the early 1980s. The poor information base on industry performance characteristics makes it difficult to benchmark performance and select areas in which R&D will yield the highest payoffs.
- Information flows within the industry (on cattle availability by age, weight, location, etc.) are poor. There is no system of agents, brokers and selling centres for such information to be readily created.

- Security is a major problem. This is particularly the case with cattle on agistment. Losses incurred through theft and feral dog attack on calves, and the costs incurred in preventing these losses are a severe constraint on profitability. There is no effective registration scheme for stock identification.
- Cattle numbers have decreased markedly over the past two decades, with the smallholder sector decreasing more rapidly than the largeholder sector. Herd fertility is low and its ability to generate a rapid increase in numbers is poor. A concentration on increasing the breeding herd would reduce beef production in the short term.
- Quarantine facilities for imports of live cattle (either live animals or breeders) are limited.
- Beef cattle production is not a traditional smallholder activity — smallholder expansion will require careful attention to improving the culture for beef production and continuous extension support. Communication facilities for smallholders are almost non-existent.

Opportunities for growth

There are four key requirements for profitable beef industry expansion to occur in a way that will also improve national income.

- The ‘right’ domestic macroeconomic and industry policy environment must be in place.
- Favourable world beef prices.
- Scope for improving production efficiency.
- Strong demand by Papua New Guinea consumers for beef.

Domestic policy environment and world beef prices

Key macroeconomic requirements are a competitive exchange rate, low real wage costs and low real interest rates. Key industry policy requirements are access to imported inputs at import parity prices (no tariffs) and policies which provide equal incentives to producers for beef and competing meats and which do not distort relative prices of competing meats to consumers. In addition to these domestic policy requirements, industry expansion prospects also depend on world beef prices.

Many of these requirements are now in place. Over the past two years, there has been a big nominal and real devaluation of the kina and fall in real wage costs. And since July 1999 all imported inputs to cattle production have been duty free.

World demand for beef is static. World beef prices are dominated by US beef production, which has been at historic high levels, but is now declining. Current world prices (in US dollars) for beef are strong — a situation that should persist for the next two to three years as the recently begun rebuilding of the US cattle herd continues to keep supplies tight. As a result of these events, the kina price of beef to producers has risen sharply relative to kina production costs, providing strong incentives for domestic beef demand to be met by expanding production rather than imports.

There remain, however, several unfavourable aspects to the macroeconomic and industry policy environment. Real interest rates remain extremely high, which inflates the cost of new investment in cattle production and processing. Inflation is high and still rising. Severe fiscal discipline and greatly improved economic governance for an extended period will be needed to reduce inflation and the risk premium on lending and hence reduce real and nominal interest rates.

At the industry policy level, the government, through protection of competing imports of some meats, still provides considerably greater incentives to expand poultry meat production than it does for beef production. For domestic meat production to unequivocally be in the national economic interest, production technologies should progress to the point where the industry is competitive against imports at world prices (zero tariffs on imports).

Scope for improving production efficiency

To prosper, the industry also needs to greatly improve its production efficiency. While the current level of support for the industry is extremely poor, much of the R&D needed to expand pasture and livestock productivity has been done either in Papua New Guinea over the past 20 years or in areas of similar climatic constraints as Papua New Guinea (for example, Vanuatu and North Queensland) and could be readily applied by receptive managers. A more receptive management culture is needed for this adoption to occur — poor management is a major factor in the industry's failure to prosper over the past two decades.

Prospects for beef consumption

As noted earlier, there is a strong demand for beef among the high income cohort of Papua New Guinea beef consumers. There are also strong prospects for cheap cuts of beef to substitute with imported sheep meat in the meat purchases of low income households. Globally, sheep numbers are falling, reducing the availability of sheep meat. To the extent that this translates into higher import prices for sheep meat, prospects for substitution of beef for

sheep meat will improve. Per capita income growth in Papua New Guinea can only improve (on the dismal performance in the past), which will stimulate beef demand.

Threats to industry expansion

These opportunities for growth are also tempered by a number of actual and potential threats as follows.

- Government trade policy has disadvantaged beef production in the past and the policy environment is weighted against beef — through duty free access from Vanuatu, much higher ad valorem tariff equivalents on imported poultry than beef and duty free imports of all sheep meat in addition to fish and meat for canning and processing. The government remains vulnerable to pressures to continue an uneven playing field for meat.
- Competing meats are cheaper and price is critical for the majority of consumers — low quality cuts of imported sheep meat can be ‘dumped’ on the market without incurring penalties.
- The law and order situation, which is already a big problem for the beef industry and disadvantages rangeland beef production by more than it does production of poultry (which is easier to secure), may deteriorate further.
- The strong efficiency of nearby beef export industries in Australia and New Zealand, supported by highly targeted and well financed R&D programs, provides a continuing threat to sales of local product.
- Beef production is not geared to village cultures, which are built around a smallholder garden tradition. These are more suited to small, easily managed animals such as goats and rabbits.

A model for production expansion

Both largeholder and smallholder sectors of the industry have some, but not all, the attributes needed to expand production (table 6.1). A framework that shares these attributes will be needed to achieve a sustained expansion in production.

Expansion prospects on largeholder properties are constrained by their inability to acquire customary land. Yet, to achieve a substantial increase in herd size and beef production will require utilising more and more customary land for cattle grazing.

6.1 Attributes of largeholders and smallholders

<p>Largeholder</p> <ul style="list-style-type: none"> ▪ Expertise in pasture improvement and management ▪ Access to capital for investment ▪ Expertise in animal husbandry ▪ Established breeding herds and genetic material ▪ Transport and market access ▪ Long experience in beef production 	<p>Smallholder</p> <ul style="list-style-type: none"> ▪ Lacking in smallholders ▪ Smallholders have poor access and find it difficult to fund fencing materials, water provision and purchase of cattle ▪ Limited in smallholders ▪ Limited in smallholders ▪ Lacking in smallholders ▪ Experience often limited in smallholders
<p>Smallholder</p> <ul style="list-style-type: none"> ▪ Access to customary land ▪ Most located close to, or surrounding, largeholder properties on freehold land 	<p>Largeholder</p> <ul style="list-style-type: none"> ▪ Located on a fixed supply of freehold land and cannot easily access customary land

While smallholders have potential access to customary land, they lack expertise in pasture improvement and animal husbandry techniques and have very limited access to capital and knowledge.

This distribution of attributes lends itself to a nuclear estate model for industry expansion. Under this model, expansion of production on customary land would be facilitated by nearby nucleus estates on freehold land. The estates would assist smallholders by providing extension advice on property development and livestock and pasture management. They would also provide, on a fee for service basis, transport and market access opportunities and be prepared to sell breeding stock to smallholders and buy back stock when appropriate. Smallholders in return would provide their land and labour.

There are many variants of largeholder–smallholder cooperation that might be entered into. These include formal leasing and agistment arrangements for land and cattle, and largeholders developing, in conjunction with smallholders, ‘bankable’ development projects on customary land and obtaining development finance for these projects. Agistment is the least preferred option for the smallholder. Income is earned but no new skills are acquired, and landholders are often left with degraded pastures.

For these arrangements to work, both largeholder and smallholder must have a clearly defined set of responsibilities that they are prepared to honour, with

each having appropriate incentives through sharing of costs and returns. The production growth and extension model used by Niugini Tablebirds in the poultry industry provides an example of a highly successful nucleus estate system in the Papua New Guinea village and cultural environment. In that model, both parties have strong incentives for success. The poultry company requires grown birds and is prepared to offer, on a contract basis, feed, day old chicks and extension advice, and arrange access to finance for smallholders to produce marketable birds. In return, the smallholder is prepared to offer land, labour and husbandry to earn income by following the production technologies of the company. Under the contract system, producers may incur penalties if the contracts are broken (such as through illegal sale of birds and feed) or may be rewarded with additional batches if performance is good. Through this system, the farmer acquires management and husbandry skills while at the same time earning a regular income.

7 An agenda to facilitate beef industry development

THERE IS MUCH THAT CAN BE DONE to facilitate beef industry development. It is important, however, that measures chosen both facilitate development and *add* to Papua New Guinea living standards. This rules out policies involving specific industry subsidies and increased tariffs on competing imports of beef. While such policies will enhance industry growth, they represent a tax on some other sectors of the economy. The gains to the beef industry are therefore offset by reduced economic performance elsewhere. The result is reduced, not increased, national income and living standards. Subsidies to beef producers, for example, require higher taxes, increased borrowings or reduced government expenditure elsewhere in the economy to fund them. This in turn has adverse implications for the growth prospects of other industries. And higher tariffs on imported beef mean higher beef prices to consumers. By having to spend more to satisfy their beef demands, consumers will have less to spend on other goods and services — which disadvantages the industries supplying these goods and services.

An effective agenda to facilitate beef industry development must:

- capitalise on the strengths of the industry and take advantage of its opportunities; and
- address and overcome its weaknesses and the threats it faces.

The agenda must also take on board the lessons of the past endeavours to foster beef industry development.

Lessons from past endeavours to stimulate beef industry development

The following key lessons can be drawn from previous attempts (by the government and aid donors) to stimulate beef industry development in Papua New Guinea.

- If financial support is involved, projects must have reasonable prospects for being viable in the absence of the support — otherwise they will collapse when support ceases.

- The need for extension services to smallholders is continuous — extension arrangements must be institutionalised in some way.
- Extension support services need to be provided independently of government — there are too many demands on government for it to be in a position to offer support on a long term basis.
- Good management is the key ingredient of commercial success — assistance programs will fail unless producers have the necessary management skills to operate their properties in changing biological and economic environments.
- Assistance should empower managers to perform. It should not compensate for poor management.

Strategic imperatives and initiatives

We propose a series of initiatives to facilitate beef industry development. These initiatives can be grouped under four strategic imperatives for the industry as follows.

- Establish an information base.
- Enhance smallholder production capacity.
- Improve industry supporting infrastructure and operating environment.
- Improve general economic environment in which the beef industry operates.

In addition to these collective initiatives, there are many actions of an individual nature that producers can take (and are taking) to improve their profitability. Control of feral dogs is a prime example. Feral dog attacks lead to large losses of young calves.

Establish information base

Industry development needs to occur from a common base of understanding. Development plans and goals for the industry need to be set from a base book of information that sets out the industry's current level of development and performance. Such information will assist in fine tuning and prioritising initiatives, setting numerical goals which can be monitored, and benchmarking the performance of the industry as a whole and its components. Table 7.1 sets out an agenda of actions to do this.

7.1 Industry information initiatives

Initiative	Problem being addressed	Priority
Information bank		
<ul style="list-style-type: none"> ▪ Design an information collection and dissemination network. ▪ Conduct a survey to establish base performance criteria — livestock numbers, location, herd structure (age, sex), productive performance (calving and weaning rates, growth rates), turn off (age, weight, numbers), producer perceptions of problem areas. 	<ul style="list-style-type: none"> ▪ There is no accurate picture of the industry's current size, performance, etc. This inhibits sound planning of initiatives to improve performance. ▪ Free flow of information is essential for the operation of efficient markets and efficient resource allocation. Information flows in the industry are poor. 	High
Benchmarking		
<ul style="list-style-type: none"> ▪ Design a benchmarking scheme to compare and rank outcomes on livestock and pasture productivity among cattle producers. ▪ Include mechanism for periodic collection and dissemination of results. 	<ul style="list-style-type: none"> ▪ Individual producers are ignorant of the performance of others and industry–regional performance norms. Exposure to this information will stimulate producers to improve individual performance. 	Medium

Enhance smallholder production capacity

Our report has argued that expanding smallholder production is critical to the growth prospects of the beef industry. The immediate challenge is to develop a sustainable smallholder system. Initial development should be with current smallholders who have demonstrated cattle management skills and a commitment to the industry. This development may be through the nucleus farm system with smallholders undertaking contracts to grow (or breed) cattle for the largeholders.

This will need to be followed by development of new smallholder farms, preferably located close to support services, transport and abattoirs. This expansion would depend on the ability of potential farmers to clearly identify ownership of surveyed areas of land and to establish agreements for long term use for cattle grazing.

Table 7.2 sets out agenda items to facilitate smallholder development.

7.2 Smallholder development initiatives

Initiative	Problem being addressed	Priority
Smallholder extension and marketing support		
<ul style="list-style-type: none"> ▪ Design a nucleus estate driven smallholder extension scheme whereby largeholders have an incentive to provide, on a regular basis, extension and marketing support to smallholders in the vicinity. ▪ Funding–payment arrangements to be worked out as part of the scheme. ▪ Review funding arrangements for existing extension services and examine scope for broadening services. The funding must ensure adequate support to allow officers to visit producers on a regular basis. 	<ul style="list-style-type: none"> ▪ Smallholders are urgently in need of extension and marketing services on a continuous basis. 	High
Smallholder extension and training		
<ul style="list-style-type: none"> ▪ Develop information packages for extension officers and producers. Packages should be constructed around current knowledge and past research, including work in northern Australia and Vanuatu. 	<ul style="list-style-type: none"> ▪ There are currently no user friendly information packages on cattle production for smallholder farmers. 	Medium
Cattle industry land expansion and/or utilisation		
<ul style="list-style-type: none"> ▪ Provide leadership for the establishment of incorporated land groups to develop cattle projects (lease, lease back, etc.). ▪ Research and develop other suitable land tenure models. ▪ Develop a standardised agistment agreement (for industry endorsement) to define responsibilities, payments, etc. for agistment of cattle. 	<ul style="list-style-type: none"> ▪ Grazing land is constrained on largeholder properties. Expanding smallholder land area for grazing is a difficult and time consuming process. 	High

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7.2 Smallholder development initiatives (continued)

Initiative	Problem being addressed	Priority
Finance		
<ul style="list-style-type: none"> Investigate operations of smallholder credit scheme and modify to make it more applicable to the needs—circumstances of producers. Develop loan facility to meet the special needs of cattle producers. 	<ul style="list-style-type: none"> Current credit facilities and instruments are not well suited to smallholder needs for cattle grazing. More appropriate credit facilities are needed to enable smallholders to improve fences, water points, yards and pastures, and finance stock purchases. 	High

Improving the industry's operating environment

There are a range of initiatives that need to be undertaken under this heading (table 7.3).

7.3 Industry operating environment initiatives

Initiative	Problem being addressed	Priority
Livestock security		
<ul style="list-style-type: none"> Exert continuing pressure on the government to address the law and order situation and boost stock squad resources. Develop—upgrade national animal identification and brand registration system. Develop workable cattle movement control system. 	<ul style="list-style-type: none"> Cattle theft is a significant problem for producers. 	Ongoing
Abattoirs		
<ul style="list-style-type: none"> Government, in partnership with producers—processors, to 'sort out' abattoir location, construction, modernisation issue on a priority location basis. 	<ul style="list-style-type: none"> Abattoir facilities are underutilised with government facilities severely rundown. An industrywide solution will be needed over the medium term. 	Medium

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7.3 Industry operating environment initiatives (continued)

Initiative	Problem being addressed	Priority
Quarantine issues		
<ul style="list-style-type: none"> ▪ Establish (construct) a multi-purpose facility for handling agricultural animals. ▪ Facility to be extended to handle breeding techniques such as AI and ET. ▪ Current (operating) costs of facility to be self-funding. 	<ul style="list-style-type: none"> ▪ There is a need to urgently build up a breeding capability, which will involve live cattle imports. Import of new genetic stock could be achieved through the use of AI and the import of females. A suitable quarantine facility would need to be established and maintained. 	High
Quality assurance and incentives		
<ul style="list-style-type: none"> ▪ Develop industry standard carcass classification scheme with associated price grids to reward quality. ▪ Establish and circulate criteria for each market including Sing Sing market. ▪ Examine the results of MSA (Meat Standards Australia) with a view to introduction of quality assurance on-farm and at other points throughout the chain. 	<ul style="list-style-type: none"> ▪ There is no incentives based carcass quality scheme in place. 	Low (quality and consistency will be more likely to be achieved when numbers are increased).
R&D		
<ul style="list-style-type: none"> ▪ Conduct review of R&D needs for the industry. ▪ Prepare fact sheet of R&D findings on pasture and livestock research in the wet tropics for efficient beef production. ▪ Design dissemination system. ▪ Investigate alternatives for industry participation in R&D prioritisation and financial–other support for that research to occur. 	<ul style="list-style-type: none"> ▪ Much R&D of relevance has already been done, but is not being disseminated. Many producers lack the means of obtaining this information. ▪ There is a need to get beef industry R&D back on the R&D agenda. ▪ There is currently no mechanism for producers contributing R&D suggestions and contributing toward funding and ‘owning’ collective industry R&D. ▪ Largeholders are commissioning and/or undertaking their own R&D. They do not have incentives to share findings. 	High

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7.3 Industry operating environment initiatives (continued)

Initiative	Problem being addressed	Priority
R&D		
<ul style="list-style-type: none"> ▪ Identification and evaluation of suitable pasture species. 	<ul style="list-style-type: none"> ▪ The development of suitable grass–legume mixes is essential. Species selected for evaluation should be chosen as ‘best bet’ options from information available from Australia, Asia, South America and projects such as the Vanuatu beef project. Evaluations should be made on largeholder properties or research stations, providing ongoing demonstration sites for farmers. Such sites would provide production and financial information to farmers over time, thus allowing better informed decisions to be made. Out of this work, farmers would be presented with a series of development options to suit their production aims, financial situation and skills. The preparation of pasture options could form part of a farmer training package. 	High
<ul style="list-style-type: none"> ▪ Identify nutritional limits to production (energy, protein, minerals, etc.). ▪ Develop suitable supplementary feeding strategies for various classes of livestock and seasons. These strategies would be geared toward the identification of nutrient gaps in key livestock groups such as weaners and breeding females and the efficient use of available byproducts and flexibility in using supplements. 	<ul style="list-style-type: none"> ▪ Poor nutrition is the major cause of low growth rates and a major contributor to low reproduction rates. 	High

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7.3 Industry operating environment initiatives (continued)

Initiative	Problem being addressed	Priority
R&D		
<ul style="list-style-type: none"> Establish pasture management principles to manage weeds. 	<ul style="list-style-type: none"> Weed infestation in improved pastures. 	Medium
Education		
<ul style="list-style-type: none"> Develop suitable training packages for all levels of livestock management. 	<ul style="list-style-type: none"> Current degree courses have a low emphasis on livestock production. Restructure of degree courses is critical to the production of suitable graduate personnel in the industry. Such redevelopment could be achieved through a twinning arrangement with a suitable Australian university; twinning would also be used to further train institutional staff including technical staff. 	Medium

Improve general economic environment in which beef industry operates

Initiatives under this heading are set out in table 7.4.

7.4 General economic environment initiatives

Initiative	Problem being addressed	Priority
Administrative–legal		
<ul style="list-style-type: none"> Strengthen Plant Diseases and Control Act to help prevent spread of noxious weeds. 	<ul style="list-style-type: none"> Weed infestation from outside properties is an increasing problem. 	High
<ul style="list-style-type: none"> Review current act and penalties on slaughter registration. 	<ul style="list-style-type: none"> Sing Sing slaughter should be formalised under set conditions. 	
Tariff protection		
<ul style="list-style-type: none"> Pressure government to ensure that trade policy not used to provide unequal incentives to competing meat producers and consumers. (Best way to do this is to steadily reduce protection (top down) to all meats.) 	<ul style="list-style-type: none"> Trade policy currently discriminates between meats. 	Ongoing

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7.4 General economic environment initiatives (continued)

Initiative	Problem being addressed	Priority
Transport		
<ul style="list-style-type: none"> Encourage government to upgrade–develop road network and strengthen resources of local communities. 	<ul style="list-style-type: none"> Poor road infrastructure inhibits beef industry development. 	Ongoing
Consumer education–information		
<ul style="list-style-type: none"> Review labelling laws — ensure retail purchasers are provided with information on cost per unit of meat in retail ready packs. Provide education on meat purchase value for money in school curricula. 	<ul style="list-style-type: none"> Retail consumers are poorly placed to determine value for money in meat purchases. 	Medium

APPENDIXES

A List of persons consulted

A.1 List of persons consulted

Contact	Position	Area of expertise
Mark Low	General Manager Niugini Table Birds, Lae	Poultry production and processing
Bob Wilson	Manager Numundo Beef	Beef production in conjunction with palm oil waste
Alan Holland	Manager Melanesian Hotel, Lae (former President, Meat Traders Association)	Meat processing and retailing; hotel catering
Philip Franklin	Managing Director Trukai Industries Limited	Beef production, Markham Valley
Stephen Farhall	Manager, Cattle (Sulikon) Trukai Industries	Largeholder beef production and integration with smallholder production
John G Nilan	General Manager Moale Trading	Demand for low priced meats in hot meals at Kai bars
Geoff Fahey	Senior Extension Officer (Beef) Queensland Beef Industry institute	Beef production in Papua New Guinea
Adrian Lee-Archer	Manager ADF	Retailing of meat and smallgoods
Godfrey Seeto	General Manager Lings, Port Moresby	Consumer requirements for different types of meats at trade stores and wholesale outlets
Garry Ormsby	Operations Manager East New Britain Supermarkets Ltd	Consumer requirements for beef and competing meats at supermarkets
Jim Meharg	Manager Ramu Beef	Large scale beef production in Markham and Ramu Valleys

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A.1 List of persons consulted (continued)

Contact	Position	Area of expertise
Terry Hagger	Manager Ramu Beef Abattoir	Slaughtering and processing of beef
John Moripi	Manager Lae Abattoir	Slaughtering and processing of beef
Reinhold Friedhoff	Managing Director Azobelle Pty Ltd (Vanimo Beef)	Economics of importing live cattle for feeding, processing and sale in Papua New Guinea
Simon Brennan	Operations Manager Angco Coffee (Vanimo Beef)	Economics of importing live cattle for feeding, processing and sale in Papua New Guinea
David Thorold	Livestock Development Officer DAL	Papua New Guinea beef production sector and smallholder development prospects
Ian Grant	AusAID Project	Village meat production schemes — especially rabbits
Hans Onga	Branch Manager Niugini Table Birds, Port Moresby	Consumer requirements for beef and competing meats in Port Moresby area
Mr Rahmen	Chief Statistician Department of Agriculture & Livestock	Livestock and meat statistics

B Estimates of meat production, consumption and trade

B.1 Estimates of meat production, consumption and trade in Papua New Guinea

		1980	1990	1998
Beef				
Production (commercial)	tonnes cwe	1973	2050	2500
Production (subsistence) ^a	tonnes cwe	284	295	360
Total production	tonnes cwe	2257	2345	2860
Exports	tonnes shipped weight	0	0	0
Imports (ship weight)	shipped weight	6862	8700	8900
Adjusted imports (cwe) ^b	tonnes cwe	10293	13050	13350
Consumption (commercial)	tonnes cwe	12266	15100	15850
Consumption (subsistence)	tonnes cwe	284	295	360
Total consumption	tonnes cwe	12550	15395	16210
Self-sufficiency ratio (commercial)		0.16	0.14	0.16
Self-sufficiency ratio (total)		0.18	0.15	0.18
Sheep meat				
Production (commercial)	tonnes cwe	0	0	0
Production (subsistence)	tonnes cwe	5	15	15
Total production	tonnes cwe	5	15	15
Exports	tonnes shipped weight	0	0	0
Imports (ship weight)	tonnes shipped weight	4321	26100	32900
Adjusted imports (cwe) ^c	tonnes cwe	4753.1	28710	36190
Consumption (commercial)	tonnes cwe	4753.1	28710	36190
Consumption (subsistence)	tonnes cwe	5	15	15
Total consumption	tonnes cwe	4758.1	28725	36205

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B.1 Estimates of meat production, consumption and trade in Papua New Guinea (continued)

		1980	1990	1998
Sheep meat (continued)				
Self-sufficiency ratio (commercial)		0.00	0.00	0.00
Self-sufficiency ratio (total)		0.00	0.00	0.00
Goat meat				
Production (commercial)	tonnes cwe	0	0	0
Production (subsistence)	tonnes cwe	9	9	9
Total production	tonnes cwe	9	9	9
Exports	tonnes shipped weight	0	0	0
Imports (ship weight)	tonnes shipped weight	0	0	0
Adjusted imports (cwe)	tonnes cwe	0	0	0
Consumption (commercial)	tonnes cwe	0	0	0
Consumption (subsistence)	tonnes cwe	9	9	9
Total consumption	tonnes cwe	9	9	9
Self-sufficiency ratio (commercial)		na	na	na
Self-sufficiency ratio (total)		1	1	1
Poultry meat				
Production (commercial frozen)	tonnes cwe	3760	11389	17500
Production (village fresh)		3760	11389	17500
Production (subsistence)	tonnes cwe	5760	5760	5760
Total production	tonnes cwe	13280	28538	40760
Exports	tonnes shipped weight	0	0	0
Imports (ship weight)	tonnes shipped weight	8558	96	0
Adjusted imports (cwe)	tonnes cwe			
Consumption (commercial)	tonnes cwe	12318	11485	17500
Consumption (subsistence plus village fresh)	tonnes cwe	9520	17149	23260
Total consumption	tonnes cwe	21838	28634	40760

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B.1 Estimates of meat production, consumption and trade in Papua New Guinea (continued)

		1980	1990	1998
Poultry meat (continued)				
Self-sufficiency ratio (commercial)		0.31	0.99	1.00
Self-sufficiency ratio (total)		0.61	1.00	1.00
Pig meat				
Production (commercial)	tonnes cwe	223	1000	1013
Production (subsistence)	tonnes cwe	5000	5000	5000
Total production	tonnes cwe	5223	6000	6013
Exports	tonnes shipped weight	0	0	0
Imports (ship weight)	tonnes shipped weight	0	0	5
Adjusted imports (cwe) ^d	tonnes cwe	0	0	5
Consumption (commercial)	tonnes cwe	223	1000	1018
Consumption (subsistence)	tonnes cwe	5000	5000	5000
Total consumption	tonnes cwe	5223	6000	6018
Self-sufficiency ratio (commercial)		1.00	1.00	1.00
Self-sufficiency ratio (total)		1.00	1.00	1.00
Fish				
Production (commercial)	tonnes cwe			
Production (subsistence)	tonnes cwe			
Total production	tonnes cwe	43617	26188	26200 ^e
Exports	tonnes shipped weight	1366	1100	609
Imports (ship weight)	tonnes shipped weight	0	81	16
Adjusted imports (cwe)	tonnes cwe			
Consumption (commercial)	tonnes cwe	42251	25169	25607
Consumption (subsistence)	tonnes cwe	na	na	na
Total consumption	tonnes cwe	42251	25169	25607
Self-sufficiency ratio (total)		1.03	1.04	1.02

^a Estimates of Sing Sing trade. ^b Assumes all imports are boneless. Adjustment factor for boneless to carcass weight is 1.5. ^c Assumes 90 per cent of imports are bone-in and 10 per cent are bone-out. Adjustment factor for bone-out imports is 2. ^d Assumes all imports are bone-in. ^e Figures refer to 1996. na Estimates not available.

Source: These estimates have been compiled from a variety of sources — official statistics in Papua New Guinea, Australia and New Zealand, FAO (fish), and estimates from industry officials and participants.

C Australian exports of beef (by cut) to Papua New Guinea

C.1 Australian exports of beef (by cut) to Papua New Guinea kg shipped weight

Cut code	Cut description	Exports
		kg
1550	Shortloin steak T-bone	4 721
1550	Shortloin-3 rib	10 360
1550	Shortloin-3 rib (Z)	6 232
1552	Shortloin-1 rib	5 788
1560	Striploin-3 rib (Z)	284
1562	Striploin-1 rib	828
1563	Striploin-2 rib	19
1570	Full rump	1 018
1590	Rib set-5 rib (W)	16 160
1620	Clod	197
1640	Brisket-10 rib	14 746
1686	Short ribs-1 rib	204
1690	Short ribs-5 rib	13 301
1695	Spare ribs	21
2000	Topside	774
2010	Inside	14 850
2010	Inside (Z)	255
2020	Silverside	598
2030	Outside	9 200
2040	Eye round	1 005
2050	Outside flat	119
2060	Thick flank	239
2070	Knuckle	10 290
2070	Knuckle (Z)	250
2080	Full rump	1 239
2090	Rump	56 396
2090	Rump (Z)	296
2100	Rump D trim	5 280
2100	Rump steak (P)	643
2140	Striploin-3 rib	20 700
2142	Striploin-1 rib	3 493

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C.1 Australian exports of beef (by cut) to Papua New Guinea kg shipped weight (continued)

Cut code	Cut description	Exports kg
2150	Tenderloin	1 554
2160	Tenderloin side strap off	2 708
2198	Thin flank meat sidE	22 860
2200	Thin flank	74 390
2201	Thin flank meat	181 078
2205	Inside skirt	99
2206	Flap meat	12 780
2210	Flank steak	15 136
2221	Cube roll long	2 760
2240	Cube roll (rib eye)-5 R(Z)	1 293
2240	Cube roll (rib eye)-5 RIB	32 827
2241	Cube roll (rib eye)-4 RIB	115
2242	Cube roll (rib eye)-6 RIB	104
2243	Cube roll (rib eye)-7 RIB	9 173
2250	Chuck & blade-5 RIB	125
2260	Chuck-5 rib	6 285
2260	Chuck-5 rib (Z)	254
2270	Chuck SQ cut-5 rib	798
2275	Chuck roll-5 rib	2 152
2300	Blade or clod	43 489
2300	Blade or clod (Z)	252
2302	Bolar blade	263
2310	Chuck tender	380
2320	Brisket-10 rib	5 071
2330	Brisket PE-5 rib	41 535
2331	Brisket PE-4 rib	16 560
2340	Brisket NE-5 rib	7 600
2360	Shin/shank	7 021
2390	FQTR-1 PC-10 rib	2 635
2445	Butt & rump	231
2466	Rib meat	23 740
2560	Trimming	4512 301
2561	Beef trimmings	1273 998
2562	Beef trimmings - unsorted	216 987
2570	Diced beef	35 357
2572	Cubed beef	1 148
2580	Hamburger (ground beef)	5 070
2580	Minced beef (ground)	26 841
2590	FQTR & HQTR - mixed	18 931
2601	FQTR-10 rib	95 525

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C.1 Australian exports of beef (by cut) to Papua New Guinea kg shipped weight (continued)

Cut code	Cut description	Exports
		kg
2602	FQTR-11 rib	19 040
2610	FQTR meat-10 rib	136
2620	Cubed beef steak	2 714
2620	FQTR & HQTR meat	3 536
2630	Chuck meat	66 749
2660	Short rib plate	34
3000	Carcase (light veal)	99
3165	Loin chop	84
3230	Leg – long cut	246
3715	Knuckle	1 249
3948	Haunch set	165
		6994 984

Source: Red meat and livestock statistics provided by Department of Agriculture, Fisheries and Forestry Australia.

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