

FOUR PAPERS ON THE PAPUA NEW GUINEA
CATTLE INDUSTRY

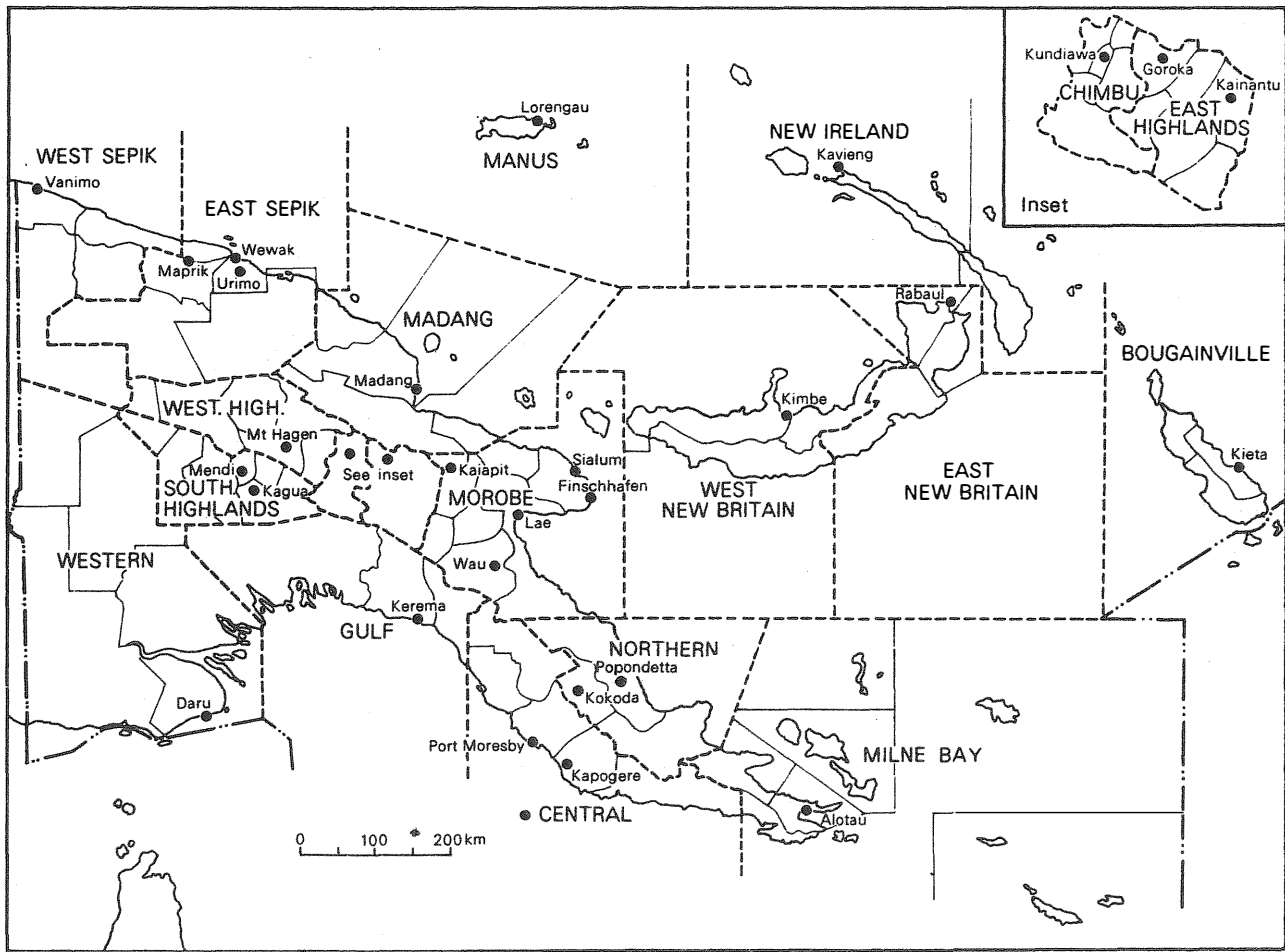


Fig.1. Papua New Guinea: Districts and sub-districts

FOUR PAPERS ON THE PAPUA NEW GUINEA
CATTLE INDUSTRY

PAPERS BY P. F. PHILIPP, L. L. LANGNESS,
F. VON FLECKENSTEIN
AND M. EVANS

The New Guinea Research Unit
The Australian National University
Port Moresby and Canberra

1975

© The Australian National University 1975

This work is copyright. Apart from any fair dealing for the purpose of private study, research, criticism, or review, as permitted under the Copyright Act, no part may be reproduced by any process without written permission. Inquiries should be made to the publisher.

Printed and manufactured in Australia by
The Australian University

National Library of Australia
card no. and ISBN 0 85818 029 4

Announcement

On 25 August 1975 the Papua New Guinea House of Assembly passed legislation providing for the establishment of the Institute of Applied Social and Economic Research. Under the terms of a previous agreement with the Australian National University, the Institute took over most of the assets of the University's New Guinea Research Unit in Port Moresby.

The Institute will formally commence operations in January 1976. Its functions, as laid down in the Act, include the promotion of research into social, political and economic problems in order to enable practical solutions to be formulated, the dissemination of research findings, the provision of consultancy services to government, and the provision of practical research opportunities to train Papua New Guinean research workers.

The Institute is governed by a council, whose membership includes representatives of Parliament, the public service, the community, the universities and the staff of the Institute.

This is the last issue of the New Guinea Research Bulletin. In its stead the Institute will publish a monograph series which will be distributed from Port Moresby. The Monograph will retain the format of its predecessor and will present the results of social and economic research in Papua New Guinea by staff of the Institute and other researchers. Four titles will be published each year. Annual subscription in 1976 is K10.00 (\$Aust.12.46)* and commences on 1 January 1976. Individual copies cost K2.50 plus postage. Manuscripts being prepared for publication deal with social and economic research needs and priorities in Papua New Guinea, internal migration, decentralization and social indicators.

Other publications of the Institute are the Discussion Papers and Luksave. The Discussion Papers present preliminary reports of research being undertaken within the Institute

* A kina is equivalent to \$1.18 Australian. However, \$Aust.0.60 has been added to allow for currency exchange.

and are available for an annual subscription of K8.00 (\$Aust.9.48). Individual copies are available at K1.00 plus postage. Luksave presents short summaries of selected Monographs in simple English, Pidgin and Hiri Motu and is especially suitable for schools. The series is available for an annual subscription of K1.50 (\$Aust.1.77). Individual copies are available at K0.30 plus postage. A bibliography series is also currently being prepared.

All inquiries should be addressed to:

The Editor,
Institute of Applied Social and Economic
Research,
P.O. Box 5854,
Boroko,
Papua New Guinea.

Preface

In recent years cattle raising has been one of the fastest growing industries in Papua New Guinea. Papua New Guinean smallholder projects have been a major component of this growth. This Bulletin brings together four papers on the cattle industry. In the first, P.K. Philipp presents data on indigenous participation in the industry, which was collected by Professor Philipp while a visitor to the New Guinea Research Unit in 1970. Papers by L.L. Langness and F. von Fleckenstein evaluate two smallholder cattle projects in the Eastern Highlands District. In the final paper M. Evans uses a simulation model to assess the financial viability of a smallholder cattle project in the Goilala sub-district.

All monetary amounts are expressed in Australian currency.

Photographs in this volume are reproduced with the kind permission of P.K. Philipp.

R. J. May

Port Moresby 1975

Contents

		<u>Page</u>
Preface		vii
Paper 1	Cattle raising by Papua New Guineans P.K. Philipp	1
Paper 2	The Nupasafa cattle: rural development in the Eastern Highlands L.L. Langness	67
Paper 3	Ketarovo: case study of a cattle project F. von Fleckenstein	91
Paper 4	The financial viability of smallholder cattle projects: the Goilala case M. Evans	139
Bibliography		251

Tables		<u>Page</u>
3.1	Sources of repayments, actual Ketarovo cattle project	110
3.2	Livestock prices: Ketarovo cattle project, 1969-73	114
3.3	Carcase prices: Papua New Guinea, 1969-73	115
3.4	Returns to the nation, actual Ketarovo cattle project	119
3.5	Returns to the nation, planned Ketarovo cattle project	119
3.6	Returns to Ketarovo, actual Ketarovo cattle project	120
3.7	Returns to Ketarovo, planned Ketarovo cattle project	120
3.8	Returns to various factors of production: Ketarovo cattle project, 1969-73	121
3.9	Values of land and labour: Ketarovo cattle project, 1969-73	122
3.10	Ketarovo cattle project: margin per year on project loan and private cattle sold, 1969-73	127
4.1	Sources of supply for the main inputs into smallholder beef production in the Kunimaipa-Karuama	167
4.2	Technical parameters of smallholder cattle production	168
4.3	Technical performance 'standards' for smallholder cattle production	174
4.4	The main determinants of the technical parameters of beef production	175
4.5	Basic assumptions 1: prices considered as constant throughout project life	186
4.6	Basic assumption 1: 'salvage' values of assets at the end of project life	187
4.7	Basic assumptions 2: the capital expenditure pattern (fixed costs) for a project established with twelve breeders	188

	<u>Page</u>	
4.8	Basic assumptions 3: sources of finance for cashable inputs into a project established with twelve breeders	189 189
4.9	Basic assumptions 4: model parameters	191
4.10	Effect of heavy culling, other parameters remaining unchanged at year 2 values	194
4.11	Effect of 'low cost' improvements (reducing average age at turn-off and calving), other parameters remaining unchanged at year 2	194
4.12	Effect of improving the calf/breeder ratio, other parameters remaining unchanged at year 2 values	194
4.13	Effect of improving the mortality rates, other parameters remaining unchanged at year 2 value	195
4.14	Effect of improving the calf/breeder ratio and mortality rates simultaneously, other parameters remaining unchanged at year 2 values	196
4.15	Effect of introducing 'low cost' and 'high cost' improvements simultaneously, other parameters remaining unchanged at year 2 values	197
4.16	Stabilization of breeding herd compared with continued expansion	198
4.17	Fattening cattle for slaughter compared with rearing cattle for sale as stores and breeders	200
4.18	Assumed breeder culling rates	202
4.19	Average length of life (years) on project of breeders which arrived in year 0	202
4.20	Average life expectancy (years for heifers entering the breeding herd in year 12)	203
4.21	Effect of the breeder culling rate	204
4.22	Effect of the timing of further investment	206
4.23	Repayment schedule for second loan	207

	<u>Page</u>	
4.24	Comparison of direct and loan financing of investment expenditure for paddock area expansion	207
4.25	Repayment schedule for \$1,390 at 3 per cent per annum	209
4.26	Effect of repaying at half the current rate of interest on the financial performance of 'marginal' projects	210
4.27	Alternative repayment schedule for \$1,390 at 6% p.a.	212
4.28	Alternative repayment schedule for \$1,390 at 9% p.a.	212
4.29	Effect of alternative repayment schedules at the current rate of interest, on project financial performance	213
4.30	Effect of alternative repayment schedules, at one-half times the current rate of interest, on project performance	215
4.31	Effect of lower average slaughter weights on project financial performance	216
4.32	The 'minimum' project: effect of different credit arrangements on financial performance	222
4.33	Effect of early loan repayment on financial performance	225
4.34	Cash flow analysis for alternative loan repayment scheme 3	229

Figures

1	Papua New Guinea: Districts and sub-districts	Frontispiece
1.1	Major and minor roads in Papua New Guinea	4a
3.1	Ketarovo cattle project	95
3.2	Suggestion for subdivision fences	97
3.3	Ketarovo cattle project: net production of beef	107

	<u>Page</u>	
3.4	Cumulative withdrawal and balance owing to the Development Bank, 1970-73	109
3.5	Ketarovo cattle project: total herd	116
3.6	Ketarovo cattle project: value of breeding stock	116
3.7	Ketarovo cattle project: calving rate	116
3.8	Ketarovo cattle project: mortality rate	116
3.9	Physical capital: Ketarovo cattle project 1970-73	118
3.10	Individual costs: Ketarovo cattle project	122
3.11	Ketarovo group involvement in cattle project (cumulative)	125
4.1	Upper Kunimaipa and Karuama village	143
4.2	The financial and technical unit of a village cattle scheme	148
4.3	Time paths of technical performance parameters	180

Appendices

3.1	Sources of numerical data and assumptions made	130
4.1	The smallholder cattle project model	240
4.2	The smallholder cattle project model: stabilized herd modification	243
4.3	The smallholder cattle project model: store/breeder sale modification	244
4.4	Technical performance parameters I: assumed time paths	245
4.5	Technical performance parameters II: time paths assumed	246
4.6	Reinvestment in paddock area expansion	247
4.7	Project net income streams in selected simulations	248
4.8	Formula for calculating variable loan repayment under an 'equi-loss' credit agreement	250

Plates	<u>Page</u>
1.1 Waritsian, upper Markham Valley	9
1.2 View of Markham Valley from Kassam Pass	9
1.3 Palank's farm	21
1.4 Palank with his prize bull	22
1.5 William and his herd, with the bull, in the village	31

Paper 1

Cattle raising by Papua New Guineans

P. F. Philipp*

From March through November 1970, the writer studied beef cattle raising by Papua New Guineans in the following Districts of Papua New Guinea: Northern, Central, Morobe, Eastern Highlands, Chimbu, Western Highlands, Madang, East Sepik and the island of New Britain (see Frontispiece). These areas included most of the beef cattle projects operated by Papua New Guineans at that time.

This study is divided into two parts:

- (i) a series of case studies of the development of cattle raising by Papua New Guineans;
- (ii) a discussion and analysis of Papua New Guinean cattle raising.

The case studies were chosen to emphasize the great diversity of factors which affect Papua New Guinean cattle raising, such as rancher motivation, entrepreneurship, know-how, descent group influence as well as location, land and resource availability and quality, the effects of government and mission methods and policies, and the quality of the development agents involved. The discussion and analysis section is not only based on the case studies, but on many additional informative ranch visits by the author and on other published and unpublished information.

* The author is a professor of agricultural economics at the University of Hawaii and was a Fulbright researcher with the New Guinea Research Unit of The Australian National University in 1970. This research paper is published with the approval of the Associate Director of the Hawaii Agricultural Experiment Station as Journal Series No. 1851, 12 February 1975.

Part 1: case studies

Cattle raising in the Morobe District

Ever since cattle raising by Papua New Guineans began in earnest during the decade of the 1960s, Morobe has been by far the most important District in terms of number of cattle held by local people. Out of the total number of 8,862 cattle held by Papua New Guineans at 30 June 1970, an estimated 2,200 head or roughly one quarter of the total were in Morobe District.¹ During the survey of cattle raising by Papua New Guineans, major consideration was therefore given to the development in this District.

Wain Census Division.² The area is centred on the mission station of Boana which is reached in a small plane from Lae in about fifteen minutes. Boana is linked by footpath to the Markham Valley, but there is no road into the area. The country is very dissected, with steep slopes, mostly covered with rain forest, but it has some grass-covered areas in the lower section. Most of the villages are at altitudes between 450 and 1,200 metres.

A German Lutheran missionary, Gustav Bergman, founded the Boana mission station in 1932 and acquired the first cattle in 1933 to make the station more independent economically. In 1938, the first cattle passed into the hands of Papua New Guineans when Bergman presented his mission workers collectively with a bull, a cow and a heifer. The handing-over of cattle to the local people was contrary to mission policy; when it had been done elsewhere, the cattle had gone wild. The people of Boana, however, kept their cattle tamed by constant handling. At first, the cattle roamed free during the day but were tied up at night. Then the people built fences in their own way, mainly from giant bamboo, and later substituted these with wire fencing and fence posts of good quality timber.

Cattle raising by the people of the Wain did not increase

¹ Files, Department of Agriculture, Stock and Fisheries (DASF).

² In addition to his visit, the author received information on cattle ranching in the Wain from W. Straatmans, mission and DASF personnel, and from articles by Jackson (1965) and Shand and Straatmans (1967).

much until 1954 when Bergman imported and sold them an additional twelve cattle. Shortly thereafter he learned about a government subsidy scheme for imports of cattle in large groups and wrote to the District Commissioner asking that the Wain-Arab-Naback be included in this scheme. The response was at first discouraging; he was told that the scheme had been intended for Europeans and it was said that Papua New Guineans would allow the cattle to go wild. Bergman invited inspection of the cattle already possessed by the Wain. A patrol was sent up and reported favourably on cattle raising by the people in the area. It was finally agreed that the Wain-Arab-Naback people be included in the scheme provided the mission acted as agent. As a result, an additional thirty-six heifers were imported from Australia.

The missionary introduced cattle into the agriculture of the Wain to improve the level of living of the people and to enrich their protein deficient diet. He helped them to acquire cattle for themselves and taught them how to handle and take care of them; he learned to understand them, gained their trust and was thus able to develop cattle raising without the autocratic methods which were then often used in developing agriculture. There was no pressure for rapid development and the people set their own pace.

Beginning with the importation of Administration-subsidized cattle, the DASF took an active interest in cattle raising in the Boana area and made more good quality cattle available at low prices. Its rural development officers (RDOs) trained local assistants and supervised their activities during their patrols in the area. They advised on location and construction of cattle enclosures, cattle management and pasture improvement. By 1964, the total cattle population in the three census divisions Wain, Arab and Naback, into which the mission had originally introduced cattle, was estimated at about 400 head.

The people of the Wain did not have to be pressured into raising cattle; on the contrary, they were keen to acquire them. Except for the original gift of three head by the missionary, they paid for all their cattle out of savings from wage labour and vegetable sales, and since the latter part of the 1950s, also from the sale of coffee. They paid as much as \$100 for a heifer in the 1954 importation. The Administration-subsidized cattle were sold to them at \$70 a piece. When these last cattle arrived, the most influential big-man of the Wain, Sing-in, was holding about

\$6,000 in cash contributed by groups of people and individuals who wished to acquire cattle.

There appears, in the traditional society of the Wain, to have been a 'big-man' type of prestige structure involving large pig feasts and a complex system of presentations. Pig numbers fell dramatically just at the time when the cattle enterprises were spreading throughout the Wain. Cattle have largely replaced pigs in major feasts. The status associated in the past with the possession of pigs seems to have been transferred to a considerable extent to cattle, though pigs are still of some importance. Though the importance of feasts and gift giving has declined, leadership is still, to a considerable extent, of the 'big-man' type. The prestige system associated with pig husbandry and exchanges had been adapted to the cattle industry. Co-operation in the purchase and pasturing of cattle appears to have replaced the actual exchanges which occurred with pigs. Cattle ownership and the transactions involved confer a similar prestige.

Cattle purchases are often nominally made by big-men; however, the money for these purchases is contributed by groups of persons of whom the big-man is either the largest contributor or the organiser or spokesman. Traditional patterns of co-operation are largely employed in the raising of money to buy cattle and in the establishment and operation of the cattle enterprise. Kinship plays an important but not exclusive role. The flexibility of their traditional land tenure system has enabled the people in the Boana area to introduce cattle without requiring any radical changes in it. However, the people have adjusted their traditional ways where they think it useful and have introduced innovations. Thus in some localities, from two to as many as six parishes keep their cattle together in one enclosure enabling them to reduce the disadvantages of small-scale cattle operations. They use paid herdsmen to take care of many of their herds thus avoiding the difficulties experienced in many other descent-group cattle projects by Papua New Guineans, where nobody has a clear-cut responsibility for the cattle or gets an adequate reward which would induce him to do a good job. In the Wain the first herdsmen were trained by the missionary and they passed their knowledge on to others who also received instruction from the DASF; they received a money wage which depended to some extent on the degree of their attention to duties. In contrast to the traditional non-cash exchange

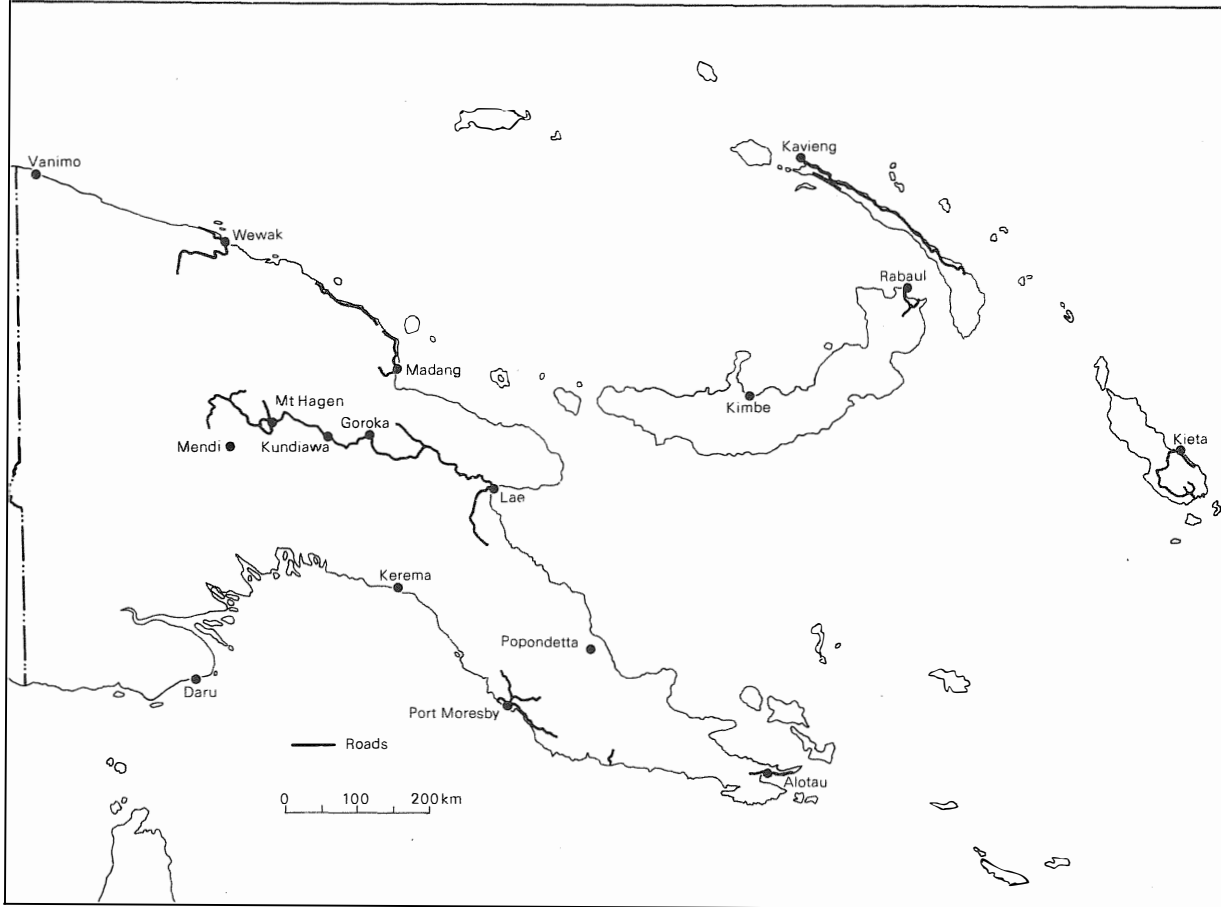


Fig. 1.1. Major and minor roads in Papua New Guinea.

activities with regard to pigs, cattle or their meat are often sold for cash, usually for consumption within the area, although meat is occasionally sent by plane to coastal city markets.

A rapid future expansion of cattle raising is not to be expected in the Boana area. Additional agricultural land is limited; the rough topography precludes much of the area's use for cattle and certainly prevents large-scale mechanised ranching. Some increase in cattle numbers may be possible through improved cattle and pasture management. The dissected topography limits access to and communication between the villages of the Wain. This makes commercial meat marketing difficult and costs high. It also makes supervision and servicing by DASF officers time-consuming and costly.

As a result one sometimes hears comments such as 'giving cattle to the Boana people was a mistake. The area is not suited for cattle raising and the sooner we abandon the whole thing, the better'. In defence of past development policy it can be pointed out that Bergman's purpose of introducing cattle to improve the level of living of the local people has been achieved, although this improvement has been limited. The introduction of cattle has resulted in some intensification in the use of available land and labour resources and in additional capital accumulation; it has strengthened the development of a money economy, a prerequisite for economic development and it has enriched the protein content of the diet of the people counteracting the consequences of the decline in pig raising. Lastly, cattle raising has given the Wain people a lot of satisfaction. For example, although coffee brings in far more money than cattle, the people of the Wain seem much more interested in cattle than in coffee. It is not uncommon to hear complaints about the work of caring for trees and preparing berries for sale. Corresponding complaints are seldom heard in relation to cattle. This difference in attitude may be owing to the fact that coffee growing does not have any close counterpart in the traditional system, whereas cattle fits well into the traditional prestige system.

Not much more can be achieved in beef cattle production under the existing resource and access conditions in the Wain. Who is to say whether the drastic changes forced upon Papua New Guineans in other areas of the country to rapidly improve their level of living are more desirable, from the

point of view of overall welfare of the local people, than a slow change brought about within the framework of accustomed ways of life?

Today's economic policy goals are different from the limited goals undertaken in the Wain. Instead of a leisurely development pace, a more rapid development seems to be desired to lift the economic status of the people and to provide for a better economic basis for the country. The developmental human and financial resources of Papua New Guinea are in limited supply. Thus the government may want to concentrate these resources in areas with the greatest economic potential and pull them out of areas with low development potential. For cattle raising in the Wain, this may well mean a reduction in the level and quality of services of the DASF which in 1970 had an RDO stationed in Boana. For the sake of the people of the Wain, it is hoped that the DASF could at least keep a minimum of sufficiently qualified officers in the area to keep cattle raising going.

The Sialum cattle project. What we may call the Boana approach is apparently still relevant in some parts of Papua New Guinea as shown by the Sialum cattle project described by Jack McCarthy in a Post Courier article.¹ The Sialum area lies 56 kilometres northwest of Finschhafen on the narrow coastal fringe of the high Huon Peninsula country. Until the creation of this project, the 8,000 people of the area had been economically neglected. The country, except for the coastal grasslands, is rugged and steep. No cash crops whatsoever had been introduced.

In 1963, a grant of \$110,000 was made for the Sialum cattle project by Bread for the World, an organization financed by the Protestant churches of northern Europe. To put the scheme into operation the Lutheran Economic Service found Mr Hans Wiederhold, an experienced animal industry worker who had spent much time developing cattle stations from the bush in South Africa. In 1964, three groups of villages made available 800 hectares of wild, unimproved country. Men from five villages volunteered to fence the property, to build 16 kilometres of road to the future ranch and to build a jetty on the rough coast to land the cattle. 'Getting the cattle ashore was tough. Some ran into the bush and mountains and were lost; some fell into gorges and

¹ Jack McCarthy, 'Men with a mission help the people', Post Courier, 15 October 1970. The author did not visit this project, but included it because of its originality.

were killed, and some were eaten by crocodiles, but we began with forty head.¹ In the latter part of 1970, the ranch had 600 head of cattle kept in fifteen fenced paddocks to which stock water was being pumped; there was even a section for experimental work on grasses and improved pastures. Wiederhold had trained his own local assistant for five years who by 1970 carried out most of the veterinary work.

From the beginning of the project, the training of local men to handle cattle on their own property was encouraged. Village volunteers in teams of twelve received sixteen months of work and instruction. At the end of the training, each man was given two animals in calf to take back to his village group and was helped in the construction of fences, yards and paddocks. The fourth such team was under training by 1970. More than one hundred cattle had been distributed to twenty-four village groups. The largest such group consisted of twelve head of cattle.

The Sialum cattle project was successful in bringing substance and confidence into the lives of local people who had had no chance for economic advancement before its establishment.

Waritsian. In the village of Waritsian in the Upper Markham Valley was a group cattle project owned by many villagers. Waritsian lies just off the Lae-Highlands Highway and is thus easily accessible. The project was started in 1955 when two men from Waritsian, former students at the mission school at Kaiapit, persuaded the Lutheran missionary there to sell one cow and one bull to the village. All the people in Waritsian contributed to the purchase price of the cattle at the rate of one or two shillings per person. From then on the project slowly grew, with intermittent purchases of young stock and sales of mature cattle. The project continued to be entirely village financed and supported by unpaid clan labour.

When the author arrived in the village in July 1970 the project was in sad shape. Cattle of all ages and both sexes, numbering about twenty-five, were running together in one herd; the pasture was largely unimproved; the fences were in poor repair so that the cattle frequently broke out of their paddocks and wandered into the peanut fields of the village or onto the highway.

¹ Jack McCarthy, 'Men with a mission help the people', Post Courier, 15 October 1970.

The problem was, like in many other cattle projects operated by descent groups, there was no clear-cut line of responsibility. Nobody was charged with checking the fences, watching whether the cattle had enough to eat and checking the cows when they were calving. The older men did not seem to see or care. Some of the younger men, particularly a few with years of experience in cattle handling on expatriate plantations, did see the problem, but did not have the influence to change things. Four different clans lived together in Waritsian, of which three involved in the project constantly disagreed with one another about it. One issue was the fact that the whole project was located on land claimed by only one of the clans. Another was the problem of dividing the money from cattle sales. For example, in 1969 the project sold five steers to the Lae abattoir for \$956; for seven months the clans could not decide how to divide the money.

Finally, in July 1970, the three clans agreed to break up their joint project and divided the cattle and the money. Each set up a separate project with the intention of expanding its operations, using some of the unused kunai (Imperata species) grass areas nearby. Pessimists were afraid that the new clan projects might soon run again into the same problems unless people with cattle knowhow were given adequate responsibility and lines of authority. At least one man, the intelligent and forward-looking local government councillor of the village, believed that the solution to Waritsian's cattle project problems was to set up individually owned and operated projects. He himself had claims from his father to a large kunai area and he was in the process of deciding whether or not to develop this land on his own with the help of a Development Bank loan.

The Mindari and Amara projects. Commercial cattle raising by Papua New Guineans near Lae began in 1963 when Mindari and Amara received their first cattle from the DASF.

Mindari got about sixty hectares from his clan for which title conversion was in process. Of the total area, about thirty hectares were fenced in 1970, the rest still unfenced and in bush. His first cattle purchases were financed from savings from his cocoa garden. He reinvested all his available income in more cattle and by April 1970 owned twenty-seven head. Later in that year, he received a Development Bank loan of about \$3,900 for the purchase of more cattle and for expansion and improvement of paddocks. His land is good; when fully improved it may carry as many as five head per hectare.

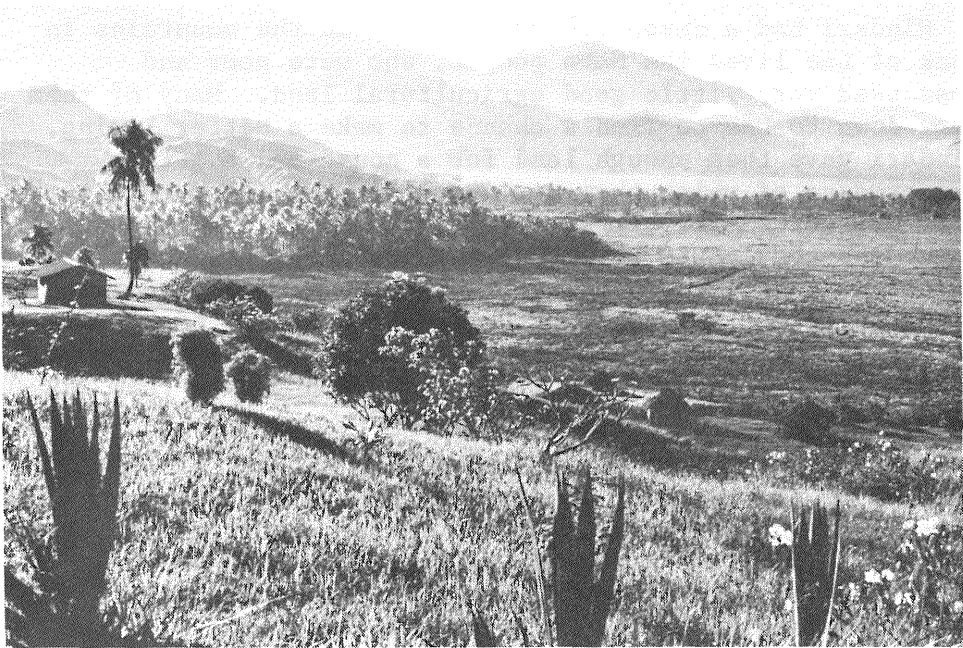


Photo: P.F. Philipp.

Plate 1.1. Waritsian, upper Markham Valley. (The cattle project is located on the grass area beyond the huts.)



Photo: P.F. Philipp.

Plate 1.2. View of Markham Valley from Kassam Pass.

Mindari had a cheap labour supply. In the mountains in back of Lae lived the Naba people, who were poor and possessed very little good agricultural land. Many of them came down to Lae to find a chance to make a better living. Mindari gave them enough land for a house and a garden, the produce of which they could sell in Lae. For this the Naba men worked for him four days per week. Fridays and Saturdays they could help their wives in the gardens and bring their produce to the Lae market. They received no wage. However, Mindari was running into labour problems. He used to have eight Naba families on his property: three had left him by April 1970 when he refused to pay them any money as wage.

Amara's cattle project, located near Mindari's, was similar to the latter's in size and most other respects. He also employed Naba workers under similar conditions to those of Mindari. He was fifty-one years old in 1970 and had had four years of schooling. He got the idea of going into the cattle business from the Lutheran mission nearby. He was fortunate to have a gravel pit on his property, the gravel of which was used in building the Lae airstrip. He used the \$200 from the gravel sales to buy his first cattle. Two of his brothers had money in the bank which they gave him for buying wire and more cattle. Both men had since died and Amara inherited their share in his enterprise.

It is hard to imagine more favourable cost and marketing conditions for ranchers: Mindari, for example, controlled sixty hectares of land about ten kilometres or so out of Lae along the coast road north. His land costs him very little. The labour which he employed to improve the land came practically free. His major 'labour cost' was the forgone income from cattle raising on the small area of his land used by his labourers as gardens. He had little transportation costs to Lae where all his cattle were sold. A government abattoir was located in Lae as were sources of any ranch materials he needed and veterinary and extension services of the DASF.

Both Mindari and Amara were highly regarded leaders; both were local government councillors. Following their example, several ranches had sprung up around them.

Monkei's cattle business. Two other above-average men in the cattle business near Lae were Monkei and Pou, both located in the lower Markham Valley along good roads about thirty-two kilometres from Lae. Monkei was a successful

Papua New Guinean agricultural entrepreneur. His case was the more remarkable because he acquired his basic capital by commercially producing sweet potatoes, coconuts and cocoa in an area where the local people were little interested in growing these cash crops. They seemed easily discouraged by low prices and diseases in these crops and thought that it would take too long to get them into production. Instead they liked to work on ships or in town as houseboys to get quick cash. The land Monkei used was not his but his wife's whose brothers gave her sixty-eight hectares for his use. He started out by growing sweet potatoes on a fairly large scale. From the sale of these he saved a thousand dollars, which he used in planting some 3,000 coconut trees and a cocoa plantation. Then he built a coconut drier and at the time of the author's visit he was just opening a new trade store.

He first became interested in cattle when he heard about Mindari's success. When two rural development officers came to his village to explain the advantage of growing cattle, he and another man decided to try it. They were both sent for two weeks to the Administration's cattle station at Baiyer River to learn some rudiments of cattle raising. When they returned, they called the people together and tried to encourage them to go into cattle raising. The others said, 'you start first and we will watch you and see'. They helped him and the other man fix fences and establish a pasture. He got a loan of \$900 with which he bought twelve cattle. He sold eight of these and, with the money, paid back the loan. At the time of the author's visit, he had two steers and two heifers, which he kept in his coconut plantation. He had cleared six hectares for a sweet potato garden. After finishing with the garden, he intended to put grass there. He paid his clan and family workers mainly with tinned food and sweet potatoes. In October 1970 Monkei got a new loan of \$6,100 at 6-3/4 per cent interest from the Development Bank to pay for twenty more steers, twenty heifers, one bull and fencing material for twenty hectares more.

When the other man in the village who had trained with Monkei at Baiyer River sold his cattle, he bought a pig with some of the money and gave the village a feast. When he told the people that the money for the feast and for the pig came from the sale of cattle, interest in acquiring cattle rose substantially in the village.

Pou. A fine man of fifty-five years, Pou was a leader of his clan and a 'father figure'. He worked for many years on a plantation in Popondetta. When he returned to his home village in 1967, he took over about thirty-two hectares of clan land to which he had claims from his father. In theory, he had clear title to the land but there was no land title commissioner in Lae to officiate in the transfer of title.

He made friends with an expatriate neighbour who advised him first to plant some hardwood trees. He planted 15,000 kumarere and 13,000 teak trees on some of the land. On the advice of the expatriate and of the RDO, he then applied for a cattle loan with the Development Bank. He cleared and planted some eight hectares using his own money, because it took some nine months for the loan to come through. He finally received a loan of \$1,776 in 1969 at 4-3/4 per cent for ten steers and ten heifers. This seems a rather small cattle loan now, but it was a large one in 1969, when the Bank had not yet adopted the policy of giving larger loans for cattle projects. The loan was co-signed by his eldest son and brother. His son worked with him but his brother, who was a local government councillor, did not do much work on the ranch. The loan included funds for clearing at the rate of \$12.50 per hectare which was paid after the clearing job was done. With this money, Pou paid his two grown-up daughters' and his son's wages for the work they did. In 1970, he had one bull and twenty-nine other cattle.

Pou was highly regarded in the area because he had travelled much, had planted trees for commercial purposes and was the first Papua New Guinean in the area who got a Development Bank loan for cattle. Both the DASF and the Department of Forestry used him to spread the good word. As a result of his example and influence, four more cattle loans were made in his village. Since these loans were given much later, when the Development Bank had already begun its policy of making much larger loans, some of these newer cattle loans were substantially larger than the one Pou himself received. However, this fact in no way affected his position within the community.

Minek. In another area, Wonkos Creek near Lae, clan land was divided into several parcels for the purpose of developing more cattle projects by clan members. In 1970 the parcels were in the process of being converted into fee simple title. Wherever possible, the DASF favoured cattle projects which were close to each other. This greatly

facilitated supervision and servicing and also made it easier for the ranchers to co-operate with each other.

One of these ranchers was Minek who was thirty-four years old and had had four years of education in a mission school. He had taken a three-month cattle course at Baiyer River. Of his forty-eight hectares planned for grazing, he had cleared twenty to twenty-two hectares. He had received several loans from the Development Bank totalling \$8,360, with which he bought forty-three head of cattle and paid for clearing and fencing. The cattle were bought at the subsidized rate of \$60 per head. A few months from the time of the author's visit, these cattle should have been ready for market. At a price of twenty-nine cents per pound, more or less, they should have brought Minek somewhere between \$150 and \$165 per head and should have resulted in a good profit. If all goes well, this property should be free and clear of debt in about ten years. Under good management which should allow carrying two or more head per hectare when fully developed, this property should be able to provide an annual income of at least \$4,000 per year, a very good income. Minek hired six labourers to work for him in clearing and in helping with the cattle. He did not employ labour from his own clan because he believed that they wanted more money and did less work.

Situm and Gobari settlements. The ex-servicemen's settlements of Situm and Gobari are located on a good road within a distance of about twenty kilometres more or less northeast of Lae in the coastal plain of the Huon Peninsula. The twenty-nine blockholders had government leaseholds of a little less than twenty hectares each. The settlements were originally set up for coconut production only. However, in 1968 the government decided that the blocks could in addition also be used for beef cattle grazing. In this way, labour requirements could be reduced because cattle could serve as convenient grass cutters keeping down the leguminous cover crop, grass and weeds under the coconut palms. Besides, the cattle would manure the blocks and the more intensive use of the land would increase returns. The older plantation areas on each block, up to ten hectares in area where palms had grown sufficiently large so that they would not be damaged by cattle, were to be used.

The carrying capacity of the blocks was estimated to eventually reach 2.5 animal units per hectare. The original herd per block was to consist of fourteen head: ten steers and four heifers. For his cattle project, each settler was

to get a loan from the Development Bank, which was to amount to about \$1,200, of which \$840 was to be allocated for the purchase of cattle and the rest was for fencing material and other establishment costs (Ploeg, 1971).

In 1968 Simbi was the first settler to have cattle in Situm and Gobari. Simbi worked for twenty-seven years in Wau for an expatriate and during five or six of these years he had worked with cattle. When Simbi left his employer in 1963 to settle on his block in Gobari, the latter offered to give him five cows as a retirement gift whenever he was ready for them. When Simbi's coconut palms were big enough not to be damaged by cattle, the promised five cows were sent him. These cows had all calved by the time of the author's visit and Simbi's total herd consisted of ten head. He had nine hectares of coconut groves divided into three cattle paddocks and the cattle seemed to be in good shape.

In 1969 the better settlers, who already had about five year old coconuts, were selected first to receive cattle. By July 1970 ten cattle projects had been initiated, of which eight had been stocked. The settlers, except for Simbi, had had no experience with cattle raising. Since they had to take care of their coconut plantations, there was no time to send them to the cattle school at Erap. However, the RDO sent two of his indigenous rural development assistants (RDAs) to Erap where they had attended the sixteen-week practical cattle course. For the first six months, while the RDO paid close attention to the cattle operations of the settlers and continued to instruct his RDAs, the cattle did well. Then, because of pressure of other work, the RDO had to give full responsibility for the supervision of cattle to his assistants and to the settlers themselves for a period of two months. The results were near catastrophic. Because of very high rainfall of about 500 centimetres per year at the settlement, grasses grow quickly and sometimes their protein content falls below the minimum required by cattle. During this particular two-month period, rainfall was especially heavy. The cattle suffered badly both from lack of adequate feed and from worms. One heifer in calf died and some steers were in an advanced stage of starvation for lack of protein. The other cattle were in bad straits and had to be hand fed.

Strict control of the cattle projects had to be reintroduced by the RDO. He brought the cattle raisers together for instruction once a week and took them to other projects to show them what is required for good cattle management.

He hoped that in another year the cattle raisers of Situm and Gobari would have enough technical knowhow to do the routine cattle operations by themselves. However, he felt that it might take years until they would acquire a feeling of responsibility and the self-control to handle their cattle projects without constant supervision.

Coastal area east of Situm and Gobari. In the coastal area of the Huon Peninsula east of Situm and Gobari, unused land was available for cattle projects. The lack of a good road and particularly of bridges over some of the larger rivers had retarded development. Some descent group cattle projects were in existence. However, after the first burst of enthusiasm, during which the fences were built and the cattle received, little was being done on these projects. The author visited such a project, the access to the main gate of which was so overgrown with fern that it was hard to get to it.

Interest in setting up individual cattle projects was, however, rapidly increasing in the area. Clans were making available much land for such enterprises. Several factors seemed to aid the RDO there in his selling job. The older influentials in the villages were getting concerned about the attitude of their young men, some of whom took little interest in village affairs. They periodically drifted into Lae, took a comparatively well paying job there for a month or so and then drank the money up or otherwise spent it. Then they returned to the villages with empty pockets to recover for the next trip to town. The influentials hoped that cattle projects would be a way to keep their young men home. Clans were also getting concerned about the consequences of not using much of their land. They had heard rumours that the government might put a tax on such land or take it away from them. The ease of getting substantial loans for cattle projects from the Development Bank was another incentive for their wanting to go into the cattle business.

The local RDO had selected for development land along the road, which all passers-by could see. He started a project by dividing the first eight-hectare block into four two-hectare paddocks and by laying out the fence lines. The trained RDAs and workers from his station helped villagers in building fences for the first two-hectare paddock, after which the villagers were usually able to continue on their own under supervision. The RDO inspected every paddock upon completion and paid the contract rates for this work for

which funds had been provided under the terms of the Development Bank loan. Local people passing these new cattle projects on the road were impressed and wanted to start cattle projects too.

There was an interesting example, a few kilometres up the road from Situm and Gobari, of expatriates and local people joining forces. Singau plantation was raising cattle and became overstocked. It made an agreement with a village nearby to use some of its land as pasture. The plantation used its own labour and materials to fence the pasture. After one year of pasture it gave the village one head out of every six which had been pastured on village land. This agreement was mutually advantageous. It helped the temporarily overstocked plantation and it gave the villagers the opportunity to build up a herd without capital. This quite favourable agreement for the local people was perhaps in part also the result of the fact that one of the partners of the plantation was a councillor in the local government council and expected to get some political advantages from this agreement.

Lower Bulolo Road, Markham Valley. The development of cattle projects in the Markham Valley along the lower Bulolo Road could at best be called mediocre in 1970. The villagers did not show too much initiative; the projects were started and pushed ahead by aggressive RDOs. What made the area mainly desirable for cattle projects was the availability of land (in rain forest) and its nearness and accessibility to Lae via a good road.

The author visited Bonsim who lived thirty-seven kilometres from Lae near Galensis plantation. Bonsim, now a village influential, had six years of mission schooling and worked several years with cattle at Galensis plantation. He also planted 500 coconut palms more than three years ago and 3,600 coffee trees two years ago. His brothers helped him in these operations as well as in his cattle project which was located on clan land demarcated to his family group. Land disputes had been solved by the people themselves within the village. In December 1969, Bonsim was granted a cattle loan of \$4,835 from the Development Bank at a 5-1/4 per cent interest rate. He had set aside a twenty-four hectare piece of forest land for his cattle project near the village. By April 1970, he had fenced four hectares and finished his cattle yard and crush.

Cattle owners in the area hired highland people whom they considered hard workers compared to the local people. Their own relatives wanted more money than the ranchers could or wanted to pay. With growing demand for felling labour, wages were going up. In 1967, the wage for felling had been \$5 per hectare; in 1970, it was \$12.50 per hectare and ranchers had some trouble finding labour even at these rates. The rate for fencing was \$6 per two weeks of work. The labour efficiency of hand felling was quite good. It took fourteen men one week to fell 3.2 hectares which amounted to 4.3 man weeks per hectare.

Six projects were started in this area during the preceding five months of which three were ready to be stocked, two were getting their loans processed and one was waiting for loan approval. While this was a high rate of development on paper, performance was below expectations. The project owners said in their defence that they were engaged in too many other activities which slowed them down in their cattle operations.

Several people had been sent from this area for cattle school training at Erap. RDAs were stationed in the villages to assist in the development of the projects. However, they were young men with a few years of high school training, who had only recently joined the Extension Service. They knew little about ranching and were to gain some practical experience before they themselves could receive some cattle course training.

Southeast of Lae. To the southeast of Lae along the coast, people were in general not interested in cattle development. Most of them were satisfied with their existing level of development. They seemed to have the attitude that government would have to take the initiative and show them that cattle are worthwhile. With the additional difficulty of access, this type of community has had a low DASF priority for development of cattle projects.

Lei-Wompa Cattle Graziers' Association. The RDOs of Morobe District felt the pressure of the additional work resulting from these many new cattle projects. It took much of their time to plan these projects, arrange for loans from the Development Bank, buy materials, transport cattle, supervise management and do all the paper work involved in the servicing of these projects. Thus, one RDO set up the Lei-Wompa Cattle Graziers' Association with about seventy

indigenous members and he acted as their adviser. He considered work with such a group to be a highly effective way of doing extension work which saved him time. There existed also a European graziers' association in the District. The RDO thought at that time (1970) that it would not have helped the Lei-Wompa Cattle Graziers' Association much to amalgamate with the association of the Europeans because the interests of the two groups were still too far apart. One of the purposes of the new cattle association was to develop co-operation among the Papua New Guinean cattle raisers to help themselves.

Eastern Highlands District

Palank.¹ In some parts of Papua New Guinea, expatriates had developed profitable ranching operations, while right around them Papua New Guineans with hundreds of hectares of equally good land had shown no inclination to follow suit. When Papua New Guineans were asked why they did not try, they said: 'Expatriates can run such a big business but we cannot'. DASF officers decided to present Papua New Guineans with an example of a successful big local cattle raiser. The man they selected was Palank who had had fifteen years of experience in various Administration cattle stations and was probably the most experienced Papua New Guinean cattle man.

Palank was a hard working man who originally came from the Chimbu District. He was greatly valued by many expatriate cattle ranchers who knew him from working with him at the cattle fairs in Lae and whose cattle he had handled during quarantine and then driven to their properties. They were willing to help him and gave him good recommendations when these were needed to acquire a government land lease. His sponsors tried first to get a lease for him near Erap in the Markham Valley. The people of Erap knew him and his success would have given great impetus to cattle raising by Papua New Guineans there. However, the Land Board awarded the property to an expatriate. A second lease for which Palank applied was also given to an expatriate. Perhaps this can be considered as an example of lack of co-operation which sometimes occurred between different parts of the bureaucracy and which interfered with the development of cattle raising by Papua New Guineans.

¹ Valuable information on this subject was received from Livestock Officer Fred Fletcher.

In 1969 Palank was finally successful in getting a good government lease, 240 hectares in size in the Kainantu sub-district of the Eastern Highlands District. The Development Bank gave him a loan of \$28,000, the largest loan which had been given to a Papua New Guinean. Palank was also the first Papua New Guinean cattleman who, as a result of the size of his operation, was able to import cattle from Australia under the government's subsidy plan. Financed by an Australian stock and station agent, he was able to go to Australia to select his cattle. This fact as well as the large size of his loan were well publicized in the press and made him something of a celebrity.

Palank's ranch lies a long distance, perhaps 240 kilometres, from his home community. This, together with the fact that he used no clan land and no clan finances, made him independent from his clan. However, he kept contact with his clan and, frequently, some of the people of his line stayed with him. He lived simply in a house built with local materials and raised himself the food for his family and his workers. His life, however, was changing. As a stock man on a government station he probably had an estimated income of about \$1,000 per year plus free housing. When fully stocked, his ranch according to budget plans should provide a potential income of \$7,000 per year.

At the time of the author's visit in 1970, Palank's success was still in the balance; he still had to prove himself. He knew and liked cattle and handled them conscientiously. He was one of the few Papua New Guinean cattle raisers who had horses to herd his cattle. There was thus little doubt about his technical competence as a cattleman. However, he had had little experience as an independent entrepreneur. An operation of a size such as his (he had a hundred head of cattle in 1970 and was not yet fully stocked) required a substantial amount of entrepreneurship. During the establishment phase of his cattle business, all his finances and major decisions were supervised and guided by his bank supervisor, a livestock officer of the DASF. Beginning in 1972, Palank was budgeted to pay back his loan in eight annual payments. He had practically no experience in such things as book-keeping, accounting and bank financing. As a stock man there had always been somebody above him who had made the vital decisions. The fact that he was illiterate and spoke only Pidgin made things harder for him but was no major limitation. There were also human questions. Having become a celebrity, how would he stand up to this challenge? Would he realize that a well-

known man still has to work as he had done all his life? Would he be able to handle people as an employer? His record, up till then, had been good; he had had some labour trouble but had overcome that. For a while he seemed to have been drinking quite heavily, but he stopped that. Actually, money was not yet plentiful for him because he was still building up his herd and did not have many cattle for sale. In the meantime he had to pay his labour bill and other current expenses.

His bank loan paid for a diesel tractor and a tipping trailer. Fortunately, his local government council needed repairs and maintenance done on the road leading past his ranch. He got a contract for ten days of outside road work per month for himself and his tractor and trailer at \$20 per day. Since his ranch structures were almost completed, his hired labour could handle the work load while he was away on this outside contract.

It was too early, in 1970, to decide whether Palank would finally be successful as, what might be called, a medium-sized cattle operator. Even if he would succeed, it must be remembered that there were few Papua New Guinean cattlemen of his calibre and experience in the country at that time.

Western Highlands District

Doa. While Doa was not as experienced a cattleman as Palank, he was one of Papua New Guinea's most impressive agricultural entrepreneurs.¹ At the time of the author's visit in 1970, he was about forty-five years old.

For twenty years, from 1943 to 1963, Doa worked on Korn Farm, the agricultural station of the DASF near Mt Hagen. At first Doa was paid in goods, not in money. His typical pay consisted of one bush knife and two gold-lip shells. Doa himself was involved in bringing about a change in the salary payment from goods to money which was introduced as pay in 1951. During his long work at Korn Farm Doa avidly picked up all he could learn from his Australian employers. Much of the area of Korn Farm was originally swamp land. Doa learned how, by digging deep six-foot trenches through the land, the water could be drained and the swamp transformed into highly fertile land.

¹ Much information came from unpublished notes by W. Straatmans on his interview with Doa, 1969.

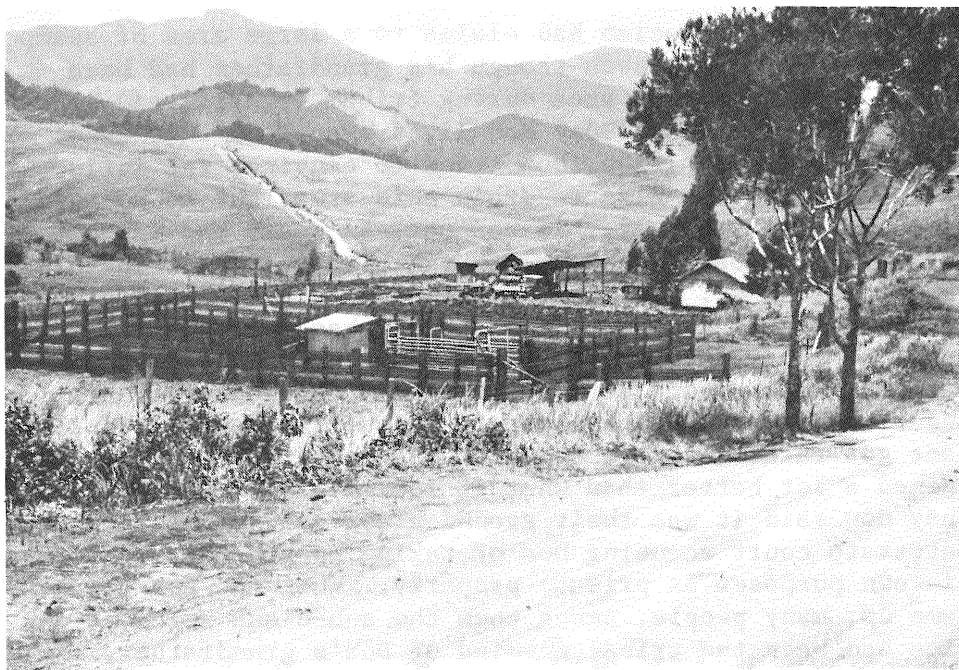


Photo: P.F. Philipp
Plate 1.3. Palank's farm.

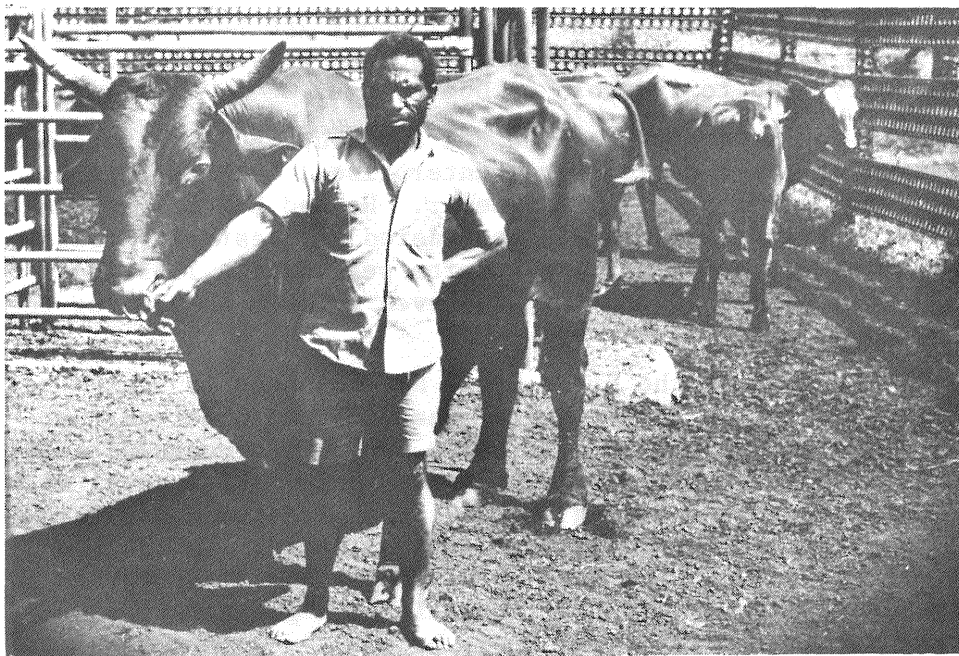


Photo: P.F. Philipp
Plate 1.4. Palank with his prize bull.

Doa and his sub-clan had claims to a large area of swamp land near Korn Farm even though his grandfather had been driven away from this area during tribal fighting and he and his son and grandson (Doa) had lived away from this land. Many times in the 1950s, Doa tried to convince the influentials in his sub-clan to drain this area, but to no avail; his clan only saw that this was useless swamp and was not interested. Doa alone from his sub-clan went back to this land to claim it. In 1963, he began to dig drainage ditches with the aid of labour. When the ditches were completed he asked the government to survey the land and to mark the boundary with cement pegs. When the boundary survey got under way, his sub-clan began to become interested and in fact got rather excited about it. Because the land now seemed a lot better than what it looked like before drainage, they now said it was their ground after all. They took the matter to court accusing Doa of taking up sub-clan land for his own purposes as private property. When the court case came up, many people, among them the sub-clans which at one time had been the tribal enemies of Doa's grandfather, stated their claims to the land. However, Doa won the court case which involved about 300 hectares of land. Because there had been so much argument about this land, Doa wisely decided to give away about forty hectares to the other claimant and to retain for himself about 260 hectares as personal property. In 1968 the land was converted from customary land to freehold in Doa's name.

When Doa left Korn Farm he had saved up \$600. Before he started on other agricultural enterprises, such as cattle raising, he had been a pig breeder. He had had as many as forty or fifty pigs and was considered the best pig breeder in the area. This business had its peak during 1963 and 1964 when he got \$20 per pig and even as much as \$30 for the very heavy animals.

Doa was one of the first Papua New Guineans to begin cattle raising in the Mt Hagen area. He had observed that all Europeans whom he met in Papua New Guinea consumed a lot of beef and that European women gave their babies cows' milk on which they grew strong and healthy. This made him think that cattle raising would be a good business. In 1964 he fenced his paddock and in 1965 he bought his first cattle with some money he had made in selling coffee and from a small government loan. He first bought ten weaned steer calves at \$30 a piece from the agricultural station at Baiyer River. He sold five to six mature steers per year. All the money he received was reinvested either in new stock

or in additional fencing, labour, and so on. If he needed money badly he might sell some of his cattle, before they were ready, for about \$100. However, if he had enough money, he would wait until he could sell his cattle for \$200, which he considered the full price. By 1969 Doa had a herd of twenty-five head of cattle including four cows and heifers ready to calve. By 1969 he had, in addition to his cattle, a not yet bearing coffee orchard and 9,000 bearing coffee trees, which gave him receipts of \$100 to \$200 per month. He also had 3.2 hectares of tea which brought him a gross income of \$200 per month. His business was thriving. However, he realized that at the present rate of growth it would take him another twenty years until his property would be fully developed. Doa, therefore, applied to the Development Bank for a loan for his cattle enterprise. The Bank granted him a loan of \$18,000 which was the second largest loan received up to that time by a Papua New Guinean. With this loan Doa expanded his fencing from 120 to 200 hectares and the government bought him an additional thirty-five heifers from Australia.

Doa was an example of what an able and energetic Papua New Guinean could achieve in agriculture, given the right opportunities. He started his working life in an essentially non-monetary exchange economy. He received a minimum of formal schooling and spoke only Pidgin. At least until 1969 he was almost entirely what we might call in the West a self-made man. He inherited no capital from his parents. His father, however, instructed him with regard to the traditions of his sub-clan and his and his clan's claims to land. At the same time, his father advised him to stay in the area where he was born and not to return to the land near Korn Farm which his grandfather had left under pressure. Doa disregarded this advice. He correctly recognized that the development of an agricultural business required assured use rights to a piece of land. First he tried to get hold of land in co-operation with his sub-clan. When he did not succeed in this, he began operating on his own and he had been essentially a loner in business ever since. The loosening of their economic bonds with their sub-clan or clan has in various degrees been one of the characteristics in the stories of many successful Papua New Guinean cattlemen.

Doa expressed his attitude as follows: he was never interested in developing his land in combination with others; all the money which he saved went into his investments and no other friend or relative participated in this investment,

even if they wanted to; this gave him complete freedom to do with his land what he wanted and to divide it eventually between his children without having to ask a shareholder if it would be all right. Doa realized that it was necessary to invest and reinvest most of the profits which he made. He observed that the European planters built up large businesses in this way and he wanted to do likewise. He did not use his savings and profits, as so many other Papua New Guineans did, to buy a car to drive around or to drive people around. He was always afraid that the money would go to waste in doing so.

Doa saw quite clearly the difference between himself and most of the other Papua New Guineans around him. He said:

In my area many men could have done the same thing as I have done and developed a large agricultural business. However, they are not prepared to do this; instead they use up their small earnings in the hotel on drinking or they waste it on playing cards. In the best case, they use their money as an investment to help another man in setting up a trade store and they see no or little return of this investment. They do not seem to be able to set up their own business and develop that business successfully.

Doa was well aware that the reason he could do what he did was because he had worked for so many years at Korn Farm where he had seen how Europeans did agricultural work and business. He said that many others could have set up an enterprise on land on which they could have laid a claim, but they had no imagination as he had.

One thought which spurred Doa on were his ten children, particularly his boys. When his children would have grown up and received their education Doa wanted to have something to show them and to give them. He wanted to develop his business for them to eventually take over; only then could he think of retirement. Another thing that spurred Doa on in succeeding in his business was his desire to accumulate sufficient money to buy additional land, particularly land which a few years ago he had to sell to an adjoining expatriate tea plantation. Doa was highly ambivalent about the sale of some of his land for the establishment of this tea plantation. He had only a share in the claim to this land and the other people were all willing to sell. He saw the advantage of having a tea factory immediately adjoining his property to which he could sell his tea without having

to ship it far away. So Doa finally sold the part which came under his jurisdiction and he got \$1,400 for it. However, he regretted the transaction and hoped that he eventually could accumulate sufficient money to buy back this property.

Doa fully realized that the future of his business depended on his ability to hold on to his land. To understand some of his actions, one must realize that his experience with European landholding contracts and ways of ownership was after all severely limited. One of his concerns was that at some stage the government might want to buy the land which he owned. He was afraid to give in to demands by the government even for small amounts of land and even if such giving up would greatly enhance the usefulness and value of his remaining property. In this way one can understand why he opposed the development of a new road which would have passed through his property. Eventually that road had to be built at higher cost along the boundary of his property. The government also wanted to buy some gravel located on his property. Again he felt the danger to the continued possession of some of his land and refused, even though this would have really been a favourable business transaction for him. Such a stand did not make him friends in the government bureaucracy. For example, when he asked for conversion of his land to freehold, his application was stopped at the District level. However, Doa was a go-getter and not easily intimidated. He went all the way to the Administrator, who was impressed with him and arranged for transfer of the freehold title of the land to him.

Doa was not motivated only by narrow egotistical considerations. He saw the need for development of his District and of Papua New Guinea as a whole. He realized that the development of services such as health and education services and the building of roads and airports had to be paid for; that his country was heavily dependent on and in debt to Australia. He saw the solution to overcome these difficulties by developing profitable enterprises on the land. His broader concern for the welfare of the wider community was one of his reasons for developing his agricultural business.

Doa also realized the advantages of diversification. He did not confine himself to cattle but went into coffee and tea production simultaneously. He also opened a trade store. In this way he felt that he would not get hurt if demand for the product of one of his enterprises should decline.

Doa employed a substantial labour force of some twenty-five people. When he started to dig his drainage ditches in 1963 he did not have much money to pay. He made up for this by killing some pigs and by giving his relatives and friends a feast. By 1969 the cash wages he paid were comparable to those paid by expatriate plantations nearby. He employed, in addition to tea pickers, ten daily labourers and a cook. They were paid monthly. The minimum pay was \$6 per month for a new man who had just started to work for him and \$15 a month for a top class worker who had been with him for at least two years.

In 1973 Doa died intestate. At the time of his death, he owned a herd of 167 head of cattle of all ages. He also had ten hectares in coffee and tea and his total property was valued at \$60,000.¹ The settlement of Doa's property became an important court test case. The Supreme Court in Port Moresby ruled that distribution of a Papua New Guinean's properties should be by customary law rather than by a formula laid down by British law. The justice said that the land was subject to a tenure conversion order and had ceased, during Doa's life, to be 'native land'. But he said it continued to be the 'land of a native' for succession purposes.²

Doa wanted to bequeath his property to his children and he probably would have been disappointed with the court's decision. Nevertheless, even if he could have foreseen the judge's stand, the writer thinks that Doa's actions as an agricultural entrepreneur and as a cattleman might quite likely not have been affected.

East Sepik District

The number of cattle in indigenous cattle projects in the East Sepik District increased from ten head in 1964 to 1,359 at 30 June 1970. The District had the third largest cattle population in Papua New Guinean cattle projects in 1970, after the Morobe District with 2,200 and the Eastern Highlands District with 1,692 head. The major credit for this development must be given to the District livestock officer, Bill Graham. He stocked his first indigenous cattle project in 1965 and had about seventy such projects stocked by the time of the author's visit in April 1970.

¹ Post Courier, 3 August 1973.

² Post Courier, 3 September 1973.

The people came to Graham's office and told him they wanted cattle. He informed them that they should collect at least \$400 for their future cattle project and see him again after they had cut forty posts, three metres long and thirty centimetres thick. Only about one-third of the original applicants came back and only about a third of their posts were acceptable. They had to continue to cut posts until the required number of forty was ready. Then Graham checked and chained the proposed project area and selected a place for the future cattle yard, which has to be well drained, shaded, accessible by road or water and close to a source of drinking water. A group of Graham's live-stock assistants helped the villagers in making the necessary improvements. They first built a cattle yard and then an adjoining smallholding paddock. Posts which were left over were used as corner, strainer and gate posts. Everywhere in the country the quality of posts was a problem; ordinary bush posts usually just lasted two or three years at best. The livestock officer encouraged the use of some of the good hardwood posts of the area such as quila or garamut which might last as long as ten years if cut from mature wood.

The demand for cattle by villagers was great. Graham did not have to sell cattle projects. He estimated that with some selling the number of cattle projects in the District could have been tripled. Demand was such that every village was expected to have at least one project. While he considered all parts of the District suitable for cattle raising, he concentrated his efforts in areas accessible by road or water transport. Since he was headquartered at Wewak, most of the projects were developed along the Wewak-Maprik road and along the coast road on both sides of Wewak. He decided that developing projects right on the road was the easiest way to give publicity to his cattle development program. The author discovered how effective this idea was when he asked local cattlemen where they got the idea of raising cattle. Several said, 'I walked along the road and saw these cattle and I wanted to have some too'.

Where a new project was started, many people participated in the financing of a single animal, but as the herd grew, individual ownership of animals became more common. Many East Sepik villagers worked in Wewak or outside of the District. When cattle projects were established, these people would contribute to the financing of the herd. For example, every single member of the transport pool in Wewak

'owned cattle'. The rapid East Sepik development was the more remarkable because cattle and wire purchases were largely financed by the would-be ranchers themselves. At the time of the author's visit in the District, the Development Bank had not yet started to finance any Papua New Guinean cattle projects there.

Cattle to stock village projects came primarily from the government stations of Erap, Moitaka and Baiyer River. In contrast to the practice in many other Districts, the projects were first stocked with heifers and not with steers. This method of stocking generally proved successful, with low death rates, although it resulted in a fairly low calving percentage during the first years.

The relative profitability of cattle was probably a factor in the popularity of cattle in this area. The other major cash crop in the villages in the hilly area behind Wewak was coffee. In April 1970, a steer ready for market brought \$100 which was about equal in value to 650 pounds of coffee. Very few villages there sold that much coffee per year.

Many projects were still run on the system of keeping the cattle in a paddock at night and grazing them out during the day, although fencing of additional paddocks was strongly encouraged. The night-time paddock, daytime grazing system has worked much better in the East Sepik, which is better suited for this type of management, than, for example, in the Eastern Highlands District. However, here too were found some of the same problems which arose with this system in other areas. For example, the villagers might work hard for six weeks and then decide to go hunting. So they would all go and leave the supervision of the cattle in the hands of one old woman. On their return, after a few days or a week, they might find the cattle in a run-down condition, because the animals had not been regularly let out of the paddock during the day. It took at least a year of constant DASF supervision and struggle with the villagers until the night paddock-day herding system was accepted as part of the required routine of jobs to be done in the village. Once accepted there was usually comparatively little trouble with this system. In some villages responsibility for taking care of the cattle herd was shifted every two weeks from one or two people to the next group. These men did their job conscientiously while they had the responsibility. Like in many other Districts, the cattle were not separated by age or by sex; all were kept together as one herd. All

herds visited by the author, however, were in good condition. Graham believed that even a small heifer should not have too much trouble with its first calving, even if mating under the described conditions should have occurred too early, as long as it was in good condition and could grow as fast as a calf within it. Horns were generally kept to avoid wounds at the place of removal, which might attract the screw worm fly.

The management level of these cattle projects was still fairly low. The potential carrying capacity on improved pastures was high in many parts of the District. For example, on the lower slopes of the Prince Alexander Mountains near Wewak, less than one hectare of improved grassland could carry one to two head on a year round basis. However, most of the local cattlemen did not know how to manage an improved pasture. They sometimes grazed it before it was fully established. Alternatively, they did not spell it to let the grasses come back after having grazed them down. Instead, they left the cattle locked up in the improved paddock until all the grass was completely eaten out. Where rainfall was sufficient Bracciararia was the best grass; Centrosema was doing well, but Puararia was even better because it was not palatable enough to be eaten out to destruction by the cattle. During 1970 a number of trainees returned to their cattle projects from the Erap cattle school. With the forthcoming opening of a new cattle school at the livestock station at Urimo in the East Sepik, the level of management in the District could be expected to improve.

Graham had put a few of his best local cattlemen on his staff as livestock assistants. This could easily be done in the past when educational requirements for these jobs were not strict.¹ This arrangement had advantages for both the livestock officer and for the cattle project operators. The livestock officer acquired men who were interested in their jobs and learned quickly. For some of the livestock assistants, this arrangement also worked out well. Take, for example, William, a pleasant and able man of about forty years of age and with a will to make his way in the world.

William had tried several unsuccessful ways to get ahead

¹ By 1970, the educational qualification for a newly entering livestock assistant in the DASF was form one in high school.

until he finally found a good one. He started out as a local leader in a cargo cult which landed him in jail. He then claimed some land which was owned by an important local mission and which had formerly belonged to his clan; this also proved unsuccessful and only resulted in the enmity of some of the local Administration officials for whom he had made a lot of trouble. As a livestock assistant and with the help of the livestock officer he was able to buy good female stock and had the use of good government bulls. The livestock officer also taught him how to buy and sell cattle at the right stage and time. William kept his cattle a few kilometres outside of Wewak on suitable land belonging to the clan of his stepfather, to which, however, William had no permanent claim. When his herd outgrew the available pasture area there, he was able to convince his own clan to agree to the transfer of 120 hectares of clan land to his and his brother's fee simple ownership. However, when this deal came up for approval, the local administrative officers prevented the deal from going through. Their major official reason for this refusal was that this land was too steep for a cattle enterprise. While it was indeed rather steep land, most of the village cattle projects on the slopes of the Prince Alexander Range were on the same type of land.

William was, however, undaunted. Prevented from using land the European way, he used the traditional approach. Together with his brother, he organized a clan project in which the two were the undisputed leaders. His brother lived on the place and had day-to-day supervision of the project, while William himself had the major say in general management and in policy decisions. On the two projects located on the land of William's own clan and on that of his stepfather respectively, about sixty cattle were kept in 1970, of which thirty-eight belonged to William. This made him the largest and most influential Papua New Guinean cattle owner in the East Sepik. He was also one of the few Papua New Guineans in the Sepik who have learned to handle improved pasture well. When fully improved, the 120 hectares under his control will be able to carry a herd of 200 or more cattle. William has made his way.

One of the few local cattle projects not financed originally by Papua New Guineans themselves was that of Anaga, a famous war hero of the Second World War. The Reserve Bank of Australia gave non-repayable loans to several pioneer ranching projects in Papua New Guinea, one of which was Anaga's little cattle ranch, commenced in 1965.



Photo: P.F. Philipp.

Plate 1.5. William and his herd, with bull, in the village.

Development of this property of about two hectares was an interesting example of how local traditional beliefs might interfere with the development of a project and how they could be overcome. The place chosen for the project was considered by the local people to be a place masalai, the trees of which were inhabited by spirits; terrible things would happen if the trees were cut down. Since the local villagers refused to touch any of the trees, the livestock officer called on his own crew to fell them. The villagers crowded around to see what would happen to the unbelievers who dared to cut down these sacred trees. Nothing happened and the local people ever since have used the area as a cattle project without qualms.

At times, European businessmen joined with Papua New Guineans in cattle projects by loaning them money. In some of these cases, lack of knowhow on how to keep records was a drawback to the Papua New Guineans. An expatriate operator,

out to make a quick buck for himself, could easily manipulate the books to his advantage in such a situation. The indigenous partner would come out second best because he would have no written records to counter the expatriate's claims.

The outlook is bright for indigenous cattle raising in the East Sepik District. Unless the government was to encourage expatriate cattle raising in the District, the demand for beef could not be filled from local sources for years to come. The new government station at Urimo was to provide good cattle at close quarters. An abattoir was under construction in 1970 and slated for completion in less than a year. Many good potential areas such as the alluvial land along the Sepik River had barely been touched for cattle raising. However, disputes over the ownership of some land, particularly in the coastal strip around Wewak, interfered with the development of this area.

This District may also serve as an example for the importance of individual leadership in and co-operation of the various bureaucracies of the government in developing Papua New Guinean cattle raising. The Extension Service, which has the responsibility for promoting Papua New Guinean cattle projects, apparently did not have the personnel in the early years to do this job in the East Sepik. A young livestock officer of the Animal Industry Division, stationed in the District, saw the possibility for and was highly successful in initiating cattle projects during a period of five years. When the RDO eventually became more active in promoting cattle raising, friction developed between the representatives of the two services in the District resulting, in 1970, in non-co-operation between them to the disadvantage of the development of cattle raising by Papua New Guineans.

Northern District

The number of indigenous-owned cattle in the Northern District rose from zero in 1967 to 353 head in June 1970, which was the largest number for any of the five Districts in Papua.

Conditions for the development of indigenous cattle projects in the District were highly favourable in 1970. A major factor for this development was the quality and interest of the RDOs in the District. For example, Bob Black, the RDO until early 1970, was considered an extension man of above average ability; he was forceful, diplomatic

and personally involved. One cattleman in the area expressed his opinion as follows: 'We liked Mr Black. He gave us big help night and day. He visited us every weekend. Before we did not know, he showed us'.

Moreover, the District Commissioner took a personal interest in cattle development. The Development Bank was starting up operations and was looking for Papua New Guinean customers. Land tenure conditions were also favourable. The Northern District had been chosen as an experimental District for land tenure conversion, from customary to freehold land title. Clans were quite willing to make cattle land available for title conversion. On most projects topography was not a problem because the land is fairly level. A usable road system built during World War II when this area had been used extensively by the Allied forces still existed. This easy access to cattle projects greatly facilitated DASF assistance and supervision. A ready market for fat cattle existed in Mamba Estate Pty Ltd in Kokoda, which operated a slaughterhouse and marketed the meat in Port Moresby. A new road had just been opened connecting Popondetta with Kokoda and the DASF provided cattle transportation from the indigenous ranches near Popondetta to the slaughterhouse, at a nominal fee of \$3 per head. A market also existed in Popondetta itself and, in case of need, cattle could be killed on the slaughtering floor of the Popondetta Agricultural Training Institute.

Hegata, an example of a cluster project and of land tenure conversion. Hegata is a village located a few kilometres outside of Popondetta. In 1968 the RDO called a meeting in the village of Hegata and told the people that their 5,400 hectares of clan land were good for cattle. He called for volunteers to start cattle projects. None of the people knew anything about cattle then and for this reason most of them hesitated to get into that business. However, eight men were willing to try. The clan agreed to let each one of the men use a block of eighty hectares of clan land, which had been only used for hunting and was located fairly far from the village. It was mostly kunai grassland, but also had some forest. The clan also gave permission to the eight members of the new cattle settlement to apply for land tenure conversion. In June 1970, three of the settlers had already received their freehold title to the land and the others were going to have their land hearing soon.

The cattle settlement had a reasonably good access. A four-wheel drive road ended on one side of a deep gully and had to be traversed on foot to reach the settlement on the other side. The settlement layout was good. The blocks were divided into two cluster groups of four. Each cluster group shared the use of a cattle processing yard located, together with the four dwellings, where the four blocks were coming together. This layout fostered co-operation among the ranchers and facilitated supervision by government personnel.

The Development Bank gave a loan of about \$1,200 to every settler except one who was not eligible because he had not yet paid back a previous loan. The Development Bank loan was to be enough to buy eight heifers, five steers, some fencing material, legume and grass seed, and veterinary supplies.

The RDO gave more assistance than just simple extension advisory service. In addition to planning the layout, handling all aspects of the Development Bank loan and helping in yard and fence construction, he had the DASF tractor with driver work for two months on the settlement free of charge, rolling the kunai and preparing the land. When several cattle died from starvation during their first month on the project, when put in a paddock containing only old kunai grass, the DASF replaced the cattle at no cost to the ranchers. The DASF personnel made most of the management decisions including arranging for marketing of the fattened steers.

The settlers would sometimes co-operate with each other such as in cutting and hauling posts, and in fencing. However, each settler mostly worked on his own land, helped by his family and relatives. The latter were not paid money for their work but expected to eventually receive cattle, once the Development Bank loan had been repaid.

By mid-1970, each settler had planted about four hectares of improved pasture. At the time, the cattle of all settlers in a cluster group of four were still handled and rotated through the blocks as one herd. The first instalment on their loans was due in December 1970, but they had fat steers to sell which would return more than the amount of the instalment.

When asked how they felt about their cattle project, the settlers said that it was at first very hard to plant the grass and to make the fence. However, they were happy once

they got their animals, particularly since the DASF replaced the ones that had died. One of the settlers was being trained at the cattle school in Erap; he was not only to be a help to his fellow settlers to become more independent from the DASF in routine decision making, but also to be a help to other villagers of Hegata. Once they had seen the success of their rancher clansmen, seven more Hegata men planted grass, cut posts and approached the DASF to give them cattle. Now, instead of the DASF having to sell the idea of cattle, the demand for cattle projects was coming from the people themselves.

Anthembo Pastoral Syndicate. This was a progressive type of a group cattle project located near Kepara village on the Kokoda-Popondetta Road in the Northern District. The people living in four villages had sold a large piece of forested land to the government and had received \$10,000 for it. They had asked Chris Abel, the RDO of the Kokoda sub-district, what to do with the money and together they had come up with the syndicate idea. Their plan was that the recipients of the money would become shareholders in a group cattle project, which would be developed on another property, which they still owned. This they did and the Syndicate was formed with 150 shareholders, including women and children, from sixty different families, who held anywhere from \$14 to \$250 worth of shares per person.

The Syndicate had eight directors, of whom two were elected in each of the four villages. During its annual meeting, the directors selected the manager, who was to have overall responsibility for the Syndicate's operation. The manager was the key man in the Syndicate. He employed the labour, handled payments and even supervised the directors when they were working on the project.

The man chosen as manager in 1970 was Lucian, a comparatively young man of thirty-two years. He was a man with good common sense and, with one or two years of high school, comparatively well educated. He was highly regarded in the community and an elected local government councilman. The RDO, the Syndicate's adviser, said that he would not have agreed to the scheme, if a man of Lucian's ability and character had not been available. Lucian himself came from one of the four villages and was one of the biggest shareholders of the Syndicate.

The land selected for the project was located in a favourable climate belt for cattle raising with generally no serious drought periods, but was heavily forested. By mid-1970, twenty hectares had been cleared and four paddocks, planted to improved pasture, had been stocked with twenty-five steers. Clearing was proceeding on another eight hectares. At first, some of the work had been done by the shareholders themselves. However, they were busy with their own cocoa blocks and gardens, which was one of the reasons why they had come up with the idea of the Syndicate in the first place. Thus a group of four hard working hill people was doing the clearing and planting, supervised by one of the directors who worked with them on a two-week rotation basis. The Syndicate had established a seven-hour work day, from eight to four, with one hour out for lunch, which was less than on the nearby Mamba plantation. The workers were paid \$.70 and the director \$1 per day. One permanent man who had six years of cattle experience on Mamba plantation took care of the cattle. He had been paid \$1 per day until recently, when his salary was cut to \$.80 because the Syndicate felt that it was spending its capital too quickly. Of the original \$10,000, about \$5,000 had already been spent on labour, wire and stock, while the cattle on the place were worth \$3,000.

The directors of the Syndicate faced a major financial policy problem. They needed to buy another twenty-five to thirty heifers and a bull, worth about \$3,000, for additional stocking. They also needed to continue their clearing operations. Should they limit themselves to their own resources and slow down their clearing operations until more money became available from stock sales or should they continue clearing at the present rate and borrow for the cattle purchases from the Development Bank at an interest rate of 5-1/2 per cent? The problem was still under discussion at the time of the author's visit.

How did the higher echelons of the DASF look at this idea of the Syndicate? They asked the RDO why he did not follow usual Departmental policy and push individual cattle projects. They were watching the progress of the Syndicate but seemed to be willing to give it a try.

Part 2: discussion and analysis

Motivation for raising cattle

To many Papua New Guineans, particularly in the highlands, the major attraction of a cattle project is that it is a way to become a big-man; it helps them to gain status, prestige and power. Prestige is derived from the fact that they are able to afford and display such a 'conspicuous investment' asset as a herd of cattle.¹ In some parts of the country, cattle still have a novelty value and a man gains prestige for being the first person to raise cattle in an area.

While the daily needs of villagers are largely satisfied within their subsistence economy, they need a limited, though increasing amount of money to spend on store goods, recreation, transportation, educational and health fees, religious contributions, bride price, taxes, and so on (Holzknecht 1970). They consider cattle to be a good source of money income.

Although cattle are a welcome additional meat source in view of the low animal protein content of the villagers' diet, they are rarely raised primarily for home consumption. In some areas they are used, like pigs, for singsing or in traditional exchanges.

To some clans such as those near Korofeigu in the Eastern Highlands District, cattle projects serve as a way for holding onto their land against claims and squatters of other clans. Other clans with idle land, such as those in parts of the Morobe District, are worried that such lands will be taxed. To prevent these things from happening, they erect fences and put cattle in to show that the land is being used.

Or, as pointed out for the coastal area east of Situm and Gobari, the older influentials see their young men attracted away from the village and are trying to keep them at home by letting them initiate cattle projects. In some areas, however, some of the older influentials may be less receptive to the idea of a cattle project. They tend to be satisfied with traditional village life and the status which they have achieved. They realize their inability to run a cattle enterprise and the danger of losing social

¹ For a discussion of 'conspicuous investment' see B.R. Finney (1969:22, 24).

standing to the younger men as a result. They are afraid that the new methods being introduced into the village in connection with a cattle enterprise would undermine the traditional ways. They also may not like the new pressures, such as having to repay bank loans or having to do more and different work, that will come with a cattle project.

Some limitations in raising cattle

Cattle and pasture knowhow. The low level of cattle and pasture knowhow due to a lack of a cattle and pasture tradition still adversely affects cattle raising in Papua New Guinea. Cattle were unknown in pre-contact Papua New Guinea; by 1961 the two million Papua New Guineans owned less than 400 cattle.¹ Serious Administration efforts to introduce cattle to Papua New Guineans only started about 1960. By June 1970, the number of Papua New Guinean-owned cattle had risen to 8,900,² but ranching knowhow had by no means increased in the same proportion.

Lack of understanding of cattle management, nutrition and health, and of pasture requirements is widespread. Many villagers do not understand the need for subdivision and rotation of paddocks; they do not know how to handle nutritional lactation stress of cows during the wet season in areas like Situm and Gobari. Thus, Clark (1970a) reported as follows on cattle management in the Eastern Highlands District: 'Calving percentages of less than 50 per cent, breeder mortality of more than 10 per cent, inadequate culling programs, and the practice of leaving steers on projects for over four years, in excess of profitable turnoff weights, are not uncommon'.

While some Papua New Guineans are still afraid of the 'big pig', others have learned to handle cattle remarkably well and to tame them easily. For example, during the author's visit to Reginald in the Northern District, the herd stampeded and was about to run him down. Reginald stepped coolly in front of the onrushing herd, offered them some salt and stopped them in their tracks. In another instance, near Goroka, the author saw cattle imported from the expatriate ranch of Leron Plains, known for its wild cattle, having become so tame within two months that they would quietly walk to a woman and eat sweet potatoes out

¹ DASF files, Port Moresby.

² Ibid.

of her hand.

Papua New Guineans are mainly a gardening people. Work in subsistence gardens is done well along time-honoured traditional lines and people work hard (Holzknecht 1970). Labour needs of cattle projects are often still insufficiently understood. Cattle ranching is frequently not yet included in the rhythm of the village routine, as mentioned for the East Sepik District. Necessary ranch jobs such as watching out for and treating strikes by the screw worm fly are sometimes overlooked or put off until the next day, when it may be too late.

Western concepts. Many villagers have difficulties understanding Western concepts of business and profit. Traditional big-men in clans acquired their position partly because they were shrewd exchange manipulators and knew how to handle men and organize social activities. Their aim in such undertakings was, however, not profit in the Western sense but prestige and influence. Many Papua New Guineans today still fail to grasp the notion of operating a business for profit. For example, near Korofeigu in the Eastern Highlands District, the author saw a badly overstocked cattle project, with cattle in poor condition. However, to the owner, the important consideration was to gain prestige by showing off a large herd, regardless of whether or not his cattle lost weight.

Indigenous ranchers also have problems with Western business methods and techniques such as planning and budgeting, financing, depreciating, marketing and pricing. They have difficulties understanding many concepts which are important to a successful business venture such as the role of time and the distinction between gross and net return.

Take, for example, Jaffo, who had been running his five-hectare cattle enterprise near Goroka for several years. He was a hardworking man who had been employed for twenty-five years or more on agricultural experiment stations and on an expatriate plantation. He was one of the lucky ones who had been selected as a settler for the Arona smallholder scheme, which is mentioned later. He said:

I started my cattle project with my \$1,000 savings. I could not budget my money like a white man and I did not keep books and records. I spent money on steers and cows, fencing materials, labour of my clan people and food. I must have spent unwisely on labour and food and now I have no more money.

Please tell the didiman (DASF extension officer) to teach me how to budget and keep records.

Another example was a man who, with his brother, was to head a clan cattle project on 400 hectares near Kapogere in the Central District. He was an educated man and spoke excellent English, but he was unable to prepare, unaided, a budget of his proposed cattle operations which was required to support his application for a Development Bank loan.

Education and training of cattle raisers

Under normal conditions in a continuing culture situation, skills, knowledge, motivations and attitudes are imparted by various means such as the usual process of childhood upbringing, formal education, exposure to meaningful situations and adult interaction (Nadkarni 1970:4). In the case of need for rapid human development, particularly under conditions of cultural change, the imparting process has to be speeded up and childhood upbringing loses, in relative importance, to the other three means of providing education. The existing limitations of Papua New Guinean cattle raisers such as lack of pasture and cattle knowhow and of Western business techniques and even lack of entrepreneurial orientation and behaviour can be overcome by the above three means of imparting education.

Papua New Guineans get some training and advice from private expatriate ranchers and from missionaries. Working as ranch hands on expatriate ranches has given many Papua New Guineans an opportunity to gain ranch experience under efficient management. The very existence of successful expatriate cattle ranches serves as an example to local people of what can be accomplished with cattle under their own soil and climatic conditions and how it can be done. Some expatriate ranchers have given much helpful advice in cattle raising to their former workers and to neighbouring cattlemen. The owners of Mamba Estate in Kokoda found it economically convenient to support Papua New Guinean ranchers because the latter would buy their young feeder steers and breeding heifers and in turn would sell them the finished animal for slaughter and marketing. Others, like Oxlate and Sprague in Morobe District did it for reasons of friendship or because it brought political advantages. Missionaries played a role in getting village projects started in the early days as in the Wain and in Waritsian, and they still do occasionally as we saw in the Sialum cattle project.

Cattle schools. Most of the formal education and training in ranching is, however, given to Papua New Guineans by the government and in particular by the DASF. The Animal Industry Division of the DASF runs cattle schools which offer sixteen-week long courses for indigenous ranchers. These schools were established on government livestock stations, where sufficient cattle and pasture are available. The first such school was started at the Western Highlands Livestock Station at Baiyer River, the second at the New Guinea Lowlands Station at Erap and the third was scheduled to open late in 1970 at the new livestock station at Urimo in the East Sepik District. Eventually, these three cattle schools are to train almost 200 cattlemen per course.

In April 1970 in Erap, instruction in Pidgin was geared to the level of education of the average trainee, who was barely literate. For example, of the twenty-four trainees all could understand Pidgin, but four were illiterate. Forty per cent of the course consisted of theory taught in the classroom and 60 per cent of practical work and observation trips. The classroom work in the morning dealt with cattle anatomy and physiology, diseases and pasture and cattle management. A simple syllabus in Pidgin, including drawings and diagrams, had been prepared by the instructors. In the afternoon, trainees did all types of ranch work on the station such as cattle handling, building and repairing of fences and yards, pasture improvement, maintenance, and so on. Some of this work was also done on nearby indigenous cattle projects to give training under the type of conditions which trainees could expect to find when they returned home.

We mentioned earlier that many Papua New Guinean cattle raisers are not adjusted to the rhythm of cattle work, to Western orderliness and punctuality, and to following necessary cattle routines. The Erap instructor made it a point to educate his trainees along these lines. For example, he posted rules regarding the timing of daily activities, to which the group had to adhere strictly. There are also rules regarding leaves of absence. On the first day of one course, one trainee decided to make a visit to Lae contrary to the scheduled training activities of the school and in spite of the warning of the instructor. On his return he was promptly sent home. The remaining trainees were much impressed and co-operation and punctuality greatly improved. The school tried to widen the horizon of its trainees by giving them new experiences such as by taking them on excursions and showing them industrial and commercial

developments in the area.

There must be real co-operation between the RDOs who select the trainees in the Districts and the instructors at the cattle schools. This has not always been the case. Some RDOs think that these schools are of little value because they do not prepare the trainee for the exact conditions which they find at home. This is too narrow a point of view. The RDOs should, however, be informed about what their trainees have learned in the cattle school. This will enable them to help the trainees better on their own cattle projects. The instructor, in turn, must have opportunities to visit his trainees on their own projects to help him improve his cattle course.

Success of the cattle schools requires continuity of a well developed curriculum and reasonable tenure continuity of the instructor. Both had been lacking in the Baiyer River cattle school, where operations were even suspended during much of 1970 for lack of an instructor.

In the selection of student applications for the cattle schools, only those villagers who have shown real interest in cattle raising should be considered, preferably those who can point to some tangible evidence of their interest such as having fenced their area or cleared some land for improved pasture. Unfortunately, clan influentials themselves rarely take the course because they think that their presence is needed at home. Indeed, it often happened that young men were trained at the cattle school, but on return were given no voice in the managing of the project; or, former trainees, who had worked hard to make the project a success, were not given a fair share in its returns. As a result, many former trainees lost interest and dropped out of the cattle project and even left the village in search of jobs in the towns.¹

The big-men of the clan should give assurances to the RDO before one of their clan members is accepted for training, that they will listen to the management advice of these trained people upon their return and that they will reward them adequately. Perhaps such a promise by the clan leaders should become an integral part of their loan agreement with the Development Bank. Village influentials should be given opportunities to learn as much as possible about cattle and pasture so that they can better understand what cattle

¹ Post Courier, 30 August 1972.

school graduates want to do on their projects and why. In March 1970, the acting regional RDO for Papua invited about a dozen village influentials from all over the region to Port Moresby for a week at DASF expense. He visited with them good village cattle projects in the Central District and gave them a chance to discuss these projects with the project operators themselves. He also took them to government research stations doing cattle and pasture work, to the Port Moresby slaughterhouse and to a cattle auction. This short course for influentials was an excellent idea and was well carried out.

Rancher associations.¹ These cattle schools did not include in their curriculum training in Western business techniques, economic knowhow and entrepreneurship, though it is hoped that they will eventually do so. The Kainantu RDOs Heath and Quinn showed that education in these topics could be given via rancher associations or similar farmer groups as part of regular group extension work. In March 1970 these RDOs formed the Kainantu Primary Producers' Association in which any farmer, man or woman, could become a member. Its purpose was to initiate thinking, questions and discussion among the local farmers. Meetings were held monthly at different places throughout the sub-district. The Association was run by a committee, the members of which were selected by the people in the several areas of the District. One of the jobs of the committee was to select topics for discussion. It was the RDO's job at the meeting to give an introductory explanation of the selected topics and to act as resource person during the discussion. When the author visited in July 1970 the topics for discussion chosen by the committee were: who sets prices for things? what is interest? what is business profit?

High schools, vocational schools and primary schools. Existing educational institutions, in which cattle training and education could be introduced or expanded are high schools and vocational schools. Agricultural courses already existed in some high schools such as at Bugandi and Goroka high schools. Vocational schools created for some of the about 40 per cent of school leavers give these young

¹ See also the discussions of the Numuyagabo Cattle Association in the later section on support activities to cattle raising (also discussed in Langness, this volume) and of the Lei-Wompa Cattle Graziers' Association in the section on case studies.

people a year of practical training in trade or agriculture. Some vocational schools in the highlands had cattle in 1970. Vocational schools could become a useful vehicle for expanding practical training in constructing fences and corrals, in planting and maintaining pastures, and in handling cattle.

There is need for better basic education in primary schools in arithmetic, science and social science concepts and techniques to improve the ability of Papua New Guinean cattle raisers to grasp and use what is being taught them by their RDO. For example, in Waritsian, the manager of the village's tractor operations had learned to charge tractor users according to area ploughed. He would measure the length and width of the area by counting the number of steps while walking the boundaries. However, he ran into trouble when he tried to multiply the length by the width of the ploughed area.

Financing cattle projects

As shown in some of the case studies, Papua New Guineans themselves financed most of their early cattle projects, which were generally quite small. They accumulated the necessary capital, rarely exceeding a few hundred dollars, largely through the sale of cash crops such as coffee, peanuts and market vegetables, through savings from outside work and, occasionally, through the sale of land. The contributions of many individuals were often pooled for the purchase of a single animal.

The lack of credit could have become a severe constraint in the development of cattle raising by Papua New Guineans. However, this potential difficulty was overcome with the beginning of operations of the Development Bank in July 1967.¹ In the fiscal year 1971-1972 alone, 547 new loans amounting to a total value of \$1,173,000 were approved by the Bank for beef cattle projects by Papua New Guineans.² In the latter part of 1970 it was estimated that the Development Bank was doing 95 per cent or more of all

¹ Papua and New Guinea Development Bank, Annual Report and Financial Statements 1969, Port Moresby, p. 5.

² Papua and New Guinea Development Bank, Annual Report and Financial Statements 1971-72, Port Moresby, p. 6.

lending to Papua New Guineans.¹ Thus it is no wonder that the Development Bank has been referred to so frequently in the preceding case studies.

Since the Bank had few precedents to follow, it courageously pioneered largely new methods and policies in financing the indigenous cattle industry. It based its loans on the prospect of success rather than on the amount of available security. With the Papua New Guinean borrower, the major difficulty in long term lending is the absence of security acceptable to the normal lender. All but 3 per cent of the land in the country is held under traditional custom without any formal title (Crellin 1971:13). In excess of 80 per cent of loans by the Bank to Papua New Guineans is lent for development on such clan land. In the village, land is communally owned by the descent group, with an individual villager entitled only to usage rights during his lifetime. Since the land does not belong to him, the Bank cannot take a mortgage on it to secure the loan (Crellin 1969:25).

The Bank has, therefore, developed its 'Clan Land Usage Agreement' which improves the chances of a borrower remaining in undisturbed possession of the use of the land. In this agreement the clan leaders sign (or place their mark if illiterate) a statement acknowledging that the borrower has the right under native law and custom to use a certain described piece of land. The agreement has no legal standing and has never been tested in court. Nevertheless, clan leaders have so far honoured their commitments made in these agreements. Problems arise primarily where more than one clan claims ownership of the land or where members within the clan cannot agree on who has the traditional usage rights (Crellin 1971:13, 14). To enhance clearing up of potential disputes regarding native land, the Bank encourages applicants for loans to also apply to the Land Commission for customary title of the land (Crellin 1969:10).

The average villager usually has little cash for his proposed cattle project. The Bank is, nevertheless, prepared to give him financial assistance if his project, and he himself, pass the following simple selection criteria:

¹ Oral statement by John Beach, Deputy Managing Director, Papua and New Guinea Development Bank, at a Niu Gini Economic Society meeting.

- (i) the proposed cattle project must have promise of being economically viable, with a capacity to adequately reward the borrower for his efforts and to repay the loan;
- (ii) the project must be within the borrower's management capacity (Crellin 1971:11, 12); and
- (iii) the applicant must show that he is willing to work hard and consistently.

To prove himself, the applicant has to clear, with his own resources, four to six hectares of his land, cut wooden fence posts and put them in the ground, build a stockyard to process cattle and plant some improved grass. If he has done these successfully, he has not only shown that he is willing and able to carry through a fairly lengthy job, but he has also built up with his labour an equity in which he has a stake. The Bank will then initially loan him up to 4-1/2 times the equity which he has created with his labour. This usually amounts to the full value of his cash requirements, mainly for cattle, fencing wire and veterinary supplies (Johns 1969:10).

As a security for a cattle loan, the Bank will take out a chattel mortgage on the cattle bought with the loan as well as on any other cattle owned by the borrower. The loan will also be signed by several loan guarantors chosen from the clan leaders and relatives. With the Clan Land Usage Agreement, the loan guarantees and the chattel mortgages, the Bank is prepared to lend for terms of up to ten years on cattle projects on clan land (Crellin 1969:7-9).

Supervised credit of the Development Bank. The Bank's policy of closely supervising and controlling all phases of its cattle loans, from initiation through planning, budgeting, disbursement of funds to final repayment has been a major factor in its success so far in developing indigenous cattle raising. By late 1970, the Bank had appointed some 380 RDOs of the DASF and other field officers and volunteers who handled the application and supervision of cattle loans. These agents of the Bank were familiar with local conditions, knew the applicants and could evaluate their management ability. They were empowered to approve their own loans up to \$500 in value. They were, however, primarily agriculturists and most of them had little business and banking training and experience. The Bank, therefore, appointed fourteen of its own trained and salaried representatives in the major centres of the country with authority to act for

the Bank, to give incentive and guidance in banking matters to the Bank's agents and encouragement and supervision to borrowers (Crellin 1971:13, 17).

The Bank usually does not pay living expenses to borrowers as has been done in the land settlement program; instead it pays after a task is done. The rancher, with the help of the Bank's agent, prepares a ranch development plan. When the borrower has completed a specified portion of the plan, the Bank's agent inspects the job and pays him the money due him. The Bank usually spreads out the payout of its bigger ranch loans over two or more years. For example, it may start out a borrower with fifteen to twenty head of cattle and watch how he handles those before giving him another twenty. Besides, once a borrower has received his whole loan and is fully stocked, he is expected to start repayment soon thereafter.

The Bank's policy of supervised credit has, in addition to reducing the risk factor in cattle loans, resulted in greatly improved ranch management by Papua New Guinean borrowers.

Size of loans of the Development Bank. From the point of view of a business profit, the Bank may be tempted to give big cattle loans and to develop large ranches; it actually loses money on its small cattle loans. It takes about as much time and effort to handle a small as a medium-sized ranch loan. However, in view of the two major limiting factors, absence of conventional types of real estate security and lack of experience of Papua New Guineans in managing ranches, the Bank believes it ought to be prudent regarding the amount of money it should lend at the outset to new cattle projects. It has adopted the policy of granting loans of sufficient size to justify the extension and administration services required in supervising, say, a herd of at least ten head. It tries to carefully select its borrowers in order not to tie down its funds and the precious time of the RDOs in supervising unsuccessful projects. As a borrower gains expertise, the Bank will readily approve an additional loan, if needed, to increase the size of his herd.

In the fiscal year 1970-71 the 349 cattle loans approved for Papua New Guineans averaged \$1,784 per loan.¹ In fiscal

¹ Papua and New Guinea Development Bank, Annual Report and Financial Statements 1971-72, Port Moresby, p. 6.

year 1972-73 the 463 new cattle loans approved by the Bank averaged \$2,360 in value per loan.¹ During the next few years, the Bank expects the average value of cattle loans to Papua New Guineans to increase to \$3,500. Even on clan land, loans to cattlemen often exceed the average figure several fold. Papua New Guinean cattle raisers on land settlement schemes or individual leases and those who have freehold title to their land can provide more tangible security in the form of a mortgage. To these men the Bank makes increasingly larger loans, especially if they also have some experience with cattle and own a little capital,² as in the case of Palank.

The possible disadvantages of large loans must also be considered. Lending risks may rise sharply with the size of a cattle loan, particularly in the case of Papua New Guineans who are not yet accustomed to handling deals involving large amounts of money. The Bank has also to be careful that the size of its loans will not be used as a status symbol. One Bank agent reported the following argument of a rancher applicant: 'J. has got 120 hectares in pasture and the Bank gave him a \$6,000 loan. I have 160 hectares of pasture land and, therefore, I deserve an \$8,000 loan. I need cattle, fence material, a tractor, a Toyota truck.... You tell me when I reach \$8,000'.

The Bank must also keep in mind that large loans may bring about a greater cleavage between rich and poor than has so far existed in Papua New Guinean society. For example, an annual income of \$7,000 like that budgeted for Palank amounts to seven times the income of an unskilled worker in Lae. Without the Bank's loan, Palank's income would at best reach \$2,000.

Repayment of loans to the Development Bank. Among Papua New Guineans a loan becomes an obligation which is acknowledged and has to be paid back, but the time of repayment had not been particularly important in the past. With few exceptions, Papua New Guinean ranchers have not slaughtered for singsing the cattle which they purchased with the Bank's loans; they look at these cattle as owned by the Bank. Papua New Guinean ranchers similarly recognize the need to repay their loan from the Bank, but they do not

¹ Papua and New Guinea Development Bank, Annual Report and Financial Statements 1972-73, Port Moresby, p. 6.

² K.G. Crellin, personal communication.

necessarily do it on time. 'At any given time, about half of all indigenous loans are in arrears' (Crellin 1971:15).

The Bank has adopted a firm repayment policy. Its following activities are time consuming and costly, but they show results. After three months, unpaid instalments are reduced to about 10 per cent and after six months they are nominal (Crellin 1971:15). Without constant pressure by the Bank, there would be much delinquency. Records of the country's two earlier development lending authorities, the Ex-Servicemen's Credit Scheme and the Native Loans Fund, show that both had much trouble with repayments by Papua New Guinean borrowers. Executives of the Bank expect that their loan losses will amount to less than 2 per cent of total loans, if the present practice of following up with determination on every indication of default is continued.

Assistance from the International Development Association. From 1969 to 1973, the International Development Association (IDA), an affiliate of the International Bank for Reconstruction and Development, commonly called the World Bank, provided financial assistance in the amount of \$US1.6 million to the Development Bank for the development of large beef cattle ranches in the country.¹ The objective of this program was to establish a number of relatively large breeding herds using cattle imported from Australia. The progeny from these breeding herds was to be used to stock additional cattle projects by Papua New Guineans. The IDA credit has been made available to the Development Bank for twenty-five years with interest at 1-1/4 per cent.² The Development Bank in turn has been making loans to beef cattle ranchers from this fund for periods up to twenty years at 7 per cent interest. Since these loans had been restricted to fairly large ranches, up to 1970 only two Papua New Guinean ranchers, Palank and Doa, had participated in this program.

Until 1973, the Development Bank had financed over 700 small cattle projects by Papua New Guineans entirely from its regular funds at an average interest rate of about 6 per cent. In 1973, the IDA made additional credit available to the Development Bank, which was to provide funds for the development over a period of three and a half years of an estimated 870 additional small breeder cattle projects with

¹ Papua and New Guinea Development Bank, Annual Report and Financial Statements 1972-73, p. 6.

² International Development Association Press Release no. 70/2, 1970.

a minimum of fifteen breeders per project.¹

Land and form of organization for cattle raising

Millions of hectares are potentially available for ranching in Papua New Guinea (IBRD 1965:67). Besides lands of little value for traditional crops, areas formerly shunned because of malaria and virgin forests, these potential grazing lands also comprise former fighting grounds and buffer areas between clans. Utilization for ranching of these lands often awaits settlement of the many land disputes and acceptance of boundary demarcation by all concerned, a sometimes time consuming and difficult task.

With 97 per cent of the total area of Papua New Guinea under customary tenure and thus controlled by clans or sub-clans, many of the larger Papua New Guinean cattle projects are run as descent group operations.² Papua New Guinean descent groups had, in the past, economies which provided their people generally with as much food as they wanted, with adequate housing by their own traditional standards and with leisure for feasting, ceremonial and other pastimes (Fisk 1966:23). They gave social security to the old and sick, and help and assistance, if it was needed. However, these descent group operations have the disadvantage that they keep people at a fairly low level of primitive affluence. Today, Papua New Guineans often desire additional things and services and thus have to become more efficient producers. However, the descent group is not organized for the purpose of efficient commercial production in a modern money exchange economy. Such a group, if engaged in raising cattle, may get along for a while, but then, as shown in the Waritsian example, arguments and strife may develop. Some people want to take their cattle out and leave the group. This is all right because it makes for a smaller group which tends to operate better. Gradually cattle projects will evolve in which individuals will have sole responsibility for the operation.

Perhaps it would be good if a beginning cattle project of a descent group would not use all its land for cattle, but just a portion of it. Additional land would then be

¹ Papua and New Guinea Development Bank, Annual Report and Financial Statements 1972-73, p. 6.

² The section on descent group operations has profited from a discussion of R.G. Crocombe with the author.

available, when the group starts to squabble and needs more land so that it can break up into several cattle operations like in Waritsian.

An individual owning and operating a cattle operation appears to fit well into the Papua New Guinean socio-economic set-up. Most garden plantings of Papua New Guineans are primarily the responsibility of individuals once the garden plots have been cleared. However, a Papua New Guinean is really never alone; he still has his wife, his children and his relatives, who somehow share with him. A descent group giving the right to use the land for a cattle project to an individual for a certain period or possibly for his lifetime seems to be a good solution, with the land still belonging to the group.

Many Australians, including RDOs, coming to Papua New Guinea were accustomed to and liked a freehold title to cattle properties. Thus, they often encouraged Papua New Guinean cattle raisers to apply for conversion of customary to freehold title of their cattle land. Many Papua New Guinean cattlemen could readily see the advantages to themselves of thus getting rid of their clan's interference with their cattle business, of not having to employ clan members and of not having to share their cattle income with them. They also found that they could more easily finance their cattle projects if they owned the land outright. Thus we have seen several examples among the preceding case studies, where Papua New Guineans had applied for or received freehold title to their cattle land. However, such a land conversion, in which outright title to cattle land passes from the descent group to the individual is contrary to Papua New Guinean custom and culture. As a consequence, the connections of the individual with his clan may loosen or break as was seen, for example, in the cases of Mendari and Minek.

In Papua New Guinea, wealth and status are not usually passed on from one generation to the next. The children of the big-man and of the rubbish man, or non-achiever, have a more or less equal chance to succeed in life. In every generation, all young people in the clan start out from scratch and the position they reach in their society is based on their own ability.

If outright title to cattle land can, as the result of land conversion from customary to freehold title, be inherited from father to son, the latter will be able to start out in life from a higher level than can others in the

clan. Such a change in land tenure might well bring about much more of a class society, with greater differences between rich and poor than has existed so far in Papua New Guinea. For this reason, the court decision in the Doa inheritance case was so important. According to it, customary land converted to freehold was still distributed according to customary rules of inheritance and not to the introduced European rules of distribution.¹ This court decision probably will tend to keep Papua New Guinean society more equal than it would have become without it.

Group projects. Since there are great advantages of large scale in cattle operations, good-sized group cattle projects are preferable to small individual ones, if they can be run along efficient organizational lines. In descent group operations, more emphasis needs to be given to the assigning of responsibility for the project to individuals. This may be done by shifting the management responsibility from person to person periodically as indicated in the discussion of the East Sepik District or by giving it on a more permanent basis as a paid job to a trained man as mentioned in the section on cattle schools. The potentials of a group organization like Anthembo Pastoral Syndicate also deserves consideration.

Another possible organizational form for a group cattle project is a corporation, in which stock is held by both Papua New Guineans and expatriates. In such a company, part of the finance capital and the management would be provided by the expatriates. The Papua New Guineans would contribute the land, possibly under a clan agreement with the company to use the land for a contracted period of time. The number of shares of every Papua New Guinean in the company would be based on the relative shares and rights which he claims to have in the property. He could buy additional shares if he wishes. Papua New Guineans outside of the descent group could also have the right to buy shares in the company. The local people might provide some or all of the labour or they might not be involved at all in the running of the cattle corporation. The by-laws of the corporation could contain an agreement to have a Papua New Guinean sub-manager, perhaps a Vudal or Popondetta Agricultural Training Institute (PATI) graduate, who could be relatively quickly trained. The by-laws might also encourage management training of promising local stockholders.

¹ Post Courier, 3 September 1973.

An interesting example of such a joint Papua New Guinean-expatriate venture is the Jimi River Cattle Company located in the Western Highlands District. The 9,700-hectare property has been leased for ninety-nine years from the government as a cattle lease. The original plans called for a capitalization of the company of \$250,000. The expatriate, D. Ottley, a Mt Hagen business man, has a 51 per cent interest in the property, with the local shareholders holding 49 per cent. The latter are the former clan owners, who sold the land to the government. The money which they received for the land sale was originally invested in long term government loans. The government agreed to release these funds to allow the clan members to use them as share capital in the new company. The advantage of releasing the land to the former owners minimizes future land disputes. Such disputes might easily arise where Papua New Guineans have sold their land to the government, which then settles people from different clans and areas on this land.

Ottley won this government lease in a ballot in 1970 because of his proposal of a mixed Papua New Guinean-expatriate company. In November 1972 the Company imported its third shipment of cattle from Australia. This one, valued at \$82,000, consisted of 300 heifers, twenty bulls (and two dogs). The shipment was unloaded at Madang. Since there was no adequate road connection to the project, the cattle were flown, a few head at a time, in a DC3 aircraft to an airstrip at Ruti at the ranch. The Company is expected to begin marketing beef cattle by 1976.

Whether such a mixed expatriate-Papua New Guinean cattle corporation works out to the advantage or disadvantage of Papua New Guineans would depend on satisfactory by-laws of the company protecting the interests of the local people and the personalities involved, both expatriate and Papua New Guinean. The expatriate ought to feel a responsibility toward the country and toward the local people and a willingness to train them so that they can take an equal share in the management of the corporation at a future date. He should not exploit the set-up, 'go South' (meaning Australia) and leave a plundered company and local people not trained to take over. The Papua New Guineans in turn should become involved in and feel responsible for the company and its success.

Cattle settlement schemes. In 1970 the government planned settlement schemes which were primarily designed for beef cattle raising. An example of these was the Arona

smallholder scheme near Kainantu in the Eastern Highlands District. The settlement was to be located on government land. Leases were to average about eighty hectares per block of natural grassland with an assured carrying capacity of about one steer equivalent per 1.6 hectares. The blocks were to be leased to fifteen carefully selected settlers, who already had some cattle experience. While the majority of the settlers were expected to own some assets in the form of cash and cattle before they started, they were to be financed mainly by a sizeable Development Bank loan.

A major advantage of such a smallholder settlement scheme is the comparative ease and low cost of extension teaching, servicing and supervision because the cattle raisers live close together. If the cattlemen have management difficulties, they can easily get together and often solve their problems themselves. In contrast to such a settlement scheme, cattle projects in the usual village situation are often located far apart from each other and the ranchers may belong to different and sometimes unfriendly clans. As a result there is often little chance for these cattle raisers to meet and to discuss their problems.

A government settlement scheme for cattle takes a lot of scarce trained manpower to plan, set up and execute. The living together of settlers from different areas and clans creates its own additional problems. This the author observed in Kinding, a government smallholder settlement scheme for mixed farming in the Western District, which also included some beef cattle raising. In contrast, in the ordinary village project, fewer issues arise which cannot be handled by the villagers themselves. Furthermore, government settlement schemes tend to be more costly because a living allowance is usually paid to the settlers in the early years, while in the case of village projects adequate subsistence support is usually available in the village environment. Perhaps a good compromise solution between the government settlement scheme and the usual individual village project is a cluster of adjoining cattle projects, carefully planned on clan land near the village of origin or the ranchers, such as at Hegata. Such a cluster project on clan land seems to give some of the advantages of a cattle settlement scheme on government land, while avoiding some of its disadvantages.

Size and type of cattle projects

There are advantages and disadvantages to both small and large indigenous projects. Advantages of small size are the

comparatively small initial investment required and the fact that losses from initial mismanagement, such as occurred at Hegata, cannot be large. A small herd allows more flexibility, because it can easily be shifted from one location to another on the farm and thus be integrated into a diversified farming system. A small number of animals can easily be supervised by the farmer, if kept near the farmer's dwelling. In case of land scarcity, labour can be substituted for land by bringing feed such as grass or sweet potatoes to the cattle.

The advantages of larger operations in cattle raising are much more important than the disadvantages. The basic overhead of learning about cattle does not change much whether the villager keeps one or many head of cattle. Walking to and from the project takes the same amount of time regardless of the number of animals, which is important to both the farmer and to supervising extension and veterinary personnel. This becomes a major factor when cattle projects are not readily accessible such as in the Wain. Regardless of its size, a project needs some basic installations and equipment such as a cattle crush, a corral and branding irons.

A bull can handle twenty to twenty-five female animals but is needed even if the project has just a few breeders. In 1970, government-owned bulls were being rotated among small projects. This is a labour-expensive practice, particularly if projects are far apart or access is difficult. Besides, rotation of government bulls was often so irregular that cows remained barren for long periods. For example, some heifers on Titus' project in the Northern District waited twenty months for a government bull.

Co-operative utilization of a bull is feasible, where a number of projects are located close to each other such as at Hegata. Artificial insemination was being introduced experimentally in the Eastern Highlands District in 1970, primarily to improve the quality of the stock. However, at the then existing level of technology of the method and of accessibility to native projects, artificial insemination did not appear to be an economic proposition for small local breeder projects.

Type of ranch organization. When the DASF commenced the development of Papua New Guinean small-holder projects in the Eastern Highlands District in 1960, it set up the night paddock-day herding system already mentioned in the East Sepik discussion. The idea was to herd the cattle on the

open range during the day and to keep them at night in the small grazing paddock of two hectares or less. Most of these early projects were not successful, because the local cattle raisers lacked the required management discipline. Sometimes the cattle were not brought in during the night, but were allowed to wander. As a result, they damaged gardens, were even killed on the road or became wild; or else, for days on end, they were kept during the day inside the supposed night holding paddocks, which were sometimes without adequate watering facilities. The results were overgrazing, poor stock condition, high incidence of disease and high mortality, especially among breeders (Clark 1970a:5, 6).

Even when the cattle were let out regularly during the day, in areas with hot daytime temperatures, they would tend to do more night grazing, resulting again in overgrazing of the paddocks. This was particularly the case with English breed cattle, which have little Brahman blood. Cattle with a substantial percentage of Brahman blood tend to graze more during a hot day.

Attempts to plant improved grasses and legumes in the paddocks were largely unsuccessful, particularly in view of the difficulty of managing improved pastures under these conditions. Thus in the highlands, where additional land could be fenced, the night paddock-day herding system gave way to larger, completely fenced projects. In some places, such as the East Sepik, night paddock-day range grazing survived only because of strictest DASF supervision and the lack of more attractive alternatives for earning money.

Cattle projects of Papua New Guineans should be organized as uncomplicatedly as possible. For example, during the beginning years of a cattle project, the stocking rate should preferably be adjusted over the whole year to what can be carried on the available pasture land during the normally driest period. This would reduce the need to constantly adjust the number of cattle to changing pasture conditions.

In the case of Palank, the normally driest period is from August to October. Perhaps after a few years on the property, he could carry more animals during the period of better pasture condition and sell off the excess before the dry period. An expatriate rancher suggested that Palank should acquire an additional property in the Markham Valley to which he could shift some of his cattle during the drought period. This would have resulted in difficulties for Palank because it would have meant a bigger property which he could

not have handled at that time. It would also have meant additional problems of supervision and transportation. It is much more difficult to supervise an operation at two locations than at one. Palank also would have had high transportation costs because he did not own a truck and would have had to rent one. Alternatively, he could have bought a truck. However, Papua New Guinean cattle projects should generally be set up with a minimum amount of machinery. Papua New Guineans, with some notable exceptions, are not yet used to the regular servicing and upkeep of such complicated equipment. True, Palank has a tractor and takes care of it well; however, every additional piece of equipment increases the risk of trouble.

It is often advantageous for a farmer to diversify into several commercial enterprises because one may help another. For example, Monkei could clear one area first for sweet potatoes and then for grass for his cattle. Having several enterprises also spreads the risk of loss if yields or prices in one enterprise should decline. Doa, who produced cattle, tea and coffee and ran a trading store, showed that a Papua New Guinean can become a successful manager of a business with several enterprises. However, a man with little entrepreneurial experience or talent does better to produce just one product such as beef cattle because he needs to concentrate on that one activity only.

While there is much additional land available for cattle ranching in Papua New Guinea, this is not true for all parts of the country. In some sections of the Chimbu and Eastern Highlands Districts, for example, diverting much land to cattle ranching from its present use of gardening and bush fallow could have serious consequences. It would require shortening the fallow period on the remaining land for gardens, reduce crop yields of the gardens and result in shortage of subsistence foods. Thus the rotation of crops for people and of grass for cattle on the same land should be seriously considered.

Paso was the owner of one of the original pilot cattle projects which were started in 1960 in Kapagamaligi village in the Eastern Highlands District (Godyn and Godyn 1970:48). In 1970 under the supervision of the RDO at Korofeigu, Paso planted sweet potato and ground nuts gardens within his fenced cattle paddock. Once the crops were harvested, he intended to plant improved pasture for his cattle on the same plot. Upon deterioration of the improved pasture after a few years, he planned to start the same cycle all over

again. This is really diversified farming or it could be called an improved fallow method.

Some good grass research had been done in Papua New Guinea, particularly at the Bubia and Aiyura Research Stations. However, little research had been undertaken by 1970 on rotation systems under existing management levels in Papua New Guinean villages such as the one planned by Paso. Some such research was initiated in 1970 by the Aiyura Research Station in co-operation with the Kainantu RDO in preparation for the smallholder settlement for cattlemen at Arona. More of this type of research was also urgently needed under different environmental conditions in other parts of the country.

Substitution of capital for labour. The amount of substitution of capital for labour on Papua New Guinean cattle projects depends on whether profitable alternative opportunities for labour exist and whether sufficient and reasonably priced capital is available. Take, for example, the problem of whether to use split wooden posts or steel pickets on the fence line. While the cash cost of acquisition of steel pickets is higher than that for wooden posts, pickets should last fifteen years compared to five years or less for ordinary wood posts. Pickets also require much less labour in transport, installation and upkeep. If labour is valued at \$.60 per man day, the initial cost of steel pickets on the fence line is 10 per cent more than the cost of wood posts (Clark 1970a:Appendix 7.4). However, the annual costs of steel pickets, including depreciation, maintenance and replacement labour amounts to only a little more than a third of that of soft wood posts.

Because of their lower annual cost and their being unaffected by grass fires, picket fences were common on expatriate ranches. However, in view of the comparative scarcity of capital as compared to labour, they were still little used on Papua New Guinean projects. Similar issues are involved in the question of substituting tractors for people in the transportation of wooden posts or in the preparation of land for planting improved pastures.

Profitability of cattle projects

Steer fattening projects. Clark (1970a) constructed several budgets to estimate the economics of various types and sizes of village cattle projects under conditions existing in the Eastern Highlands District. His smallest

budget was for a steer fattening enterprise on six hectares of natural pasture, with a carrying capacity of one beast to two hectares. He assumed that yearling steers were bought at \$70 and sold at \$140 per head two years later. Costs other than the purchase price of the steers included only outlays for fencing wire, tools, veterinary medicines, slaughter and transportation charges. Interest was included at the subsidised rate charged by the Development Bank. Yards were assumed to be of all wooden construction and fences of four-strand barbed wire and split wooden posts. Even assuming no rent cost and a somewhat higher management efficiency than existed then among village cattlemen, the return for labour used in the project was only \$.50 per man day. In comparison, the wage rate for casual rural labour which was then paid in the Eastern Highlands District was \$.60 to \$.70 per day. Because of the disadvantages of small scale in cattle production, smaller projects such as those two hectares in size, without grazing outside of the paddock, were even less profitable.

Return to labour did increase if more intensive management practices and more capital were employed. Suppose that the carrying capacity of the six-hectare steer project could be increased from the previous rate of one steer to two hectares to one steer to 1.2 hectares by planting improved grasses and legumes and by using some fertilizer. Let us also substitute steel pickets for wooden posts in order to decrease labour for fence maintenance. In that case the estimated return to labour would rise to \$.80 per day (Clark 1970a:9).

In evaluating this level of profitability, it must be remembered that the required level of management to run such an intensive enterprise, requiring judicious rotation to maintain the improved pasture, was then rare indeed among villagers. Besides, there was always some risk involved in a cattle project and the need to wait for years for a return. In comparison the pay of \$.60 to \$.70 per day for casual labour would be sure and immediate. Thus even this steer project on six hectares of improved pasture might not look too attractive to a villager, if money return were his only motive.

Breeder projects. The profitability of small breeder projects under village conditions appeared even lower than that of small steer fattening operations. Breeder ranches require a higher level of management and involve more risk

than steer raising. Some improved pasture is required for lactating cows, who have been found to suffer from lack of protein if kept entirely on low grade natural grass pastures such as kunai.

Bigger cattle breeder projects become more profitable. Let us assume a cattle project with ten breeding cows and a total herd of thirty-seven cattle of all ages. At a carrying capacity of one steer equivalent to 2.4 hectares, about ninety-seven hectares of land would be required. Let us further assume a fairly high management and capitalization level, an overall mortality of 3 per cent, a calving percentage of 80 per cent and steel picket fencing. These assumed conditions might not be much different from what a settler in the Arona smallholder settlement could expect. Under such conditions the labour return would have been \$1.53 per day of work at 1970 prices (Clark 1970a:19). Even assuming a somewhat lower management efficiency, such a return should look good to a villager.

The Extension Service and Animal Industry Division and cattle raising

From the foregoing analysis it becomes apparent that most of the guidance and assistance to Papua New Guinean cattle raisers were provided by the extension and livestock officers of the DASF. On the average, these officers in Papua New Guinea compared favourably with their counterparts in most other less developed countries. They were self-reliant, took responsibility, did not mind getting their hands dirty and, above all, were honest. Many were dedicated to their work. They had at least an agricultural diploma and often practical experience in ranching.

The subject matter taught by RDOs to Papua New Guinean ranchers had, however, to be substantially broadened. In addition to their emphasis on cattle and pasture techniques, they should also have taught more of the underlying reasons for these techniques. As mentioned before, they also needed to include such topics as Western business methods and techniques, entrepreneurship and management.

The average RDO was primarily trained as an agricultural specialist; he was not a social scientist or particularly knowledgeable in business techniques and entrepreneurship. He himself thus needed more training in these subjects.¹

¹ See also W. Cottrell-Dormer (1967:54).

Perhaps in the selection of new field personnel, more emphasis should be given to previous training and experience in areas other than technical agriculture. Extension specialists in fields of social science and business should be employed for use as expert advisers to extension workers in the field.

Some changes in methods and policies used in developing cattle projects seem appropriate. RDOs sometimes did too much for their rancher-clients. They did such jobs for them as building fences, planting and maintaining pastures, keeping accounts and making purchase, sale and other business decisions. They did this to show the ranchers how things were done; however, once you do things for people, they expect this to continue.

When the Extension Service did big jobs with expensive equipment free of charge for ranchers, the latter obviously did not consider such jobs to be part of their costs. As a result they considered their cattle projects to be more profitable than they really were. Examples were the costly land preparation for grass planting with a DASF tractor in Hegata in the Northern District or the transporting of fence posts, also with a tractor, on the Ketarovo cattle project in the Eastern Highlands.

Too much government coddling may result in nice short term statistics on the number of new cattle projects established, but may not bring about permanently successful projects. Livestock officers in both the highlands and the East Sepik expected a disappearance of at least 40 per cent of the then existing village cattle projects in those areas, if the above type of tactical support were completely withdrawn. More village cattlemen need to be taught self reliance so that they can handle by themselves all aspects of running their cattle project.

The success of indigenous cattle raising depends on whether sufficient qualified DASF officers are available to do the job. The experience during the fiscal years 1968-69 and 1969-70 was discouraging. The funded recruitment target for these two years was sixty-six overseas officers, but only thirty-six or slightly more than half were actually appointed. Most of the planned recruitment was in the professional or sub-professional categories.

A speed-up of educating, training and promoting through the ranks of Papua New Guinean agricultural officers is

urgently needed.¹ The only three-year institution in Papua New Guinea in which agricultural professionals, that is, diplomates, were trained was in Vudal Agricultural College. These diplomates were qualified to take jobs as RDOs, live-stock officers and experimentalists. The output of this institution was way below requirements. In 1970, twenty-two or twenty-three graduates were expected. Out of the forty-one diplomates who had qualified from this institution during the previous two years, only twenty-three men had joined the DASF.² Only a few of the Vudal diplomates had a thorough training in cattle raising. For example, in 1970, only six out of twenty-three Vudal students decided to specialize in farm management and these had a choice of several areas besides cattle such as pigs, cocoa and so on.³

Sub-professionals were trained in the two-year institute PATI. This Institute graduated about fifty men per year, of whom about twenty took non-governmental jobs. The remaining thirty graduates were insufficient to fill all the governmental requirements for positions such as assistant rural development officers who would aid local cattle raisers.⁴

Even well trained RDAs who qualified under the revised minimum educational requirement of form one in high school were in short supply (Cottrell-Dormer 1967:170). Formerly, there had been no such educational requirement. The old RDAs had played an important role in the development of cattle projects by helping with the construction of fences and corrals and by acting as translators from place talk (local language) to Pidgin or Motu between local cattlemen and expatriate RDOs. However, many of them were illiterate and had become of limited usefulness. In 1970, two and a half months of in-service training was given in Kagua in the highlands to some of the new, young RDAs.⁵ A training

¹ See also Cottrell-Dormer (1967:169).

² Based on interview with Gordon Dick, acting headmaster of Vudal, 20 November 1970.

³ Based on interview with Kenneth Witting, farm management instructor, Vudal, 20 November 1970.

⁴ Based on interview with Bill Heath, headmaster of PATI, 26 June 1970.

⁵ Interview with Kevin Tomlin, regional RDO, highlands, 8 July 1970.

school for RDAs, who were to take a twelve-month in-service course at Kapogere in the Central District was also under discussion in 1970.¹

The scarcity of experienced senior RDOs and livestock officers requires maximization of their use. This might mean, for example, more emphasis on group teaching such as, for example, in the Kainantu Primary Producers' Association and less individual assistance to ranchers. Junior Papua New Guinean officers could take over the latter responsibility.

In 1970 the lack of Papua New Guinean RDOs and senior livestock officers required policy redirection, which was all too long overdue. Besides the upgrading of educational entrance requirements of Papua New Guineans, which was already being implemented, this required greater emphasis on their in-service training and opportunities for their rapid promotion. Fortunately, a good in-service program in the areas of animal health and husbandry had been initiated by the DASF at Lae in 1969 under the direction of an experienced and forward looking veterinary officer.² However, the in-service training in 1970 amounted to only a trickle compared to the massive training which was required.

In the courses at Vudal and PATI the amount of subject matter dealing with cattle raising was insufficient in view of the planned development of cattle projects in the country. For example, PATI students got only a total of 175 'hours' (50 minutes) of lecture, demonstration and farm work in livestock of all types, not just cattle.³ The Vudal and PATI graduates did not get as much practical cattle and pasture experience as the expatriate officers whom they were eventually to replace.

Finally, the course work offered at Vudal and PATI as well as in-service training in the DASF ought to be broadened to include more training in business, economics, entrepreneurship and what might be called an enlightened approach to extension in the face of the Papua New Guinean

¹ Interview with RDO Belfield, Central District, 24 March 1970.

² Based on discussion with veterinary officer Douglas Harris, 29 July 1970.

³ Prospectus, Popondetta Agricultural Training Institute, Port Moresby, 1969.

village reality. A good beginning on the last topic was made in the extension course conducted at PATI in August 1969 by RDO A.R. Lawson (Lawson 1969).

Support activities to cattle raising

In 1970 few of the support activities needed by village cattle raisers were provided by Papua New Guineans. Village cattlemen would sell some animals themselves directly to singsing; however, marketing through normal commercial channels including abattoir slaughtering and retailing as well as providing supplies and services of all types for the projects was mostly done by the government or expatriates.

However, some cattlemen groups were formed to provide the needed support activities. The Numuyargobo Cattle Association in the Eastern Highlands District is an example of what these groups were trying to do and some of their problems.¹ The Association was formed in September 1967 under the leadership of the Korofeigu RDO. Initially its main objective was to find a market for the finished steers of their members. At that time there were no facilities for the slaughter of cattle in the District. A group of village influentials were taken to the abattoir in Lae at the same time as some of their slaughter cattle. Goroka since built its own abattoir and the Association held its first cattle auction in 1969. The Association bought two tractors, a disc plough, a chisel plough, a chain saw, a peanut planter and a grass slasher. It had a difficult time with the operation of the tractors and the equipment because of the tractor drivers' lack of technical knowledge and understanding of their machines. They needed the RDO's constant supervision. It also purchased ranch supplies and operated a banking agency for its members. The secretary of the Association who came from the Korofeigu area and was under great pressure from his community to help relatives and friends, often at the expense of other members, had to be checked two or three times a week and all accounting was done by the RDO. Finally, a new secretary had to be appointed from outside the area in August 1970 to overcome these problems.

Conclusion

Some policy issues. In 1970 economic factors favoured

¹ Godyn and Godyn (1970:69-73) and interviews with the authors.

the expansion of beef cattle raising by Papua New Guineans. Much beef was imported and foreign demand for beef was increasing. Resource conditions were good for ranching; they included a suitable climate, freedom from most pests, some good breeding stock, the availability of much potential cattle land and low-cost labour. However, ranch management on Papua New Guinean cattle projects needed to be improved to make their beef production costs and profits competitive with those of expatriate producers in the country and with competitors abroad.

Public policy decisions have to be made regarding the size, organization and location of Papua New Guinean cattle projects. Very small uneconomic cattle projects should be given minimum assistance by the government; medium-sized ranches with expansion potential should have priority. In their development, managerial capacity of village ranchers must be kept in mind as a major limiting factor. The advantage of a larger ranch on the one hand and the disadvantages of traditional type of organization of descent group ranches on the other hand call for experimentation with new organizational forms of ranches with multiple ownership. Papua New Guinean-owned stock companies or jointly-owned Papua New Guinean-expatriate corporations may provide solutions. However, these types of organizations require more study and investigation in the Papua New Guinea setting before they should be widely applied.

Group settlement on government land is often considered a promising way of developing Papua New Guinean cattle raising; however, the difficulties of this approach seem often to be underestimated. A cluster settlement of cattlemen on their own clan's land might well give many of the advantages of group settlement on government land and less of the disadvantages.

While priority in the development of cattle ranching should be given to those areas of Papua New Guinea which promise maximum success per unit of government input, the political requirement of reasonably balanced, country-wide growth must be kept in mind.

A beef cattle task force. The development of beef cattle raising by Papua New Guineans requires the co-operation of many different types of people such as ranching experts, extension men and other educators as well as social scientists, businessmen, planners and policy makers. Perhaps this development can best be brought about under the

guidance of a cattle task force, which would include all the various scientists and action-directed people just mentioned. These persons would work together under the direction of a chairman, who would call on them as the need for their services should arise. Arrangements would have to be made with the various agencies to which the individuals belong to give them full credit for any time spent and for achievements while working for the task force. Perhaps an agricultural economist, trained broadly in agriculture, business and the social sciences might be best qualified to be chairman although any member of the task force could fill this position.

Acknowledgement

I wish to thank the many Papua New Guinean cattlemen for showing me and discussing openly their beef cattle projects, and to express my admiration for what they have accomplished in cattle raising during the short period of one decade of intensive development. I express my appreciation for the wholehearted support and co-operation of the government workers at all levels, particularly those in the DASF, my colleagues at the New Guinea Research Unit of ANU and of the expatriate ranchers. Special thanks are due to my wife Elizabeth who was my research assistant. Without the help of all these people, this study would have been impossible.

Paper 2

The Nupasafa cattle: rural development in the Eastern Highlands District*

L. L. Langness

The project

The Bena Bena speaking groups of the Eastern Highlands District of Papua New Guinea were discovered by Europeans for the first time in 1930 (Leahy 1930). There was minimal contact with prospectors, missionaries, patrol officers and miscellaneous others until the outbreak of World War II, which brought a few hundred Australian and American troops to the area for the duration of hostilities (Dexter 1961). This period introduced the Bena Bena to steel tools, labouring for Europeans, a bit of European medicine, aeroplanes, jeeps, a few new foods, odds and ends of clothing, tin cans, bombs and other paraphernalia of Western culture. It was also during this period that attempts were made to suppress traditional warfare, cannibalism and infanticide. All this, however, brought about surprisingly little change in the day-to-day lives of the majority of the people.

* The observations upon which this paper is based were carried out during the period 1 January, 1961 to 15 May, 1962, at which time the author held a pre-doctoral fellowship and supplemental research grant from the National Institute of Mental Health, United States Public Health Service, and October 1970 to September 1971, at which time he had a Fulbright research fellowship and supplemental support from the New Guinea Research Unit of the Australian National University. All support is gratefully acknowledged. An earlier version of this paper was read at the 71st annual meeting of the American Anthropological Association, Toronto, in November 1972. Drs Robert Edgerton, Thomas Weisner and David Spain have offered suggestions and advice for which the author is also grateful.

After the war the towns which are now Goroka and Kainantu were created; more serious attempts at pacification began. Europeans came to alienate land for coffee plantations and other purposes; trade stores sprang up and general purpose money was introduced for the first time. Many highlanders ventured to the coastal and offshore regions to labour on plantations. The European land rush was stopped by the Administration almost as quickly as it had begun and there commenced in the Papua New Guinea highlands, as elsewhere in the world, a 'decade of development' (Howlett 1962).

Development, in this area, brought the introduction of passion fruit as the first cash crop (Read 1965), then peanuts and a variety of European-type vegetables, introduced both to improve the diet and as a means of earning money. Tilapia, calculated to add protein to the diet, were planted in specially constructed ponds - an attempt that proved to be notoriously unsuccessful. Coffee was also introduced as a cash crop. By about 1960 a few people were receiving small amounts of money for their crops. Coffee was typically planted in small plots utilizing the shade of casuarina trees which had been planted in former sweet potato gardens. With a few notable exceptions, most indigenous coffee growers in this area, even today, have no more than .2 to .4 of a hectare of coffee. In 1960 the luluai-tultul system, whereby leaders appointed by the Australian administration attempted (rather unsuccessfully) to direct village and local affairs, was replaced by a system employing elected local government councillors. This innovation, like all of the above-mentioned changes, was introduced amidst considerable confusion and uncertainty, and brought with it many practical problems (Langness 1963). At about this time a 'crash program' in education was started and for the first time education became the direct responsibility of the Administration rather than being left to the various missions that had sprung up throughout Papua New Guinea.

From 1960 until the present time the pace has continued to quicken. The Highlands Highway, an all-weather dirt road from Lae across to the Western Highlands, was constructed by a large American construction company and the dependency on air transport was broken. An important trucking industry has been established. Many Papua New Guineans, individually and as groups, now own and operate vehicles, trucks being by far the most common. More advanced schools have been established in urban centres.

In 1965 the Papua New Guinea Development Bank was established and in 1968 started various development projects in the Eastern Highlands District. It is one of these projects, the Nupasafa cattle project(s), that is the subject of this paper.

Nupasafa is one clan of the four that together constitute a large group known as Korofeigu (Langness 1963, 1964, 1968) which is located approximately twenty-four kilometres southeast of the present town of Goroka. In general the Korofeigu history of change is reasonably typical for the Eastern Highlands District of which they are a part. The Nupasafans' first experience with cattle was when a European planter imported and began raising them on land he had acquired from Korofeigu. They first acquired their own cattle when, in 1961, at the suggestion of the Department of Agriculture, Stock and Fisheries (DASF) acting officer, they took up a clan-wide collection to purchase a cow. Twenty-two of the adult males of the clan contributed a total of £30 5s (Australian). The largest amount contributed was £10, the smallest, 2s. One man who indicated his particular interest was considered to be 'in charge' of the cow although he was not the largest contributor. The cow was said to belong to 'everyone' (in the clan) and was placed in a small paddock, fenced for the purpose by the DASF, approximately three kilometres from where the people were living. There were three other cows purchased at the same time, one by each of the other three clans. The DASF provided a bull on loan. Other than curiously inspecting the beasts from time to time, there was no serious attempt made by the Nupasafans to care for them or to learn cattle husbandry. What care they did receive came from the DASF officer who periodically came to inspect them.

By 1968, when the preliminaries of the Development Bank projects started (see following discussion), the Nupasafa cow had died, leaving behind five offspring - four heifers and a bull. Some time in 1968 four men, as individuals, were encouraged to buy a cow each, so by 1969, when the Development Bank cattle were delivered, the Nupasafans already had nine animals, five jointly owned and four owned by individuals.

The Development Bank adopted the policy of using officers of the DASF as agents who were to suggest projects that had some chance of success, encourage the local people to borrow money for such projects and then supervise them. On the basis of an earlier land use survey it had been deter-

mined that the Korofeigu area, being relatively infertile grasslands and unsuitable for much else, could be used for the development of cattle. In late 1968 the DASF considered the possibility of developing cattle in the area by alienating land for an expatriate company. The idea was rejected on the grounds that not enough land would be available for alienation to interest an expatriate company and that the local people themselves were now 'motivated to participate in economic development'. No local people were included in any of these discussions.

The DASF officer assigned at Korofeigu at this time was an experienced development worker. He lost no time in persuading the local people to participate in the projects and, it appears, his aspirations for them were considerably higher than their own. He encouraged the Nupasafans to apply for three loans and, although they claim they did not want to borrow so heavily, they applied for loans in the amounts of \$8,830, \$8,747 and \$7,860. The twelve Korofeigu loans which were eventually granted amounted to \$43,927.

The procedure was to get one man to apply with at least four other adult males as 'co-signers' (as most of the people are illiterate their fingerprints were taken along with their 'mark'). The signatures implied not only that they were responsible for paying off the loan, but also that they all agreed to the use of the land for this purpose for a period of eight years. The funds were used as in the following example.

Purchase cattle:	
35 heifers @ \$150	\$5,250
20 steers @ \$80	1,600
4 cows @ \$120	480
Pasture improvement	80
Livestock maintenance	195
Fencing	800
Contingencies	100
Roads, bridges and dams	150
Ploughing	175
	<hr/>
	\$8,830

As collateral they used whatever cattle they already possessed, a number of pigs, their estimated worth in coffee trees, whatever cash they claimed to have on hand and occasionally, miscellaneous other assets. This appears to have been an arbitrary procedure because there is often little connection between the assets people actually have and

those listed as collateral. The five cattle they possessed as a result of the original cow were divided at this time, one going to each of the five Nupasafa sub-clans. Individual owners kept their own stock.

The idea behind the Bank project was to loan them money to buy stock and get them started. As the cattle matured and multiplied they would sell a number of them to make the annual loan payment (at 5-1/2 per cent interest) while continuing to build up their herds, cross-fence their paddocks, plough, plant better grasses and, in general, improve the new industry. In order to qualify for the loans and in addition to their collateral, they were supposed to provide a completely fenced paddock, plot of ground of sufficient size for the number of cattle they were to receive (the original estimate called for 1.5 to 2.5 hectares per beast), a suitable cattle yard, effective control of the land (for at least the eight-year period) and (presumably) evidence of their good faith and interest in having such a loan.

Two of the three Nupasafa loans were dated November 1969; both were approved by December of the same year. Both projects were assigned their own brand. The third loan application remains a mystery. It was not formally rejected, it just seemed to have 'disappeared' and the five men who signed it were never informed what happened.¹ The Nupasafans began fencing what was estimated to be an 800-hectare paddock, with fencing materials provided by the loan. The fencing was done by groups of adult men recruited from the clan; the men who had applied for the third loan and were waiting to hear about it (two of whom owned cattle) did not help in the fence building. Usually twenty or more would be working at any given time. The bulk of the work was done by hand; they had to carry literally everything. As there was no road suitable for a truck and as they did not possess a tractor, the materials had to be carried on their backs for

¹ I have no doubt that it actually existed, as I know the five men who 'signed' it and I have seen at least one version of it (which gives the figure of \$7,860); it also involves a separate document 'signed' by four other Nupasafa men which gives their approval for part of the land (a quite superfluous document which I have also seen). The significant fact here, however, is that the five co-signers certainly believed they applied for the loan in precisely the same way everyone else did.

long distances and up steep slopes. A DASF tractor was technically available to help them but rarely did. The area is virtually devoid of timber so they had to use metal fenceposts to supplement the few wooden ones they could provide from elsewhere on their territory. Although there is water available at several locations on this ground, during the dry season most of it disappears. The Dunantina River, on the south of the project, does not disappear, but access to it is difficult due to steep slopes and rocky terrain.

The 800 plus hectare plot of ground that was chosen is separated from the Highlands Highway on its northern boundary by land now held by the DASF itself. This land was purchased from the former European owner, mentioned above, who had made little attempt to develop or improve it. It is now referred to as the Bena Bena Station and is maintained for cattle breeding, to provide cattle for the burgeoning projects. Immediately across the highway from Bena Bena Station is the headquarters of the Korofeigu DASF. This is home base for the local development officer and was, for a short time, used as an agricultural development school. On the eastern boundary of the Nupasafa paddock are the people of Gitenu, traditional enemies of Korofeigu. The southern boundary is the Dunantina River, on part of the far bank of which live people of Kami, also a group with whom they sometimes fought. The adjoining ground belongs to Safa, which is one part of Nupasafa. The western boundary is partly joined by the Bena Bena Station and partly by the paddock of the Benimeto, one of the other Korofeigu clans.

Access to the Nupasafa paddock is through the Bena Bena Station. A long, steep ridge runs through the paddock, roughly east and west, paralleling the northern boundary. At the base of this, on the north, are the buildings that comprise Bena Bena Station. The northernmost fence of the Nupasafa paddock is thus immediately behind these buildings. Behind the station, but on Nupasafa ground, are a series of duck pens owned and maintained by the Bena Bena Station. And not far from them, also on Nupasafa ground, are a series of houses and small gardens inhabited by various non-European members of the station staff. Another series of long, rugged ridges runs east and west along the northern bank of the Dunantina, making it difficult for the cattle to graze or reach the water. The Nupasafans had wanted to use a different piece of ground for the project, a more fertile area to the west of their villages and bordering the Bena

Bena River, but as there is a long standing dispute with the Katagu people on the opposite bank of the river over the ownership of the ground, they were afraid to do so. The Nupasafa villages, which are near this ground, are approximately five kilometres from the paddock that was finally chosen. No one lives on the paddock ground and, in fact, one group of refugees that was living there was moved by the Nupasafans when the project began.

At the same time as the DASF officer was developing the various projects, he started what came to be known as the Numuyargobo Livestock Co-operative Society Ltd. This was a local co-operative society formed by selling memberships to whomever wished to join, for the purpose of buying and selling cattle, hiring machinery and dealing in 'farmers' requisites'. It was argued that such a society would be able to undersell the commercial shops in Goroka and, in general, provide valuable services for the surrounding people. A literate coastal man was employed to run the co-operative under the supervision of the DASF officer. Two tractors were purchased, along with ploughs and other equipment. Interestingly, although there was a fixed fee for membership, many men paid sums considerably in excess of the required amount to get it started.

The DASF officer who began the projects and the Numuyargobo Society was then transferred and replaced by two inexperienced ones.¹ Early in 1970, during their tenure, the first of the stock was delivered. One project received six heifers, the other received thirty heifers and three cows. With the nine animals they already possessed this made a total of seventy-eight cattle. Virtually all the stock consisted of completely untrained heifers that had been purchased from a European-managed range in the Markham Valley for delivery to the projects.² They went through, over and around the existing fences, sometimes into other projects, even before they could be branded, creating much

¹ Actually, a married couple, both DASF officers.

² Provisions for stocking all these projects appear to have not been very carefully planned, hence the necessity to purchase untrained stock from European cattle ranchers. The steers called for by the two projects were never delivered as they were unavailable. At one point it was suggested that cattle be flown in from Australia to stock the projects but nothing came of this.

confusion over ownership. In some cases the cattle got into areas not belonging to Korofeigu at all and the owners were subsequently fined for damages. The Nupasafans, for example, paid at least one fine to Gitenu. At about this time a waterhole in one corner of the project, which had been fenced by the Nupasafans, so part of their paddock, was unfenced by the Gitenu people who claimed it was theirs. It was also discovered that the Nupasafans had not yet created a cattle yard.¹

By November 1970 the Development Bank was receiving complaints about having 'gone too fast', been 'too pushy', and so on. In a circular to agency officers (Agency Circular No. 18, 10 November, 1970) they admitted this might be so, but justified their actions by observing that it was necessary for the Bank to have 'targets of performance' and for people to have financial assistance if they were to develop.

Early in the project five young Nupasafa men (along with others from other places that had projects) were selected for training at the DASF Baiyer River Station in the Western Highlands District. In a few weeks they were instructed how to ride horseback, brand, castrate, dehorn, assist in calving, administer medicine and, in general, look after cattle. In the Nupasafa case, two of these men were closely related to one of the loan holders, but the other three had no real connection with the projects other than simply being Nupasafans. They were chosen largely because they volunteered. Precisely what duties and obligations they were to have were never made clear. Even after their training, at no time was it necessary for them to dehorn or castrate, as this was routinely handled in the annual DASF inspection. As they did not live on or even very near the project, they were not there to aid in calving. No horses had been provided to the project. They had no medicines apart from a salve to put on sores which anyone could administer. Periodically the Nupasafans would attempt to drive the herd into the yard, use this salve and inspect their new possessions. This usually took several hours (and sometimes, in fact, days) of grimly chasing the cattle on foot and often resulted in failure. When they succeeded in getting the herd in the yard which was improperly constructed with no internal gate to break it up, the cattle would run and

¹ It was not completed until August 1970.

mill so wildly that they would injure themselves and had to be released before the medicine could be applied. As the cattle, a rangy Papua New Guinea breed of part Brahman ancestry, were truly wild and often charged, it is surprising no one was seriously injured or killed. The Nupasafans were afraid of them, it is true, as several of the DASF officers remarked, but no more afraid than any sensible inexperienced person would have been in the same circumstances.

By January of 1971 the two inexperienced DASF officers had been transferred and a new, more experienced one had arrived. The Numuyargobo Society at this time was in serious financial trouble and the members were convinced that the two departed DASF officers had stolen their money.¹ In addition, the new officer was immediately confronted by several of the loan holders claiming they had been told by the previous ones that they would be reimbursed for their stock that had disappeared during an attempted stock-taking muster. He reported that he had no adequate records pertaining to such losses and he had no cattle on the DASF station to use for replacements in any case. Later in the same month he reported that the Nupasafa project was simply not going as it should and, in fact, the eastern boundary had never been completely fenced. He also observed that the paddock area was probably closer to 1,200 hectares rather than the original estimate of 800. But at the same time he indicated that much of the ground was very steep, with little soil, extremely dry and that even the flatter portions consisted of poor soil and poor grass. The cattle survived, he argued, only because of the enormous size of the project and the absence of a fence. Under his supervision the cattle had been rounded up, but were so wild they had to be released from the yard. The cattle that were inspected were in very poor physical condition. The people, he said, were not interested in the project. He thought most of the cattle should be sold and the remainder put into small paddocks that could (perhaps) be improved. Many of the cattle were branded for the first time during the time this officer was in residence and he made a serious attempt

¹ There is no evidence for this whatsoever, apart from the financial collapse of the Society, which is perfectly understandable in view of the circumstances. What is of significance here, again, is that the people believed this is what happened.

to straighten things out.¹

By February of 1971 however, this officer, too, was transferred and still a new one brought in to supervise the project. The frantic and pessimistic reports had apparently stimulated the Development Bank to inquire about what was actually happening at Korofeigu. They were told by one of the senior supervisory DASF officers stationed in the Goroka headquarters that the problems stemmed from the fact that wild cattle had been delivered, the owners were afraid of them, the original speed of development had been too fast, there had been a 'land rush' resulting in disputes over boundaries, and the fences and yards were of inferior design and quality due to the lack of expertise of the indigenous owners. The original loans, it was said, were drawn up incorrectly; Korofeigu was a dry area and could not carry as many cattle as originally supposed. Instead of 1.5 to 2.5 hectares per beast, he suggested there should be four to six hectares or even more. The turnover in supervisory personnel was also noted.

At this time there was at least one project with more than two animals per hectare and several with considerably less area than they should have had. Survival was a result of the animals continually breaking out into surrounding areas and/or being taken to the Korofeigu station to be fattened. Some of the owners were ordered to find more pasturage. In one project they had to move their cattle sixteen kilometres to an entirely different area where they managed (temporarily, at least) to acquire and fence eighty hectares. The DASF moved the cattle for them as they had no way of doing it themselves. Some of the projects, of course, were in much better shape than others. But for anyone to truly understand the ownership of cattle and land at this time was virtually impossible. It appears there were the two Nupasafa projects totalling \$17,577 on 800 plus hectares, with the third loan not granted (which would have been on an additional 360 hectares). In Korofeigu, in addition, there were three Benimeto loans together on 288 hectares, totalling \$13,300; four Naganitobo loans on fifty hectares totalling \$6,400; and three Wai'atagusa loans on

¹ This account of what happened is based upon records kept at the Korofeigu DASF station and upon personal interviews with a number of DASF personnel who were involved with the Korofeigu projects from time to time. I did not, however, have an opportunity to interview all of the officers mentioned.

thirty-six hectares totalling \$6,650. The actual number of men involved is impossible to determine accurately because many men owned or claimed interests but were not loan signers, and so on. These various areas in some cases were cross-fenced and subdivided and in other cases not. There was considerable internal bickering going on, mostly among those whose projects were short of land and who because of pressure from the supervising officer had to find more.

In February 1971, the new DASF officer held a muster of the Nupasafa cattle so the District veterinarian could inspect them. Even with the aid of horsemen from the Korofeigu station, the cattle were penned and inspected in the DASF yard only with great difficulty. The cattle were in such poor condition that two of them died during the round-up and were butchered by the Nupasafans and the meat sold.¹ Three others died later while in the paddock. The DASF removed the carcasses and agreed to replace them. At this muster there were two steers, fifty-one cows and heifers, and nine calves - sixty-two beasts in all. Apparently there were four animals belonging to the Nupasafans being held on Korofeigu station as well. With the two that were sold they had a total of sixty-eight, then short of what they presumably should have had, even without allowing for any natural increase.

The veterinarian was appalled at the condition of the herd. He instructed the DASF officer to remove twenty-one cows and the nine calves to the Korofeigu station and replace them with twenty-one young steers (at \$60 each) and balance the loans accordingly. All stock was held on the Korofeigu station for a time; later, thirty-two head of the original stock were returned; this and the four head from the Korofeigu station and the twenty-one steers made fifty-seven animals in all. Then two were arbitrarily removed by the officer to be sold to other projects, leaving them with fifty-five.

The Nupasafans kept insisting that the calves be returned as they, unlike the cows and heifers that had been taken, were apparently not going to be replaced with steers. This was eventually done but only after they had been fattened and rested on the Korofeigu station. Then only seven were

¹ One was sold to a nearby group which was to pay an unspecified amount of money at some future date. The other was sold in the Goroka market and brought them \$53.50.

returned as two had died. The DASF refused to replace them on the grounds that they were in such bad shape when they got them they could not have been expected to survive. The Nupasafans now possessed fifty-five head plus seven calves.

In March 1971 the officer in charge reported that the whole scheme had been too ambitious. But he also felt the project could not simply be disbanded as the Nupasafans would, in effect, be bankrupted and the failure would have repercussions for other projects in the area. He recommended that the two projects be merged into one and that it be turned into a simple steer fattening operation rather than a breeding project. He observed that although the loans were in the names of two individuals the projects were really clan projects. According to his figures, he thought at least nineteen head of Nupasafa stock had vanished, either wandered away or died from lack of food.¹ He observed that DASF supervision of the projects had not been the best and that they should, therefore, bear some responsibility for cleaning them up. He suggested all stock be disposed of except for the twenty-one steers, the seven calves and the seven cows which had not been part of the Development Bank scheme. This would leave the Nupasafans with thirty-five animals which would be relatively gentle and easily handled. As this would make it impossible for the people to pay off the loans and still come out with anything, he suggested it was important to introduce additional numbers of steers from time to time which would be gentle, easy to manage and could merely be fattened for market. Finally, he suggested that a second DASF officer be assigned to Korofeigu station whose sole responsibility would be the development of cattle projects.²

This particular officer took an active interest in the Nupasafa project and began much more careful supervision. During May and June of 1971, under his direction, the Nupasafans for the first time had a completely fenced paddock, albeit somewhat smaller than originally planned. He arranged for the purchase of two horses from their loan funds and began to teach two interested young men to ride.

¹ Needless to say, keeping an accurate accounting of stock on this project was virtually impossible. I do not know precisely how he came to this figure.

² The duties of the single DASF officer included not only the approximately forty cattle projects but also all other DASF business such as coffee, peanuts, co-operatives, and so on.

Cross-fencing was begun, so they would have three separate paddocks and could systematically rotate the herd and improve the pasturage. The Gitenu people who had unfenced the waterhole were cautioned by the officer to leave it alone. But a short time later, when the Nupasafans attempted to do some further work on the eastern fence, they were chased away by a large band of armed Gitenu men. It was said that a Gitenu man had died of sorcery and the Nupasafans were responsible. The plan to work on the fence was temporarily abandoned. Men began carrying their bows and arrows even though people in the area at this time were being ordered not to do so.

It was discovered at this time that approximately one-fifth of the Nupasafa paddock, one of the better parts of it, including the disputed waterhole, was not being grazed at all because of a 'secret' fence. This section of fence had been built down in a gully, completely unknown to the DASF, to allow one of their clansmen employed on Korofeigu station to maintain a garden and house on the paddock land. This garden, which was small, could have simply been fenced. There was no need to tie up such a large piece of territory; but the issue was complicated by the presence of several non-Nupasafa DASF employees living (illegally) in the same area. It had been more expedient to build a short section of fence at a crucial spot than to get involved with the DASF officers over their right to have employees living on the Nupasafa land. This issue had still not been settled by September 1971, but the fence had been removed and the gardens themselves fenced, thus making available several hundred hectares of the best pasture.

During this time several of the Nupasafa cattle that had been unaccounted for were located in the Nenimeto paddock and returned to the Nupasafans. They were made to pay a small 'boarding fee' of \$5 for each animal. The two calves which had previously died were now, for no apparent reason, replaced. The DASF officer also requested that further stock be replaced.

As no more steers became available, the plan to withdraw the remaining breeders and replace them with steers could not be carried out. It was decided to let the project continue as it was. The DASF discontinued the previous policy of selling or loaning bulls and instituted an artificial insemination program, flying in semen from prize Australian bulls. As of September 1971, the Nupasafans had not availed themselves of this service. Indeed, there is

considerable doubt that most of them believed it. The original plan of hiring tractors and drivers from the Numuyargobo Society to plough the land for reseedling was given up when it became obvious that the semi-trained drivers, with the small ploughs, simply could not plough efficiently enough to make it economically feasible. The Numuyargobo Society was losing money steadily and was being kept alive by individual donations from project holders and other important men. In an effort to survive, they began to plough a few hectares to establish a peanut garden.

The officer at this time, from the Nupasafa point of view, was by far the best they had encountered. He was dedicated to making the projects successful if it were at all possible. But in July 1971 he, too, was transferred. The replacement, an experienced enough officer, had no experience with cattle. Within a month he was transferred, to be replaced by an inexperienced but conscientious young man just starting his career in DASF.

In August 1972 I received the following comment from one of the more informed DASF officers still in the area:

... you may be interested to know that the Nupa cattle project is doing well despite the severe dry season. I think that for the first time the cattle will pass through the dry season without deaths and will even look prosperous. The skills of the Nupa people and the support by DASF have both improved to bring this about. All this despite the fact that we have 'closed up' about 80-100 acres for semi-improvement of pastures and that about 100 acres of the big hill were burned off.

In February 1973 I received news as follows from the most literate of the Nupasafans:

... The cattle are coming up good. Calving percentage has been high. Most calves seem to be females. We are labouring for the bank for nothing because we get about one-fifth of the income from the sales of cattle. The Numuyargabo Society is non-existent now. We blame the advisers and the administration for it. The buildings are falling apart.

Analysis

What does one make of this? Do we consider the Nupasafa cattle project to be a success? Is it a failure? Is it no more than a comedy of errors? What is likely to happen now? Before attempting to answer any of these questions let us consider some further information.

The origin spot of the Nupasafans, a large cave hidden in a steep ravine near a high waterfall, lies within the boundaries of the Nupasafa paddock. At first, according to their oral history, there were simply Nupa. But they were successful in defending themselves and in gardening, and eventually grew in numbers. Some of them crossed the Dunantina River and began to live on the opposite bank. After a time these people came to be called Safa, the word for 'reddish', as that was the colour of the ground on which they were living. Eventually the continual raiding and warfare left them all living together approximately where they are now, a few kilometres further west and near the Bena Bena River.

The distinction between Nupa and Safa, functionally, has been of little importance. But when they applied for the three Development Bank loans, it happened that two of the applications were signed by men from Nupa and one by men of Safa. The two Nupa loans were approved, the Safa one was not. They were never told why this happened. As the Safas had expected to get their loan, they did not help the Nupas fence. Later, as they had not helped, they were not able to use that paddock. When the loan did not materialize the two Safa men who already owned cattle (one each) eventually sold them. Thus a situation had been created whereby roughly half of the group had been given a large sum of money and a considerable amount of help for development purposes while the other half, living in the same place and the same villages, had not. The Safa land, which they have not needed for their day-to-day subsistence and which had simply lain idle for several decades, acquired a new value - but one which could not be realized under the existing circumstances. This might now result in a move back to that ground by the Safa people, as they were afraid that if they continued to leave it idle, neighbouring groups would attempt to claim it for their projects. If this should happen, it would split what has been a community, in every sense of the term, into two separate entities. The final consequences of this are simply unknown.

The DASF, of course, was totally unaware of this. Although most of the loan applications contained statements to the effect that no land disputes, or at least no serious ones, would prevent the development of particular projects, the DASF officers had, in fact no special knowledge of what land disputes did or could exist.¹ The question of land in the entire area has become sensitive and the facts of the matter so impossible to come by, that no serious attempt has been made to bring about permanent settlements. The perennial fighting between Katagu and Korofeigu, for example, has existed long before the time of contact. The boundary that now exists between them, the Bena Bena River, was arbitrarily imposed by an early patrol officer who did not intend it to be a permanent land boundary but, rather, a means to keep them apart. There is, in fact, no boundary of Korofeigu territory that has not been in recent years, or is not now, under dispute. At no time has a permanent solution been offered. The Nupasafa paddock happens to be, at the moment, surrounded on three sides by undisputed land but this could change in the future and other paddocks do not necessarily have the same advantage now. The eastern boundary, including the waterhole, is being disputed. While it is not true, strictly speaking, that a 'land rush' was set off by the projects, it is true that the demands of the projects have brought about a great deal of fighting and the fighting is now over land, something they did not traditionally fight about. Virtually every one of the approximately thirty-five Bena Bena groups has been involved in fights with their neighbours in the past few years; there have been injuries and deaths. The disputes, which have been stimulated and intensified because of development, have not been settled. Statements that no disputes existed must also have implied that none would exist or be created. This has not proved to be the case.²

Somewhat less important perhaps but related to the above is the possibility that the Nupasafans could find themselves in the future with no right of access to their own project.

¹ They apparently got information about disputes, in most cases, by simply asking whomever was at hand whether there was a dispute over the land or not.

² It is also possible that the disputes cannot be settled at all except through an arbitrary imposition of boundaries simply because boundaries precise enough for fence lines did not exist in the past.

Access now is by walking across the Bena Bena Station. If for some reason the DASF refused to permit this, the alternative would be to cross disputed Gitenu ground or go through the Benimeto paddock. As Benimeto is a brother clan they might be expected to permit this. But clans do argue and even fight at times and there has already been a mild dispute between Nupasafa and Benimeto over the existing fence lines. Likewise, the DASF would probably not withdraw permission, especially if they were aware there was no other possibility for access. But what if at some future date they sell or must otherwise abandon Bena Bena Station? The point here is not that any of these things are necessarily about to happen but, rather, that they could happen.

The ownership of the land on which the projects are located is a potential problem internally as well as externally. No individual man, realistically viewed, really 'owns' a large enough plot of ground to institute a cattle project of very large size. Traditionally, men owned land in the sense that they or their fathers had cultivated various garden plots, which are remembered. But those were small plots and usually scattered. Sweet potato subsistence simply did not require precise land claims to large areas of ground. Land that had never been cultivated at all, at least within memory, was generally regarded simply as clan land and could be claimed simply by cultivation. The large Nupa paddock, very little of which had been cultivated for a long time, is thus said to be clan land. But note that there could be individual claims to specific portions of it. It is by no means inconceivable that once cattle raising is successfully established and people can see the possibilities for substantial incomes from it, individual men will attempt to restate claims to land they are at the moment ignoring. They might, of course, try to continue the 'commons' scheme they are now more or less attempting. But appearances to the contrary, there is no precedent for a clan-wide, or even a sub-clan-wide common project of this kind. Houses, gardens, pigs and even coffee gardens are all owned by individuals. While people do co-operate to help each other, they do not have communal projects. It is, in fact, a very individualistic culture. It is most probable that if the cattle survived as a cash crop at all it would be through the efforts of particularly interested individual men who can eventually borrow or lease sufficient amounts of land for these purposes. If the common paddock that has been introduced in the Nupasafa scheme survived, it would demand a kind of management, co-operation, dedication and record-

keeping not now in evidence and completely without precedent.

There is a further potential problem of great importance, also brought about by coffee and cattle projects, and also involving the land. This is the problem of refugees. Traditionally, when defeated in war or temporarily reduced in size so as to be defenceless, groups of people would seek refuge with friends and kinsmen in other places. Often they were warmly received, given garden land and encouraged to stay. Often they did stay, either never being able to return or simply becoming so incorporated into the host group they did not wish to return. There are many such groups throughout the Eastern Highlands District. So long as sweet potato subsistence gardening was the only demand on land, there was an abundance. Land, as such, was not a problem. Now, however, with coffee growing and, more particularly, cattle grazing, the land has taken on an entirely new significance. Where groups willingly provided land for sweet potato gardens, they have not always been willing to provide it for other purposes. In many cases the refugees are being told to either accept small parcels of land or 'go back where they came from'. In some cases none of them have even been to their presumed origin places. They know they belong there only because their fathers or grandfathers told them they did.

There are two such groups living on Nupasafa land now that were not there in 1962. In both cases they were refused what they believed were adequate amounts of land to enable them to live and develop as their fellow villagers do. Being Nupasafans, according to their own tradition, they returned to Nupasafa ground and, knowing no one, requested permission to resettle. They validated their claims by demonstrating that their sacred nama flute tunes (Read 1952) were similar, a reasonable, empirically verifiable claim that was willingly accepted.¹ Whereas both of these groups were provided with

¹ According to K. E. Read (1952:8), in late 1950 some of the people in this area, giving in to the demands and requests of missionaries, publicly burned their flutes and, presumably, gave up the ways of their ancestors. This created great consternation on the part of others and a great deal of trouble ensued. Although the religious significance of the flutes became apparent at this time, it was not suggested by anyone that the flutes may have had this more practical significance.

village sites and sufficient land to plant small coffee gardens, neither of them, so far at least, has been provided with sufficient land for cattle projects. One of them had settled near the Nupa origin spot but when the cattle project began they were told to move further to the south. As they had been there for only a short time this did not result in as much trouble as it might have. There were approximately 300 Nupasafans already present on Nupasafa land when these two groups returned. Together they constitute another approximately 100 people. They do not appear on the census (at least they did not in 1970) and they create an obvious problem in terms of both immediate and long range demands on land and other resources. It is doubtful land would be provided for them to have cattle so they, like the Safas, would be left simply to observe the Nupas.

There are certain problems of ownership with respect to the cattle themselves. Consider that a few animals are individually owned (even here it is most likely the case that the individual was helped financially by others when he purchased his animal), a few are owned by sub-clans and the majority, by whom? There is the loan holder, but he does not own the herd. He is helped by, and is obliged to, at least the four other men who co-signed and usually others as well. They, in turn, have been helped by a host of others. The people involved are mostly illiterate. Even the few who can read and who live at Korofeigu are not up to keeping records of large sums of money, fractions, shares and so on.¹ So far the question of ownership has not been a problem simply because in the rare cases when an animal was sold all of the proceeds went directly back into the loan, either by an actual adjustment in the loan or by virtue of simply being held until the next loan payment was due. If and when there is a profit, who will receive it? How will it be shared? Once the loan is paid off (if, indeed, that day ever comes), a herd established and sizeable sums of money involved, there is considerable doubt as to what will happen. There will be claims but no records and the sums involved will be beyond their limited arithmetic. They may devise their own way of doing this but, if so, it will be a far cry from the businesslike, profit-oriented type of operation the

¹ There are a very few Korofeigans, probably no more than half a dozen, who are considerably better educated than the rest and who most probably could manage these projects. But they, of course, do not live at Korofeigu, having gone into jobs elsewhere.

Development Bank and the DASF had in mind. For example, the loan payments that have been made so far have not been made simply from the sales of stock. This is not merely, as one might at first suspect, because not enough sales have been made. The loan payments are made in the same way other financial matters, such as bride price, are handled. The loan holder announces the payment is due and asks others to help him. People contribute money as they can and wish. The money comes from sales of coffee, labour, or whatever. There is no investment-like connection specifically between the cattle projects and the loan payments. Perhaps there will be, but such is not the case at the moment. There is prestige to be had by having a cattle project and by donating to the Numuyargobo Society and it is still basically prestige, not profit, that appears to motivate most of the Korofeigans. Those who donate to the loan payment will be repaid, not by receiving so much per share on their investment but, rather, by receiving help when they need it to buy a bride, return a gift, make a death payment and so on.

Ironically, the Nupasafans would most probably be able to work out their problems of ownership and shares, to their own satisfaction at least, if they were allowed control of their own affairs. They had, in fact, begun to work out a system of ownership whereby an individual man (whether he was helped by others or not was his own business and his own responsibility) who had contributed \$100 or more to a loan payment could claim ownership of a cow. Indeed, he would pick out a specific animal. If this animal died, he would be out of luck; if it calved, his wealth would increase. At the time of the big muster, there were a few that had been acquired by this means in addition to the cows that had been originally purchased by individuals. When the veterinarian ordered the cows and calves removed, men who one day owned a cow, sometimes a cow and a calf, and in a few cases even more, the next day owned, if anything, a steer or two. While the people may not be cattle ranchers, they do understand the facts of fertility and natural increase. But their methods cannot work when, in fact, the projects are completely controlled by the DASF. How well this system would work in the long run, even without DASF influence, is not completely clear. But, again, it would bear little resemblance to efficient, profit-oriented cattle ranching.

I am suggesting that even if the Development Bank cattle projects could be viewed as successful in Development Bank and DASF terms - that is, people learned to care for their stock, the stock multiplied, they paid off the loan

and thus established an industry that would provide them with cash - they would still be confronted with the problems mentioned above, problems simply not perceived by the Development Bank and the DASF. The decision to start the projects was made on the basis of what could be done with the kind of land they possessed and on the grounds that there was a reliable market for beef - purely economic considerations. No attention was given to other factors - psychological, social, or cultural. But there is more to it than this. There are the side effects as well.

It is obvious they received very little supervision. The Nupasafans, virtually unaided, would have had to build at least three kilometres of fence, much of it up and down extremely rocky, steep banks. All posts and wire had to be carried. They started at the northeast corner and fenced up the side of the ridge until they came to a very rugged area where they believed the cattle would not venture.¹ When they ran out of supplies they stopped. Whether they would have done more fencing or not if they had had more materials is a moot point. Although they claim they did not know it, there were plenty of unexpended funds in their loan to furnish more fencing materials. They say they were waiting to sell their coffee in order to get the money to complete the fencing. In any event, the cattle were delivered before this was accomplished. Obviously the DASF did not inspect the fence before releasing the cattle. But it was, of course, the Nupasafans who were blamed for not living up to the agreement!

Likewise, the cattle yard they constructed was located virtually in the middle of the paddock. There is no road to the yard which is about two kilometres from the Bena Bena Station. There is no reason why the yard could not have been constructed immediately behind the station where it could not only have been supervised but also would have been easily accessible by vehicle. It would have been immeasurably easier to drive the cattle into it. But it was not built there. I do not know what the facts of the matter are, but I assume either the officer in charge at the time did not advise them very well (or at all) or else the station manager at the time did not want it located there for reasons of his own. Given the negative attitude on the part

¹ They were wrong about this as it turned out. The cattle proved to be more rugged than they expected and easily went around the fence at this spot. Perhaps had they had experience with cattle they would not have made such a mistake.

of the station manager during this time this is not surprising.

The yard was improperly constructed with no internal gate to break it up and prevent milling. Likewise, it had no gate to swing shut as a trap to get animals easily into the inspection chute. Presumably it was improperly constructed because the Nupasafans received no supervision. No cross-fencing was even begun until very late in the project and thus there was no chance to introduce improvements or to rotate the stock as the areas became over-grazed. Doubtless the lack of supervision is due in part to the pressures of no fewer than six different development officers in the roughly four-year period under discussions. Why this was so is by no means clear.

Understand also the most astonishing thing of all: most of the Nupasafans did not seek the loans in the first place.¹ They were encouraged not only to apply, but to apply for large sums of money they could not understand. Although it is possible to count beyond twenty in the Bena Bena language, they rarely did so and, as virtually all of the responsible loan signers were illiterate, they could scarcely be expected to understand sums in the hundreds and thousands, to say nothing of concepts such as profit, interest, and so on. The annual reports given by the Development Bank and DASF personnel explained only in sums and totals, fractions, percentages, net gains, losses, interest, operating costs and so on, were precisely those they might have made to the board of directors of some large company. The Nupasafans understood almost not a word, except that they were not doing something properly and the Europeans were angry. Paternalism was rife. They were told what to apply for and when. The applications, of course, were filled out for them. The funds were manipulated for them, on paper, by the DASF and the Development Bank. They were given extremely little supervision but were invariably blamed when something went wrong. Although one of the goals of the project was to train them in cattle husbandry, even the small amount of training a few of them received was never allowed to be used.

¹ There are two or three Korofeigu projects which are somewhat more successful than the others. These are managed by men who took a much more active interest than others and who did, most probably, ask for additional help from the DASF. But none of the Nupasafans were in this category and they emphatically deny having requested any loans at all.

The DASF did virtually everything for them: mustered the cattle, branded, inspected and removed them, added more, even sold a few to others without consulting them, and so on. Nothing was in their hands except the most basic instruments of labour - not the money, not the records, not the control of the cattle, and not even, for the most part, the scheduling of their own time. They were usually ordered to show up for work on certain days with little or no consideration given to what else they might be doing. Needless to say, the loan payments were not always made on time. They received offensively paternalistic letters which, of course, had to be read to them.

Related to this, but far worse, is the blatant and overt racism that has been part of their relationship with Europeans since the beginning. They were continually told they knew nothing about cattle and did not look after them properly (which, of course, was quite true and could not be denied, but which also would seem to beg the question). When they crossed the Bena Bena Station to get to their project they could be told to stay out of certain areas, to be sure and close the gates, and so on, and at times shouted at. Their names were constantly misspelled and mispronounced, not only on a day-to-day basis, but even on the few cheques they received from the Development Bank. Sometimes the Goroka banks even refused to cash the cheques for them unless they could find a European to vouch for them. Worse than this, for several years the Bena Bena Station allowed their non-European employees to build houses and gardens behind the station and on Nupasafa ground. Apparently the thousands of hectares alienated for the business of the station were somehow not sufficient. One of the previous station managers had also built and maintained a series of duck pens on the Nupasafa ground and sold the ducks to the local people. At no time did anyone pay, or even offer to pay, any compensation for the use of this ground. When, at last, the Nupasafans asked about this they were told by the Korofeigu DASF officer at the time to be quiet about it or the manager of Bena Bena Station would get angry and not 'help' them any further.

These attitudes and behaviour have resulted in unbelievable damage to European-Papua New Guinean relationships in this area. The Korofeigans, in my opinion at least, have been far more patient with the whims, tantrums, arbitrariness and racism of Europeans than the latter have been with their shortcomings. Thus, even if the projects succeeded in DASF and Development Bank terms, and even if the people

could somehow work out the other problems they face, the legacy of distrust, suspicion, hostility, apathy and, in some cases, outright hatred would remain to influence the next scheme, whatever it proves to be. This seems to have been the case in so many instances around the world: for every economic step forward there have been two psychological or sociological steps backward. It is quite clear that this is the result of the repeated failure to consider any but economic factors when introducing development schemes. It is also clear that it often has to do with the intentions and attitudes of those who are supposed to be helping. Self-government for Papua New Guineans will involve, among other things, having to cope with many problems not entirely of their own making.

Paper 3

Ketarovo

Case study of a cattle project

F. von Fleckenstein*

Introduction

Ketarovo is a clan of the Kapagunarabo tribe, a Bena group living in the grasslands near the junction of the Bena and Asaro Rivers, and ostensibly patrilineal and clan-exogamous. Fictive kinship relations consciously entered into, however, are often more important than blood relations, and shallow genealogies permit congenial migrants to claim blood ties to the clan without much difficulty. As a result, Ketarovo clan now includes many immigrants who were not originally Bena speakers.

Prominence is achieved by generosity to fellow clansmen and friendly groups and by defeat and humiliation of enemy groups. A man gains the means to be generous by the farming skill of his wife or wives. Men of eloquence and fearsome aspect, and those who fought bravely in the time of fighting, can also convince others to help them pay bride prices or present pigs to other groups. The man who is able to manage his exchange relationships well can rise quickly in the esteem of his group and is usually able to organize pig presentations to other groups which help to increase his group's prestige. These are men's activities and no one is considered quite a man until he has at least one wife and a child or two. In recent decades, businesses of various sorts have become another means of achieving prominence. Most people have income from coffee and some men are able to convince others to put this money into ventures which they hope will increase the fame of their group. Recently

* The author is with the Department of Economics of the University of Papua New Guinea.

cattle has been among the most prestigious of these.¹

Ketarovo has several advantages which would seem to make cattle a most profitable enterprise. Population density is fairly low and there is a fairly high proportion of rolling grassland. It is within walking distance of the Department of Agriculture, Stock and Fisheries (DASF) abattoir at Kamaliki. The land is well-watered and the climate is mild.

Despite these advantages, the Ketarovo cattle project has many problems. An examination of these problems may suggest some changes which might be made in the way cattle projects are encouraged and aided. In this paper I shall relate the experiences of the Ketarovo people with cattle and then look more closely at the physical, financial and social aspects of the project.

The Ketarovo experience

In 1969 a Kafe-born agricultural assistant came to Ketarovo to help the people build a night paddock and raise a few cattle; he stayed with them for six weeks. They pooled money, bought cement, strainer, star pickets and barbed wire, and built the eight-hectare night paddock before he left. They were so enthusiastic, they said, that they slept near the site in order to work more quickly.

After the paddock was finished, two young married clansmen were sent to the Farmer Training School at Baiyer River in the Western Highlands District to learn more about cattle raising. Some of the older men bought nine steers to fatten and to keep in the paddock. The young unmarried men used to look after the cattle, letting them out to forage during the day, taking them to water in dry weather, putting them in the paddock at night and feeding them sweet potato leaves and grass. Two of the older men sometimes fed sweet potatoes to the cattle, but for the most part the owners did nothing for them; neither did the graduates of the Farmer Training School.

By early 1970, the steers were growing sleek with this

¹ When eight Ketarovo men were asked to rank nine businesses, cattle was most often ranked first in prestige (median = 1.5).

careful attention. Johnson,¹ an expatriate agricultural officer, thinking that the people of Ketarovo had sufficient experience raising cattle and were ready to expand their business, asked them whether they would like to get a loan from the Papua New Guinea Development Bank to raise cattle and build a large paddock. They agreed and the big-man chose a man, Koma, in middle age, to be the Development Bank borrower. He spoke Pidgin fluently so he could relay Johnson's instructions to the other men. Johnson wrote the loan application; he noted that eight² steers could be mortgaged to the Bank to provide the first repayment when they were sold the following year. The projected stock schedule assumed 75 per cent calving and 5 per cent mortality per year, figures which came from the reports of the DASF cattle station at Baiyer River. Johnson feared that the Ketarovo cattle project would be less successful than a government cattle station, but he had no other figures and the Bank required the schedule. He also projected that four hectares of pasture would be improved each year, beginning in 1971.

The loan for \$7,481 was approved in March 1970. Although the men spoke eagerly of building a very large fence, nothing was done during the coffee-picking season and in June the fence was still only a vision.³ Since the project was moving so slowly, the men decided to pool some money from their coffee sales to begin repaying the loan. They collected \$449 and paid \$430 to the Bank. Soon after this, work began in earnest on the cattle fence. Young men from the clan cut down casuarina trees in the mountains and carried the heavy logs several miles before cutting them up to make posts. Ninety-six rolls of barbed wire were bought, fifty-five for the cattle fence and forty-one to fence some tobacco gardens whose owners had obtained permission to borrow from the cattle loan. The cattle fence enclosed 156 hectares with seven strands of wire. Unfortunately it contained no water source (see Fig. 3.1). Stock were bought with money from the loan and by the end of the year the herd contained twenty-four heifers, sixteen steers and a bull loaned by the DASF.

¹ All the persons involved in this project are given fictitious names.

² One steer was initially overlooked.

³ P.F. Philipp, personal communication. See also Philipp's paper, this volume.

In December 1970 Johnson held a meeting in Ketarovo. Among other things, he said that the cattle project needed subdivisions, pasture improvement, a good crush and a roadside paddock. He then divided the people into small groups, which he thought were kinship groups, to consider these problems. In the smaller meetings, the older men expressed their anxiety about repaying the cattle loan and thought that market gardening might help them to do so. Like Johnson, they wanted to spend money on pasture improvement, fencing and purchasing more stock; they were impatient to get more profit in return for the work they had done on the project. The young men remembered that they were very unhappy at this meeting. They had worked hard, caring for the steers in the first paddock and building the fence for the new one. Now the older men declared, 'the young men were very lazy - all the work has been done by us elders'. They gave the young men none of the money from the steers, but kept what was left after about \$1,000 had been sent to the Bank, on Johnson's advice. The young men did not dare express their anger to the older men, but said: 'You have spoken well. Of course the posts are only made of casuarina and in a few years they will rot. Then we shall see what we shall see.'

The herd grew slowly in 1971. Two steers had been born in the previous year and three more were born in 1971, all of them surviving, but one cow and two heifers died during this year. No one seemed to know how they died, but the young men of the clan said that the cattle in the new project were not well because no one took special care of them. Six more steers and a cow and calf were bought by the older men with their own money. Seven of the original nine steers were sold for almost \$1,400. By the end of 1971 the herd numbered fifty-one.

New yards were also built early that year. In a July meeting with Johnson, the men decided to divide into seven groups of nine or ten men each. Each group was given a number which was branded on the cattle allotted to it and was responsible for repayment of one-seventh of the loan. Seven older men, six of them the owners of the first cattle, were named as leaders of these groups, which also included younger men. The seventh leader, Un, represented the thirteen men of his clan who had joined the new project though they had nothing to do with the first one. As this group represented a clan, Johnson assumed that the other groups were sub-clan groups, but they were not, for members of one sub-clan could be found in several of the six groups.

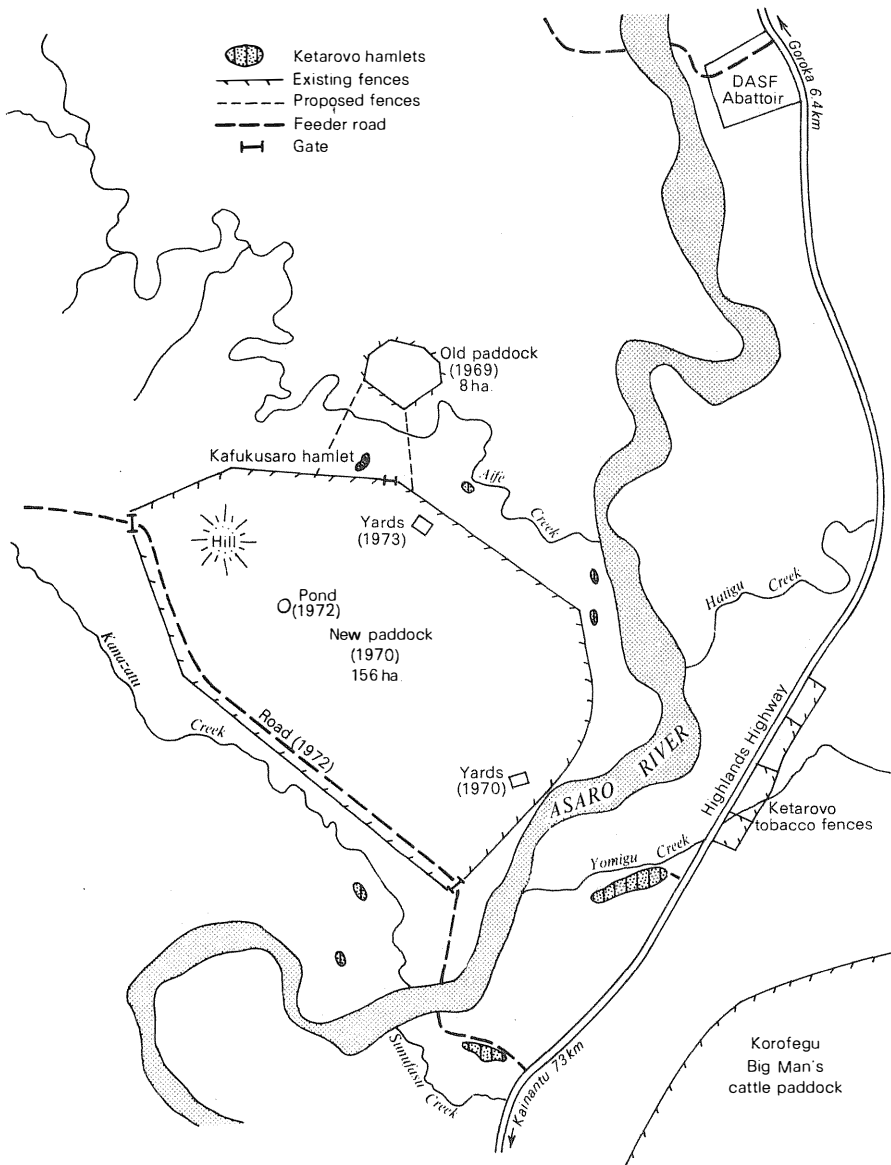


Fig. 3.1. Ketarovo cattle project: tracing of an aerial photograph (May 1970).

The leaders now felt that it was very important to subdivide the paddock into seven sections for the seven groups and Johnson reported this desire to the Bank along with a suggested plan for the subdivision and for extending the fence to enclose part of Aife Creek (see Figs. 3.1 and 3.2). No further work was done in this year on fences or pasture improvement.

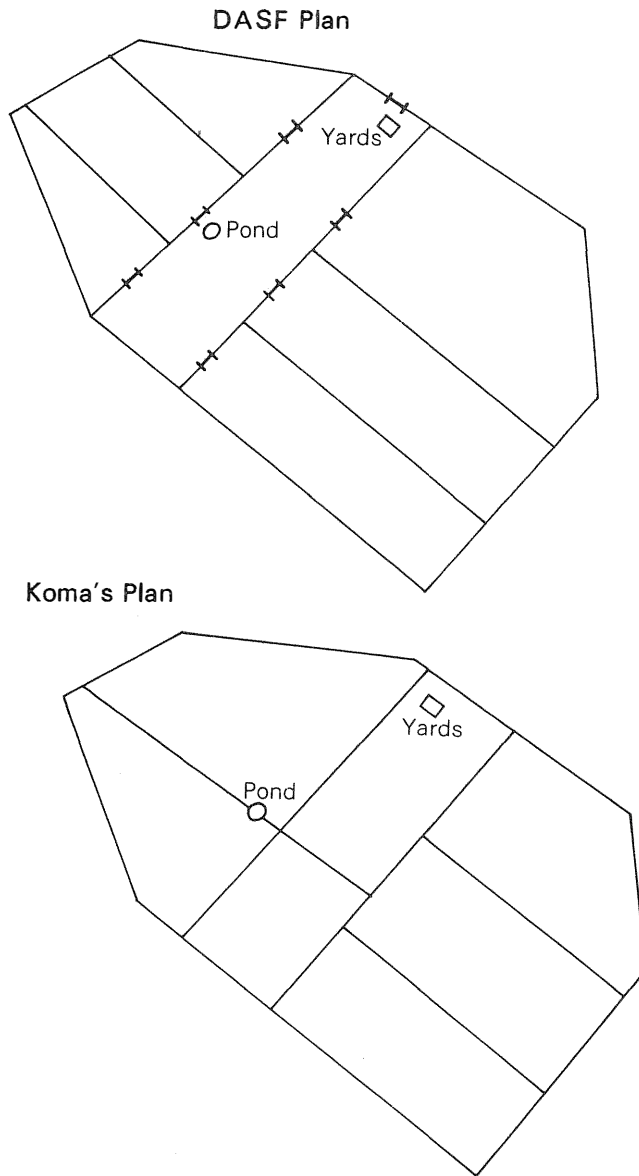
Two more young unmarried men were sent to the Baiyer River Farmer Training School in 1971. When they returned, they tried to call meetings to explain what they had learned, but no one came. By December, after the hot, dirty business of branding the cattle, they told me that they thought the cattle business was very hard and not at all pleasant.

In 1971 repayments of \$841 were made to the Bank: \$169 from sales of steers, \$129 from tobacco fence repayments, \$19 from the 1970 collection and \$524 raised by the groups from their coffee money.

In 1972 the herd began to grow naturally and some of the animals bought in 1970 were sold. Fourteen calves were born but two calves and three heifers died; twelve steers were sold in August for more than \$1,800 and more loan money was withdrawn to buy ten spayed heifers and the DASF bull. Most of the money from the sale of the steers was kept by Ketarovo men whose evident wealth encouraged others to buy spayed heifers with their own money.¹ Koma and seven men who had never owned cattle bought ten of these. The herd numbered sixty-six at the end of the year.

During the August sale of steers, one belonging to Kop's group and branded with its number was credited by the abattoir to Un. Kop was not present at the sale and only learned about it later. When he complained to Johnson he was told that he should have been present to protect his own interests and that he could not intervene in such matters.

¹ Two of the steers were part of the original herd. When they were sold, 75 per cent of their sale price was paid to the Bank together with money from the 1971 sale of the five original steers which had not yet been contributed. The Bank thus received \$1,050 from the project in 1972. Four other steers were privately purchased and their owners paid nothing to the Bank. The six remaining steers had been bought with loan money, but the money from their sale was kept by the six leaders concerned, and none of it was ever paid to the Bank.



Source: Johnson's report and interview with Koma in August 1973.

Fig. 3.2. Suggestion for subdivision fences.

It had always been difficult for the men to identify their cattle, because ear-tags tended to fall off. The Ketarovo men preferred to lop off tails or clip ears to signify ownership and to remember the coat colour of their animals. As the herd grew, such signs were not enough to prevent confusion and apparently branded numbers were not convenient identification marks for illiterate owners. Now a quarrel had broken out. The men felt that if the cattle could be separated by subdivision fences it would be easier to identify them and harder for people to steal them. They met with Johnson and told him that they would like to start building the fences but that they wanted to use better wood, as the casuarina posts they had erected only two years before were already beginning to rot. They found good wood at a reasonable price in the Kamano and Gadsup census divisions. During the last few months of 1972, group leaders made individual trips to Kamano and bought trees with their own money. They spent about \$60 on trees, which they chopped up into posts and brought home. They also spent \$70 of loan funds to buy barbed wire.

In October 1972 the Animal Industry Division (AID) of the DASF built an access road to a number of native leasehold blocks recently purchased from Ketarovo. One of these blocks was held by Morobe, a local officer of the AID whom they hoped to establish as a model grazier who could help the Ketarovo people and the other block holders. As this road ran from the Highlands Highway through a Ketarovo hamlet, across the Asaro River and through the Ketarovo paddock, and as the bulldozer making the road had also taken the time to dam a spring and create a pond to eliminate the need for extending the fence to Aife Creek (see Fig. 3.1), the Ketarovo people were asked to help pay for the road. The AID did not want a cash payment, but insisted on being paid in hardwood posts, which were not available locally. Morobe was asked to pay fifty posts, but the Ketarovo people were required to pay 200 posts, which they found exorbitant. They had agreed to pay fifteen posts for every day worked on the road and they had expected to pay three days' worth. The work, however, took fifteen days. Johnson was also upset by this large payment for he had to find transport for the Ketarovo men when they went to get more posts from Kamano. He thought that the road was not of much use to Ketarovo and noted that the site of the new yards was far from the road but close to the Asaro River ford across which the cattle were walked to the DASF abattoir (see Fig. 3.1). In early November 1972 Koma took eight other men and two

teen-aged boys to Kamano, where they paid \$20 for fifty-four standing trees. In three days of work they cut down the trees and chopped them up into posts. In late November he took a much larger group of sixteen men and spent three days cutting down 146 trees, for which they paid \$40.

Another building project which became urgently necessary in 1972 was the new yards. The old ones had been built of casuarina logs in early 1971 and they had quickly become too weak to handle the ever-growing herd. Veterinarians arriving at Ketarovo to test the cattle for disease found no one at home, though they returned many times after leaving messages for Koma who repeatedly ordered the men to drive the cattle into the yards, but no one would assemble for work. The young men said that they alone did this work and that they were afraid to do it now because the yards had rotted so. On one recent occasion the animals had become frightened while being yarded and a tree branch broken off by the stampeding cattle had flown into the air and struck a man on the head very close to his eye. As no one would yard the cattle, they could not be tested, counted, or segregated for sale. Seeing this, the older men agreed that some of the new posts would have to be used for new yards. Nothing, however, was done about the yards in 1972.

In November of the same year the bull left the Ketarovo herd. The people of Kafukasaro hamlet (see Fig. 3.1) opened the gate almost every morning to let the cattle drink in Aife Creek and forage in the grasslands near the stream until evening, when they put them back. One day the bull forded the Asaro River by himself and was found walking about on the Highlands Highway. He was taken to the nearest paddock, which belonged to the brother of a Ketarovo man who had become a leader of the Korofeigu tribe. He already had three bulls, but he did not mind holding one more. When Johnson found out that the bull was not with the Ketarovo herd, he was quite worried. Three times he tried to help the Ketarovo men get the bull back across the river, but three times he failed. Once he brought a large truck, but the Ketarovo men were not there to meet him. Again he brought the truck but the river was too swollen to ford. A third time he had no truck and the bull would not ford the river. The Ketarovo men were not very worried

about the bull's absence.¹ He had often tried to mount the young heifers and some of them had been injured by his attentions. The men thought it would be better if he stayed across the river until they could build new subdivision fences. Perhaps then they could keep him from the young heifers.

Improved pasture was planted in December 1972. Pasture improvement had been mentioned in the loan application but nothing had been done about it. Finally, in March 1972 Johnson bought \$170 worth of stylo seed together with innoculum. By December Koma finally got the heavy sack to Ketarovo. The innoculum seeds were dried and then Koma called for men to help him sow the seed. Only small boys came, but together they managed to sow the hill on the western end of the paddock.

As of 31 August 1973 no calves had been born. Animals were sold on two occasions: in January 1973, three privately owned and seven loan animals brought in over \$1,300 and in June, ten privately owned and four loan animals brought in almost \$2,000. Purchases were also made twice: in January ten men privately bought eleven more spayed heifers, some of which they sold again in June. Three of these men were young men, the first of their age group to buy cattle; three were older men who had not previously bought cattle and four were among the earliest owners of cattle in Ketarovo. None of them, however, had bought cattle the previous August. In August 1973 another group of three men bought three more spayed heifers. The bull did not return to the project during this period and the size of the herd without him at the end of August 1973 was fifty-four.

The new yards were finally built in 1973. In March they were marked out by one of Johnson's assistants and Koma took another group to Gadsup to buy posts for the yards and subdivision fences and spent \$55. During the next four months they worked intermittently on the yards. The young men who had vowed not to do any more work on the cattle project said that they finally took pity on the older men when they saw them trying to cut posts for the yards and they began to help with the work. By the end of July the

¹ None of them, however, had seen the stock schedule drawn up by Johnson. When I showed it to a young man with considerable leadership potential, he was extremely interested and quite concerned.

uprights were all in place.

The herd was left to itself in early 1973. The river was swollen, the yards broken and the pond had water most of the time, so no one counted the cattle and no one knew whether calves were being born. No one noticed the health of the cattle.

In late July Johnson brought a truck to carry some more fence posts across the river and to inspect the project: most of the animals came up to inspect him and he counted about sixty of them, noting that one lactating cow was extremely thin. The grass in the pasture had been grazed unevenly, so some of it had grown rank and inedible. He told me that he had explained to the Ketarovo men that they should not actually divide up their animals when they made the subdivision fences, but that they should rotate them from one pasture to another so that the grass would be eaten down evenly and would grow up again quite lush. As he made these explanations, the men, tired by the work of loading and unloading the heavy logs, slept in the shade of the casuarina trees.

Johnson looked at the yards and saw that the posts were well-placed and that provision had been made to keep animals from turning back and preventing other animals from entering the yards. He also visited Morobe's cattle block nearby. The latter still received his salary from DASF, though he spent most of his time on his block, with the understanding that he would advise the Ketarovo people and other block holders about their cattle. The Ketarovo men said that he had been to see them only once. Morobe, on the other hand, said that the Ketarovo people had not followed his advice, so he felt that he was wasting his time.

Repayments to the Bank were very confused in 1973. In January two private animals were used in ceremonial exchanges and one private and seven loan animals were sold to commercial butchers. The cheques paid by these butchers were made out to the individual owners or group leaders and sent to them in care of the Goroka DASF office which sent all of the cheques to the Mt Hagen branch which entirely refunded the cheque for the private animal and, surprisingly, for one of the loan animals. The remaining leaders received refund cheques of \$30 to \$60 per animal and the Bank retained 74 per cent of the sale price of these animals. The Ketarovo people found this a very sensible arrangement, as Johnson had told them that the money from the loan animals really should be used to repay the loan. In June,

fourteen animals were sold to butchers, ten of which were privately owned. As in January, all of the cheques were sent to the Bank's Mt Hagen office, but this time the Bank sent back very small refund cheques of \$15 to \$25 per animal for twelve of the beasts, thus retaining about 82 per cent of the sale price. The Bank's argument for retaining more than usual was that repayment of the loan had not been proceeding rapidly enough.

The Ketarovo private cattle owners were extremely angry when they received their small cheques. None of them had received enough to cover the money that they had paid for their animals, which was \$70 to \$90, let alone realize any profit on their venture. Johnson was upset by this peremptory action of the Bank, which he felt would cause the people to lose their trust in him; he asked me to send a letter to the Bank explaining the situation and specifying which cattle were privately owned. When the Bank received this information, they first said that they had the right to hold the money from private animals as well as loan animals because all cattle on projects financed by Bank loans are mortgaged to the Bank. Johnson admitted that they had the power but pleaded with them to consider the effect their actions were having on the private owners. Finally, the Bank agreed to return more money to private owners, but insisted that these owners should at least pay a grazing fee for the right to pasture their animals on a paddock enclosed by a fence financed by the Bank. After some discussion with Johnson, the Bank finally decided to retain 14 per cent of the sale price as a grazing fee and sent out new cheques in the middle of August. These new cheques, as well as two sizeable refund cheques sent to the two private owners who had not yet received refunds, permitted the private owners to realize margins of \$8 to \$45 over the purchase price of their animals. The Bank made this concession, however, only with the understanding that ten more loan animals would be sold in the near future, the proceeds to go entirely to the Bank.¹

Analysis

Is this a successful project? Do the people benefit from it? What lessons can be learnt from it? While the story

¹ In fact, the Bank actually received a payment of \$371 in September, of which they returned \$236, keeping only 36 per cent.

suggests answers to these questions, another method of looking at the project may clarify these answers. The data used in this study were painstakingly gathered from many sources, including the Ketarovo people, the DASF abattoir in Goroka, the Papua New Guinea Development Bank and DASF rural development officers. Occasionally, estimates have been necessary. Other information, unless specifically attributed elsewhere, is the result of talks and experiences shared with the Ketarovo people themselves during eighteen months from February 1972 to August 1973. (See Appendix 3.1 for notes on tables and figures.)

The primary goals. The success of any venture can only be measured if the goals are clearly specified. In the case of the Ketarovo cattle project, the choice of beef cattle as an enterprise was influenced by the goals of the five-year development plan of 1968 (TPNG 1968). One part of the development plan outlined the long-range plans for the development of a large national beef herd. The objective of this program was the replacement of beef imports, presumably at or below import cost. This would require a considerable increase in the capacity to produce beef animals the benefits from which accruing primarily to Papua New Guineans. The ultimate objective was a large self-sustaining smallholder herd (TPNG 1968:32).¹

In order to achieve this objective, a two-phase program was begun. In the first phase, from 1967 to 1972, Administration stations and some large expatriate grazing properties were given credit from international lending bodies to increase the size of their breeding herds through importation of stock, pasture improvement and similar measures; smallholder fattening operations, such as the original 1969 Ketarovo project, were also actively encouraged. In the second phase, from 1972 to 1980, it was planned to establish many fairly large smallholder cattle projects of twenty breeders or more, using the breeders from the expanded herds of the big stations as stock and the experience of the smallholders who had begun fattening operations.²

The program devised by Johnson for the Ketarovo project is quite clearly derived from the national program. He

¹ A total of 180,000 by 1980 (out of a total projected herd of 300,000).

² Office of Programming and Co-ordination (1971) and T. Leche of DASF, personal communication.

designed a stock schedule which would, if followed: (i) produce beef; (ii) avoid undue subsidization; (iii) create a self-sustaining herd; and (iv) provide monetary and probably social incentives for Ketarovo farmers. Objective (v) which Johnson considered very important was to increase the competence of the Ketarovo people to raise cattle. In order for the Ketarovo people to increase their competence in raising cattle, of course, they had to have the opportunity to make their own mistakes. Such a process necessarily takes time and the progress towards attainment of the first four goals will be slower than if experienced managers were running the project. Unfortunately, this lag was not taken into account in the stock schedule.

The Ketarovo people initially saw the cattle project as a way to get money and to gain prestige in the eyes of other groups. They realized that they would have to learn about cattle in order to raise them and they generally seemed to expect that Johnson would tell them what to do. They were vitally interested in Johnson's fourth goal and expected him to lead them to achieve the first three goals. Though they often seemed to be demanding orders rather than enlightenment, they were not really very interested in merely following orders. They seemed to want to acquire competence, as specified in goal (v), but did not know how to go about it. In essence, then, the Ketarovo people agreed with Johnson about the goals of the project.

The secondary goals. None of these goals can be emphasized to the exclusion of the others. Beef production can be increased in the short run without considering the other goals, but in the long run increased production depends on an increase in the quality and quantity of human and physical capital available for it. This increase is not likely to occur unless producers receive some benefits and are given enough information to allow them to see the long-run effects of their actions on future benefits.

Unfortunately, many of the agencies and individuals involved in the Ketarovo cattle project had concentrated on one goal to the exclusion of the others. They specified means of achieving this goal that in time became secondary goals of great importance to that particular agency. Some of the secondary goals became so important that they were pursued even when they impeded the fulfilment of a primary goal.

(i) Prompt repayment of bank loans. The Development Bank was anxious to encourage prompt repayment of loans in order to prevent undue subsidization of the project. They were so worried about repayment, however, that they were willing to take from the owners of the project not only any incentive to produce, but also any right to make their own decisions.

(ii) Support of local officers in agricultural ventures. The DASF Animal Industry Division supported Morobe by helping him establish a cattle project so that he could set a good example for the surrounding projects and give advice. The help that was given him in the instance of the road, however, hampered the Ketarovo project by burdening its owners with heavy costs in labour and money for a road that was only slightly useful to them.¹ The drastic underestimation of the work required on the road prevented the Ketarovo men from making a reasonable decision about it.

(iii) Supervise the loan closely. Development Bank credit is considered to be supervised credit and the agricultural officer, Johnson, was the Bank's agent. The Bank expected the agent to intervene frequently in the operation of the project to see that it developed in the right way. Johnson, on the other hand, wanted the farmers to have a chance to make their own decisions. He wanted to serve chiefly as a source of information when the farmers requested it. At times, however, he was pressed so hard by the Bank and his superiors that he was forced to give the farmers explicit directions. This inconsistent behaviour confused the farmers and they felt uncertain when faced with a decision because of lack of experience in decision making of this type. Thus, the Bank's insistence on very close supervision kept the project from serious trouble during the loan period, but it also effectively prevented the Ketarovo people from learning how to run their own cattle project.

(iv) Build a large cattle fence. The older men in Ketarovo wanted to build a big fence in order to gain renown for their project, but which would also provide money from the cattle kept within it and incidentally increase the production of beef. They became so interested in the fencing itself, however, that they thought that more fences

¹ The Ketarovo men paid \$60 in cash and 100 days of labour. Valuing labour at \$1 per day, the total cost was \$160.

would solve the problems of the project, the most important of which seemed to be the quarrels over the ownership of steers. As a result, they neglected the yards, the water supply and the bull.

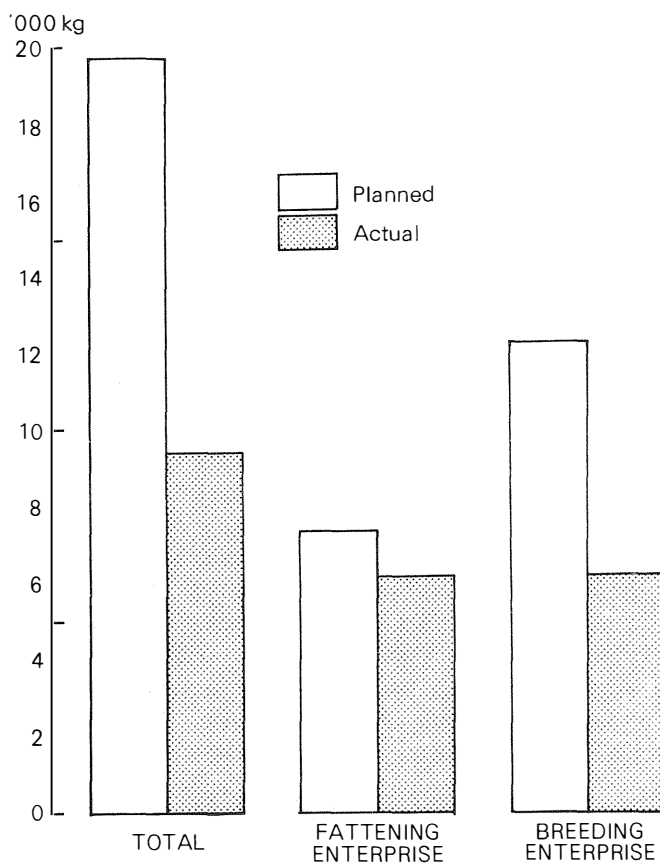
The goals pursued in relation to the project were sometimes unrelated or even pernicious to the fulfilment of the primary goals.

(i) Humiliate older men. The younger men originally supported the goals of the older men, but their humiliation at the 1971 meeting made them desire revenge. They wanted to watch the fence collapse and the older men come crawling to them begging for help. Fortunately, they did not follow this goal wholeheartedly and took pity on the older men when they had trouble with the new yards. Some younger men even bought cattle.

(ii) Placate Development Bank. The District rural development officer sent the farmers' cheques to the Development Bank in order to placate that institution and restore the prestige of the Eastern Highlands District, which the Bank characterized as having an unusually large number of cattle projects which were in arrears on loan repayments. In doing this, he co-operated in the removal of incentives and decision-making power from a project which was not in arrears.

Assessment of success. Such a confusion of secondary goals, pursued to the point where they conflict with each other, obviously leads to frustration of many of the goals. It then becomes necessary to assess the success of the project by measuring the extent to which the primary goals were achieved and by noting the impediments to the achievement of these goals, prominent among which were the pernicious goals noted above.

(i) Beef production. The Ketarovo cattle project did produce beef, although only half as much as Johnson had projected in the stock schedule (see Fig. 3.3). When the production of beef through the fattening of steers and spayed heifers is separated from the production of beef by natural increase (and the subsequent fattening of these calves and their mothers), it can be seen that the fattening operation was almost as productive as Johnson had predicted. It was intended to provide the income for paying off the loan while the breeding operation was building up the herd



Note: See Appendix for sources of data and assumptions made.

Fig. 3.3. Ketarovo cattle project: net production of beef.

and it fulfilled this function. The breeding operation, however, came to less than one-third of the projected production. It did badly because the calving rate had been much lower and the mortality rate much higher than Johnson expected.

(ii) Avoid undue subsidization: repayment of loan. Despite the fears of the Bank and of the District rural development officer, the people of Ketarovo continued to make adequate repayments during the four years under study and were never actually in arrears. Figure 3.4 compares planned and actual patterns of withdrawals and repayments. The repayment schedule specified the loan agreement required payment of \$2,200 in 1973, \$1,000 in 1974 and the remainder

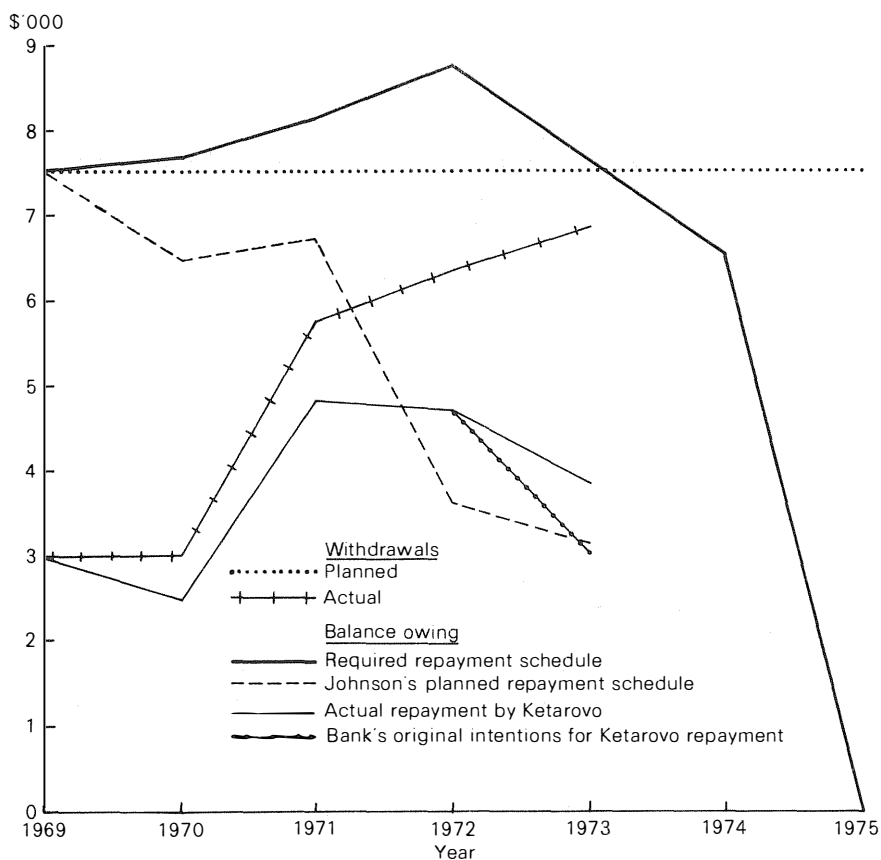
in 1975. As it was assumed that all of the loan money would be withdrawn in 1970, the balance owing would rise as interest accrued and then fall sharply in 1973, more gradually in 1974 and very sharply in 1975 as shown in Fig. 3.4. As long as the balance owing did not exceed the amount shown on this line, the project was not in arrears.

Johnson, however, was concerned that the project might not be able to meet the precipitous demand for cash in 1975 and he planned a more gradual repayment schedule, assuming that 75 per cent of all loan cattle sales would be paid to the Bank. His plan also called for withdrawal of all funds in 1970, but he would have reduced indebtedness to slightly more than \$3,000 in mid-1973.

What actually happened is more difficult to understand, because not all of the loan money was withdrawn in 1970. This is mostly due to the unavailability of breeding stock in 1970 and to waterlogged pastures in early 1971, which postponed purchase of the stock for almost a year. Despite this setback, indebtedness by mid-1973 was only about \$3,800, slightly more than Johnson had planned. Of course, if the Bank had been successful in keeping the money that it had originally withheld from the June cheques, indebtedness would have actually been less than Johnson had planned.

Although the project was never actually in arrears, the Bank evidently had good reason to be nervous, as withdrawals of loan funds were still being made. It is quite likely that the Ketarovo project will be unable to meet the original schedule of payments and will have to have the debt rescheduled. Such rescheduling, however, is probably warranted as a sensible adjustment to reality.¹ It is also evident that no clear formula has actually been followed by the Ketarovo people in paying back their loan (Table 3.1). Early repayments came from money raised from coffee sales and from the sale of the original nine steers, thus exceeding anything considered in Johnson's plan. Loan cattle, however, did not routinely provide payments, as the Ketarovo people firmly believed they did: seven of the seventeen sold provided nothing to the Bank. In one case, the Bank itself returned the money for one loan steer, thus giving the impression that loan cattle were only sometimes taken for repayments.

¹ In recent cattle project plans, Johnson has been requesting a ten-year repayment period.



Source: Development Bank and DASF records; interest owing in the required payments and in Johnson's plan was calculated on the assumption that interest rates actually in existence would have been charged.

Fig. 3.4. Cumulative withdrawals and balance owing to the Papua New Guinea Development Bank, 1970-73.

Although their behaviour sometimes seemed irresponsible to the Bank, the Ketarovo people were actually quite concerned about repaying the loan and considered it a great shame to default. For this reason, they contributed heavily in 1970 and 1971 from their coffee earnings before money from cattle began coming in. Once the money from cattle came in, however, they assumed that the Bank was looking after this matter by taking money from loan cattle and that Johnson would tell them how many loan cattle they had to turn off each year to meet their repayments. If the stock schedule had been carefully explained to the Ketarovo people and if the role of the loan cattle in paying off the loan had not only been explained to them, but also to the Bank, the whole process might have proceeded more smoothly.

Table 3.1

Sources of repayments, actual Ketarovo cattle project
(amounts in A\$)

Source and year	Payment	Less interest	Principal repaid	Balance owing
<u>1970</u>				
Coffee sales	430			
Tobacco growers	60			
	<u>490</u>	63	427	2,490
<u>1971</u>				
Coffee sales	543			
Tobacco growers	129			
2 original steers	169			
	<u>841</u>	364	477	4,834
<u>1972</u>				
7 original steers	1,050			
4 private animals	0			
6 loan animals	0			
	<u>1,050</u>	349	701	4,736
<u>1973 (Actual)</u>				
6 loan animals	680			
4 loan animals	461			
10 private animals	172			
3 private animals	0			
1 loan animal	0			
	<u>1,313</u>	161	1,152	3,859
<u>1973 (Bank's Intention)</u>				
6 loan animals	680			
4 loan animals	461			
10 private animals	996			
3 private animals	0			
1 loan animal	0			
	<u>2,137</u>	161	1,976	3,035

Source: Johnson's and Korna's records, interviews with Ketarovo and Development Bank consolidated statements.

It would probably have been simpler for the Bank to accept all of the money from loan cattle and none from private cattle. This would have seemed fair to the Ketarovo people.

The Bank has been quite fair in its general policies, but these policies were not understood by the Ketarovo people or, in fact, by Johnson and the other agricultural officers. For example, the Bank charges interest daily on the balance owing, rather than on a monthly or quarterly mean balance; this procedure favours the farmer, but he is not aware of this favour. The Bank also subsidizes the interest rates charged to smallholders by charging higher interest rates to expatriate borrowers. Thus, although the cost of administering smallholder loans is 20 to 24 per cent per annum, the interest actually charged is only 7.75 per cent per annum for loans of over \$3,000.¹ This substantial saving was not really understood by the farmers. Instead, they were mystified by communications from the Bank, which were invariably in English; even Johnson could not really explain why they must pay the amount that they owed. The best he could do was to tell them periodically how much they had left to pay back. This news was usually quite disconcerting and the men were worried about paying back the loan.

One solution to this problem is to abandon the attempt to provide perfect honesty and equity, and establish interest rates which are quite easy to understand. One such rate could be, for example, \$10 every year for every \$100 still owed to the Bank at the end of that year. If a simple accounting of the principal and the interest were kept separately and if people were encouraged to pay their interest yearly, people would learn more about the function of banks as lending agencies than they do now; they would also be able to understand in advance how much money they would have to pay and what the consequences of waiting would be. It would, of course, be useful if the announcements could be sent out in Pidgin, as there are many young people literate in Pidgin who could read these announcements to their parents.

Another problem that the Ketarovo people encountered in their dealings with the Bank was the long delays that followed their requests for information or action from the Bank. Koma, for example, complained that receipts for money paid to the Bank were not given to him promptly, and that he

¹ Barry Shaw of the Development Bank, personal communication, 1974.

had to request them several times. Similarly, in the June 1973 sales, the Bank did not make the first refunds until early August and some of the subsequent refunds were not made until the end of that month. Finally, when Johnson and Koma asked the Bank to provide them with a comprehensive statement of withdrawals and repayments in mid-January 1974, they had to wait until May to get it. The Bank explained that the Ketarovo loan was a very complex one: despite its appearance, it was actually three loans as far as the accounting department was concerned. This anomaly was probably due to the way in which the money was withdrawn, in several lumps rather than all at the beginning. In addition, some of the later money actually came from a new loan by the World Bank, which required different accounting procedures from those previously used. In sum, it seems likely that the Bank personnel themselves did not have a clear idea of what was happening to Koma's loan until they made the consolidated statement.

Such delays, of course, made it very difficult for the farmers and their advisers to plan rationally, for they can never be quite sure of their current position. It may be that changing to the simpler accounting procedures suggested above could help reduce delays.

(iii) Avoid undue subsidization: prices paid and received. If Ketarovo cattle were bought at a lower price or sold at a higher price than that prevailing in the market the agency selling to Ketarovo or buying from them would be subsidizing their cattle project. While it is difficult to determine market prices for cattle and meat in Papua New Guinea, this kind of subsidization does not seem to have occurred. Table 3.2 compares the prices estimated by Johnson in his stock schedule with actual prices paid for loan and private cattle and with the range of prices charged by DASF in 1973. DASF policy is to provide animals at commercial cost and they are satisfied that they have been doing so recently. In the first years of the cattle program, animals were sent from the Administration cattle stations to the District centres for selling: a range of prices was given to agricultural officers for animals of a certain age, because quality was known to vary. Since the officers sympathized with the farmers, however, they usually assigned the lowest possible prices to the animals. Now, they are priced at the cattle station and the farmer buys them at that price plus freight and a \$2 fee for the costs of insuring a live animal, ear-

tags and other incidentals.¹ In some cases, Ketarovo paid more than the normal market price for their animals. In 1970, when the loan heifers were bought, there was a scarcity of breeding stock and prices were much higher than they were later. There was also a slight premium for heifers bought from a commercial Markham Valley cattle station, since the delivered prices for them were the same as those from the Administration's Moitaka cattle station near Port Moresby. In this case, the Ketarovo people suffered by being among the first to begin breeding operations. Steers were generally bought at DASF prices, though the one cow bought privately was acquired quite cheaply. The prices Ketarovo people received for their animals were fairly low, compared to prices paid in other parts of Papua New Guinea (Table 3.3). Only Tapini and Lae abattoirs paid lower prices. Both of these places, however, are net producers of beef, whereas Goroka, Mt Hagen and Port Moresby are net consumers of beef. At any rate, it is clear that prices paid for carcasses at all of the DASF abattoirs by butchers were lower than the prices paid by these same butchers for carcasses obtained elsewhere.

(iv) Create a self-sustaining herd. Ketarovo failed to create a self-sustaining herd, or even to begin one. The herd grew only three-fourths as fast as Johnson planned (Fig. 3.5) while the value of breeding stock in mid-1973 was about half of what it was intended to be (Fig. 3.6). Two important reasons for this slowly growing herd are low calving rates and high mortality. Figure 3.7 shows that the actual calving rate, the number of calves born as a proportion of heifers and cows older than 1.5 years was never as high as the rate used by Johnson in drawing up his plan. This discrepancy seemed to be partly due to the poor nutrition of some of the mothers and partly due to misuse of the bull. In the early years of the project, the bull was not separated from the young heifers and he managed to hurt a number of them by mounting them prematurely. In the last year observed, he was not available and no calves were

¹ Phillip Young of DASF, personal communication, 1973.

² Animals are not slaughtered until a buyer is found and this buyer writes a cheque directly to the owner of the animal at the price specified by the abattoir.

Table 3.2

Livestock prices: Ketarovo cattle project, 1969-1973

Type	<u>Dollars per head*</u>				
	1969	1970	1971	1972	1973
Yearling heifers					
Planned		155			
Actual		155**			
DASF***					90-110
Yearling steers or spayed heifers					
Planned		80		80	
Actual loan		75#		70#	
Actual private	43##		77###	82φ	76φφ
DASF***					75-95
Cows guaranteed pregnant					
Actual			120φφφ		
DASF***					150
Bull					
Planned				no data	
Actual				350	
DASF***					250-400

* Transport costs included unless otherwise noted.

** All heifers cost the project the same. Thirteen came from a commercial ranch in the Markham, and eleven from a DASF cattle station near Port Moresby. As transport from the Markham is cheaper, the commercial prices were higher, but the records do not show what part of the cost was transport.

*** DASF livestock officer, Konedobu, Nov. 1973. Prices do not include transport, fee for guaranteeing a live animal (\$2/head) and waiting time (\$1/head/month).

Baiyer River Cattle Station. Transport was \$10/head.

Mean price for nine steers; S.D. = 7.

Mean price for six steers; S.D. = 5.

φ Mean price for ten spayed heifers; S.D. = 9.

φφ Mean price for fourteen spayed heifers; S.D. = 6.

φφφ One cow bought with calf for \$150. Imputed \$30 value to calf.

Table 3.3

Carcase prices: Papua New Guinea, 1969-1973

Place	<u>Cents per kilogram</u>			
	1970	1971	1972	1973
Ketarovo				
Planned	64	64	64	64
Actual*		73	73	73
Other Places**				
Port Moresby commercial***				97
Port Moresby DASF Abattoir				82
Lae commercial				86
Lae DASF Abattoir			64	71
Mount Hagen DASF Abattoir			73	77
Tapini DASF Abattoir				62

* Goroka DASF Abattoir.

** Interviews with commercial butchers and DASF Abattoir manager.

*** Mean of two stores: \$1.05/kg and 86¢/kg.

sired.¹ Mortality of both female adults and calves was high. Figure 3.8 compares the actual and projected mortality, as far as it is known. As no stock-taking was made in 1973, it is possible that mortality was greater than zero in that year. As mentioned above, the causes of these deaths are unknown. Some may have met with accidents when they were drinking and grazing outside the paddock, as a cow from another project was washed away in the Asaro River in 1972. Poor nutrition of mothers may have been another cause. It will be remembered that one cow showed signs of lactational stress in 1973.

¹ It is also possible that the calving rate of 75 per cent which Johnson got from the reports of the Baiyer River Cattle Station was unduly high. In the past, calving rates reported were sometimes the proportion of calves born to pregnant cows, thus producing a very high rate (George Malynicz of DASF, personal communication, 1973).

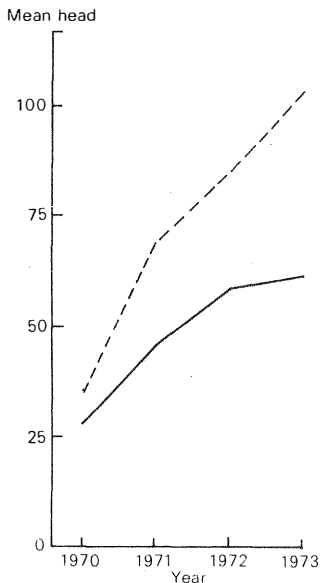


Fig. 3.5. Ketarovo cattle project: total head.

Source: Projected figure from Johnson's stock schedule; actual figure from reports based on stocktakes of the project.

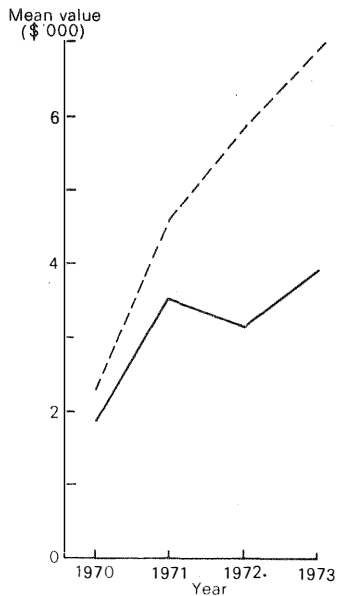


Fig.3.6. Ketarovo cattle project: value of breeding stock.

Note: Value of breeding stock assigned as in Fig.3.

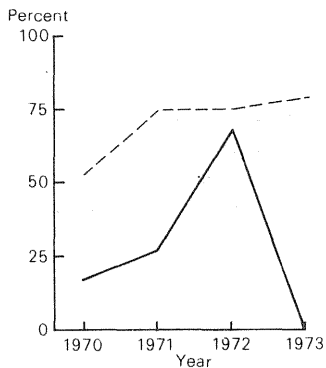


Fig.3.7. Ketarovo cattle project: calving rate.

Source: Projected figure from Johnson's schedule; actual calving rate from review reports of cattle numbers.

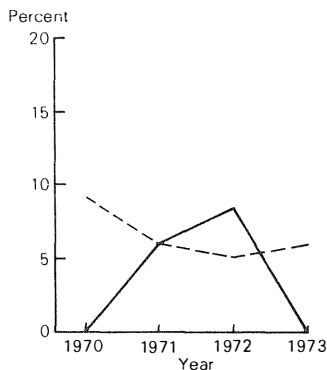


Fig.3.8. Ketarovo cattle project: mortality rate.

----- Projected
 ———— Actual

Lack of subdivision fences also allowed the herd to graze unevenly, overgrazing some areas and leaving others to grow into rank and woody growth that could not be eaten. The people in Kafukasaro hamlet did not help by letting the animals graze outside the fence. Improved pasture was not introduced in the first year, as Johnson had planned, but in the third year, when it was planted on the hill in the hope that it would spread down into the plain below. Unfortunately the cattle preferred not to graze on the hill and so did not eat the legume seeds and deposit them in their faces, as was hoped. As a result, the area of improved pasture had not increased since it was planted.

Fencing and yards have been the most vexing capital investments. Figure 3.9 shows that actual expenditure of time and money on these has been greater than planned, while breeding and fattening stock fall short of the planned amounts. Nevertheless, their contribution to the cattle project has been less. The original fence was not built to include Aife Creek, as it should have been; it was pig-proofed, though that was not necessary to keep cattle in, and the single subdivision fence which would have encouraged the herd to graze the hill had not been built.¹

(v) Provide monetary and social incentives to the nation. The Ketarovo project, in its first years of operation, does not seem to have given the nation any benefits at all (see Table 3.4). If one considered the actual costs of materials and livestock purchased, together with labour at 80¢ per man-day, land at \$5 per hectare-year, DASF services at \$150 per year and subsidized Development Bank services at 16.4 to 16.8 per cent of yearly balances, the internal rate of return (IRR) was 0 per cent. This return is slightly less than the 3 per cent which Johnson's plan envisaged (Table 3.5), though neither of these returns is very attractive compared to other possibilities such as investment in the Papua New Guinea Investment Corporation or the growing of commercial sweet potato. Recent nutritional surveys (see particularly Korte, 1974a, b and c)

¹ The large number of fences contemplated by the Ketarovo people are of dubious value for managing the pasture, because they would require extremely sophisticated graziers to determine when the cattle should be moved from one paddock to the next. Failing this, some paddocks would be overgrazed (T. Leche, personal communication, 1973).

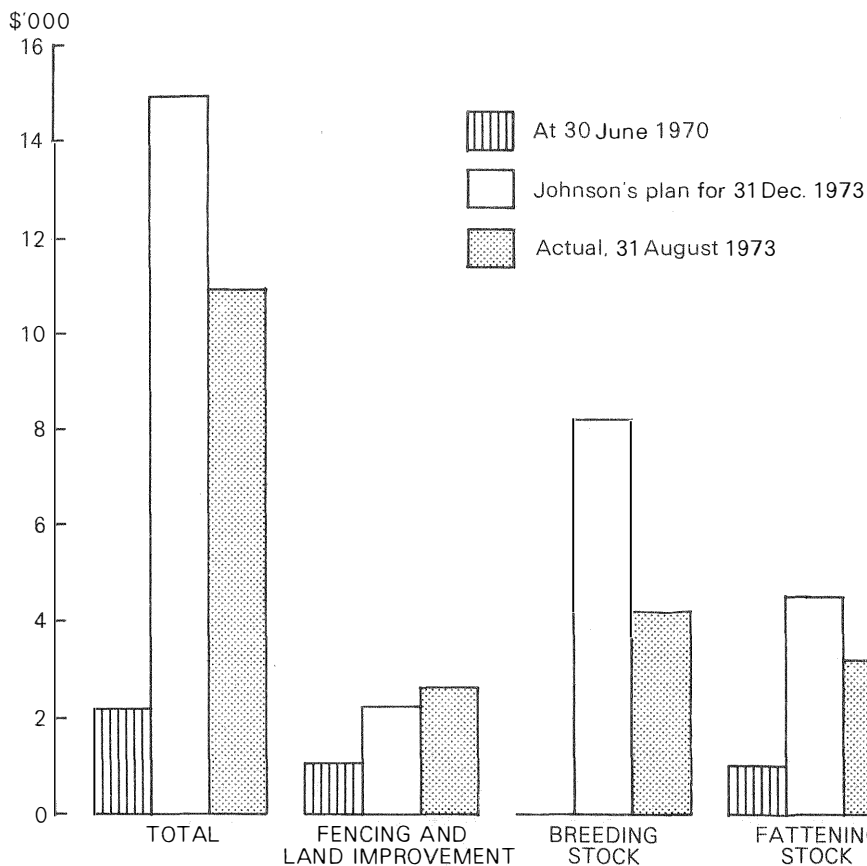


Fig. 3.9. Physical capital, Ketarovo cattle project, 1970-73.

suggest the existence of widespread malnutrition in the highlands and re-emphasize the relative inefficiency of livestock in converting nutrients into human food. The results of these surveys suggest that the nation would gain more if the Ketarovo people planted more sweet potatoes and legumes than if they continued their cattle project.

(vi) Provide monetary and social incentives to the Ketarovo people. At first glance (Table 3.6), the Ketarovo people seem to have done much better than the nation, receiving an IRR of about 13 per cent, though not quite as well as Johnson had expected (Table 3.7). The benefits, however, depend on the ability to salvage the fencing wire and posts at their present depreciated value, which might be

Table 3.4

Returns to the nation, actual Ketarovo cattle project
(A\$)

Year	Costs						Benefits			Net benefits	IRR** (%)		
	Labour	Materials	Stock purchase	Land rent	Bank costs	DASF cost	Total costs	Sales	Salvage Stock			Value Other	Total benefits
1969*	365	757	390	10	0	75	1,597	0			0	-1,597	
1970	1,560	533	4,770	428	147	150	7,588	1,396			1,396	-6,192	
1971	56	55	960	812	849	150	2,882	0			0	-2,882	
1972	287	402	1,518	812	753	150	3,922	1,839			1,839	-2,083	
1973*	124	65	825	406	347	75	1,842	3,261	8,184	3,049	14,494	12,652	0

* Half year

** Internal rate of return, the discount rate at which the sum of the net benefits is zero

Table 3.5

Returns to the nation, planned Ketarovo cattle project
(A\$)

Year	Costs						Benefits			Net benefits	IRR (%)		
	Labour	Materials	Stock purchase	Land rent	Bank costs	DASF cost	Total costs	Sales	Salvage Stock			Value Other	Total benefits
1969*	365	757	640	20	0	75	1,857	0			0	-1,857	
1970	927	1,101	6,890	356	273	150	9,697	1,275			1,275	-8,422	
1971	728	0	350	830	1,134	150	3,192	120			120	-3,072	
1972	103	0	2,320	1,030	716	150	4,319	4,740			4,740	421	
1973	123	65	730	1,030	477	150	2,575	1,574	12,690	2,261	16,525	13,950	3

* Half year

Table 3.6
Returns to Ketarovo, actual Ketarovo cattle project
 (A\$)

Year	Costs			Benefits				Net benefits	IRR (%)
	Factor costs	Loan costs	Total costs	Sales	Loan receipts	Salvage value	Total benefits		
1969*	1,522	0	1,522	0	0		0	-1,522	
1970	7,291	532	7,823	1,396	2,196		3,592	-4,231	
1971	1,883	1,065	2,948	0	2,821		2,821	- 127	
1972	3,019	866	3,885	1,839	610		2,449	-1,436	
1973	1,420	2,805	4,225	3,261	125	11,233	14,619	10,394	13

* Half year

Table 3.7
Returns to Ketarovo, planned Ketarovo cattle project
 (A\$)

Year	Costs			Benefits				Net benefits	IRR (%)
	Factor costs	Loan costs	Total costs	Sales	Loan receipts	Salvage value	Total benefits		
1969*	1,782	0	1,782	0	0		0	-1,782	
1970	9,274	958	10,232	1,275	7,148		8,423	-1,809	
1971	1,908	90	1,998	120	0		120	-1,878	
1972	3,453	3,555	7,008	4,740	0		4,740	-2,268	
1973*	1,873	3,600	5,473	1,574	0	14,951	16,525	11,052	15

* Half year

difficult to do if another enterprise such as the sweet potato gardens were not started within the existing fence. Returns to the various factors of production also seem to have been reasonable. If a partial internal rate of return is calculated by omitting the costs of a particular factor and discounting both the net benefits and the inputs of that particular factor at an interest rate which was reasonable at the time, the return to that factor can be determined for the period of the project (Table 3.8).

Table 3.8

Returns to various factors of production
Ketarovo cattle project, 1969-1973

Factor	Inputs discounted at 8%	Net benefits discounted at 8%	Return to factor
Labour	2,520 man- years	\$2,943	\$1.17 per man-day
Land	441 hectare- years	\$2,771	\$6.29 per ha/yr
Breeding stock	\$3,586	\$4,467	25%
Materials	\$1,541	\$1,882	22%

As labour and land were both arbitrarily assigned values, 80¢ per man-day approximating the mean minimum rural wage during the period and \$5 per hectare-year being the rent paid by a tobacco company using land recently purchased from Ketarovo, the return to one depends on the shadow price used for the other (Table 3.9). At any rate, either the land as used in the cattle project was more valuable than the going rate or, what is more likely, the labour as used was more valuable than the minimum rural wage, which might seem to be a good incentive to continue working with cattle.

Individuals did not receive benefits in proportion to the work and money that they put into the project. Figure 3.10 compares the individual costs and benefits for the seven leaders, for older and younger men, and for the one woman formally involved in the project. Those who bought and sold

Table 3.9

Values of land and labour
Ketarovo cattle project, 1969-1973

Labour wage (\$)	Land rent (\$)
.80 per man-day	6.29 per hectare-year
1.17 per man-day	5.00 per hectare-year

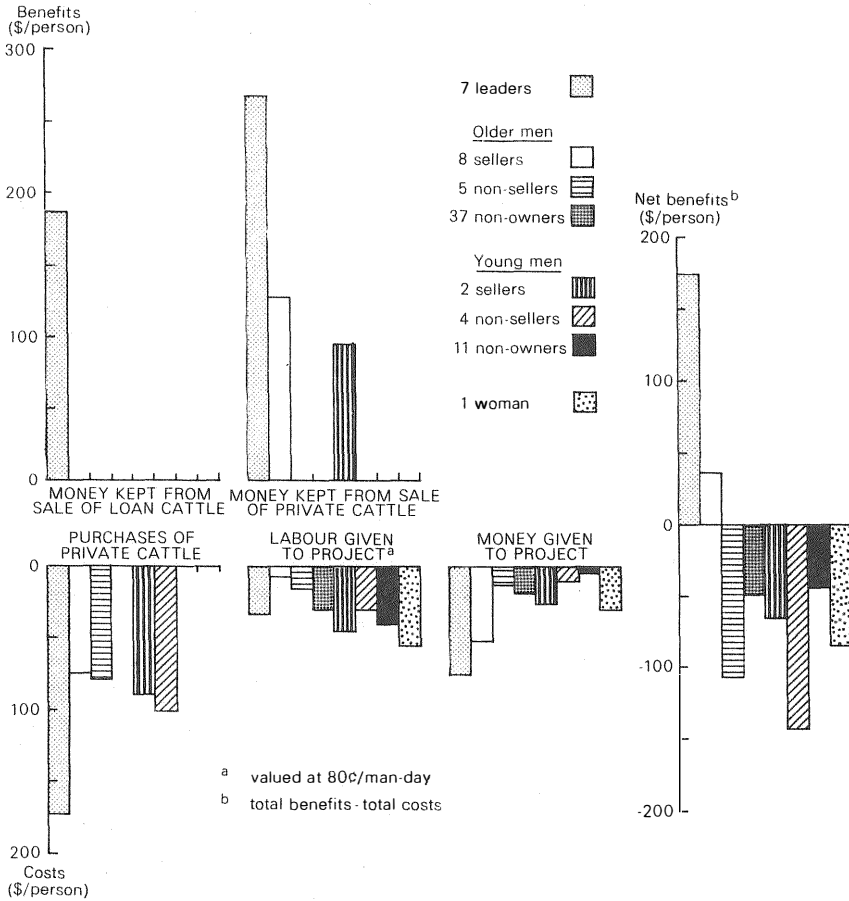


Fig. 3.10. Individual costs and benefits, Ketarovo cattle project.

cattle are separated from those who bought but had not sold and those who had neither bought nor sold cattle.

It can be seen that labour and money contributions to the project as a whole were fairly evenly divided, with the exception of the leaders who together provided the \$1,050 from the sale of animals they had bought privately. Similarly, money spent on cattle purchases was remarkably even, again with the exception of the leaders, most of whom had bought cattle for the earlier project. Returns, however, were not evenly divided. The leaders received almost \$190 per person from the sale of loan cattle; this money was held in trust for future expenditures for the cattle project and some of it does indeed appear as contributions of money given to the project, for the leaders alone bought hardwood posts for the subdivision fences. Most of the money was kept, however, and was actually at the disposal of the leaders. Returns from sales of individually owned cattle are reasonably proportional to individual cattle purchases.

When the money and labour put into the project is subtracted from the money received, it is evident that only the leaders and the other older men who bought and sold cattle received any net benefits from the project. At the end of 1973, the others had mean net costs of \$50 to \$150.

People's opinions reflected these inequalities. Koma, who benefited as one of the leaders, felt that cattle was a very good business and that it should be continued. The young men, who lost the most, felt that it might be good business, but they were not getting their share. Many of the other men who contributed some money and some labour to the project, but who had not bought cattle themselves, felt that cattle was a good business and that the Ketarovo cattle project had been helpful in making Ketarovo well known, but they also felt vaguely that they were being exploited. One such man, who provided money for his son to buy a steer, but did not know the sex or price of the animal, nevertheless thought that the DASF abattoir made a large profit in selling the carcasses of animals slaughtered.¹

Although such problems are internal ones which concern the people of Ketarovo, they reveal that overall budgets and figures do not always give a true picture of a co-operative enterprise or permit one to predict what will happen under

¹ In fact, the abattoir charges a \$3 slaughtering fee per animal, which is normally deducted from the price paid by the butcher.

different circumstances. It is clear that some few people received substantial monetary incentives to continue working with cattle, while many others had to be content with the prestige afforded to the Ketarovo people as a whole. Since some Ketarovo people gave nothing to the project, the workers in effect gained nothing from their work except prestige within the group. The young men, however, were denied even this by the statements of their elders.

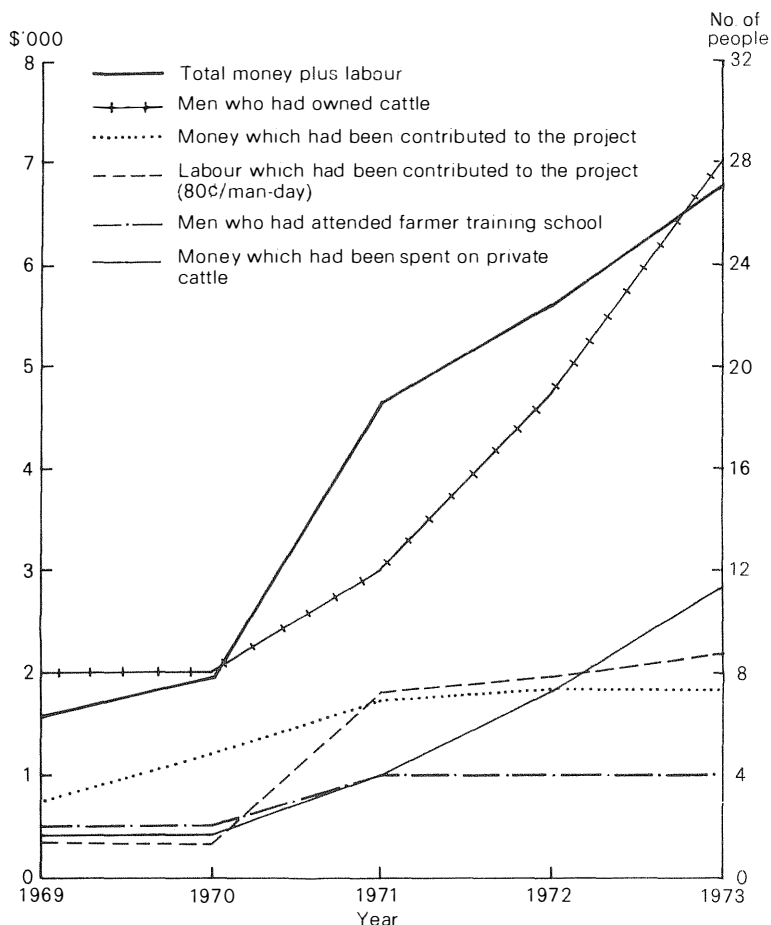
(vii) Increase the competence of Ketarovo people in cattle raising. Although the Ketarovo people put much effort and money into the cattle project (Fig. 3.11), they had very little positive experience in decision-making and very little opportunity to learn. The young men who attended the farmer training school apparently had no idea how they would impart their knowledge or convince the older men to follow their advice when they returned home and they soon decided that it was impossible, so they did not participate in decision-making.

The people who gave money to the project were moved by a desire to repay the loan and preserve the good name of Ketarovo, but they learned little about managing a cattle project in this way. In fact, once the project began turning off cattle, they relinquished to Johnson even the planning of repayment.

Finally, most of the people who provided labour to the project did so because they were told that a fence or a set of yards was needed immediately and not because they knew why these things were needed and had decided to provide them. Building the fences or yards did not necessarily teach them to understand why they were needed. Only the people who bought their own cattle were able to exercise some individual choice.

How did this loss of freedom occur when Johnson began with such a strong desire to let the Ketarovo people make their own decisions? A review of the case may help us to understand. We find that most of the decisions the Ketarovo people made had been in response to questions requiring yes-or-no answers. More complicated decisions were usually made by other people.

- (a) They said yes to the Kafe agricultural officer, then he told them what to do.



Source: Interviews with Ketarovo; for labour and money contributed see notes on Figs 11 and 12 in the Appendix.

Fig. 3.11. Ketarovo group involvement in cattle project (cumulative).

- (b) They said yes to Johnson a year later and he told them what to do - in fact he planned the whole project himself and applied for the loan. The people did not understand the plan very well.
- (c) They said yes when Johnson suggested using the returns from their steers to pay back the loan and he was to tell them when to sell their animals.
- (d) They said yes to the AID when they proposed payment for the road (although they had little chance to say no) - and they had to pay even when the cost was higher than they anticipated.

- (e) They said no when the bank took their money, even though they had not been asked, and they won by asserting themselves.

Sometimes they tried to make their own decisions, but they were forestalled.

- (a) They tacitly decided to leave the bull where he was until they built the subdivision fences, but Johnson pushed them to return the animal to the paddock.
- (b) They decided to divide the paddock up among the seven groups, but Johnson strongly urged them to rotate their cattle and submitted his plan to the Bank in a review report.

In sum, most of the decisions the Ketarovo people were asked to make actually involved striking out in the dark to choose one of two alternatives, usually on the recommendation of the person asking the question. The implications of these decisions were not made clear and other reasonable alternatives were not considered. When decisions were made for them by others, the basis for these decisions was not explained to them and thus they tended to make serious mistakes when they did make decisions on their own initiative. They acted in terms of their own understanding of the situation and found that other people became upset when they did so. Never were they allowed to see the consequences of their decision: to contemplate such a thing was too harrowing for the well-intentioned agencies fostering the project and they promptly stepped in to apply first aid.

As a result, the Ketarovo people remained fairly naive about cattle, at least as far as breeding operations were concerned. They did not understand the function of the big fence, they did not see the importance of building the herd up by natural increase and they did not appreciate the value of the yards in enabling them to keep careful watch on the health and progress of their animals.

It is possible, however, that the private cattle owners learned something about fattening steers. These private owners usually made their own decisions about buying and selling animals, except during June 1973, when they were shocked by the Bank; there is some indication that they did better in this enterprise than in the loan cattle. Table 3.10 compares the margins per year held on private and loan animals and shows that those of private animals are significantly higher. This may be due to the somewhat shorter time that the private animals were held on the

Table 3.10

Ketarovo cattle project: margin per year held on
project loan and private cattle sold, 1969-1973

Type	Number	Years held		Margin per year held	
		Mean	Standard deviation	Mean	Standard deviation
Private	26	1.35	.70	\$70.96	34.11
Loan	17	1.78	.58	\$34.88	9.75

Note: t - test for comparison of means; $t = 4.23$, $p < .01$

project, but this seems unlikely as an attempt to establish a relationship between time held on the project and margin proved to be non-significant.¹ It is more likely to be due to the care with which the owners chose their steers and the thought they gave to the time for selling them.

Conclusion

The Ketarovo cattle project produced some beef and created a herd capable of producing beef in the future, but it fell far short of the plan drafted by Johnson partly because the plan was unrealistic, but also because the plan was never clearly understood by the people. The people learned very little about how to raise cattle, because they were not fully consulted in planning the project and because many of the agencies dealing with them were so anxious to assure a physical success that they took decision-making power out of the hands of the people whenever the project seemed to be in danger. Johnson, in fighting this tendency, allowed decisions to be made in ignorance, some of which he later regretted.

Not surprisingly, the nation has not benefited from this project yet, having subsidized it by giving the services of the DASF and by advancing credit at a very low interest rate. The Ketarovo people as a whole gained something and

¹ $r = -0.2437$, $t = -1.61$. Animals sometimes come to a project in poor condition, and thus can gain condition rapidly in the first six months (Leche, personal communication).

the return to their labour was respectable if not as high as for coffee and sweet potato.¹ The distribution of benefits within the community, however, was very uneven and most people received no tangible rewards for their work.

However, it may be narrow to consider the project solely as a cattle project; the Ketarovo people, despite the difficulty they had in making the decisions about their project, succeeded in constructing a pig-proof fence in the hopes of growing gardens in some paddocks while the cattle were in the others. The project has not been very successful in providing the capital for such a mixed-farming enterprise, however, even though much money and labour has been invested. The cattle herd is fairly large, but the breeding animals were in poor health. The remaining large assets are the fence and the material for the subdivision fences, probably worth less than the calculations suggest. The posts of the main fence are casuarina and will probably last only until late 1975. Though the wire will last about fifteen more years, it will be useless without posts and thus considerable maintenance will be required to keep the fence intact. If no more work is put into the fence, it will be worthless by the end of 1975 and it is conceivable that half of the herd would need to be turned off to repay the loan and the remainder put into other cattle fences. If the pattern of the past is followed, however, it is much more likely that the loan will be rescheduled, Johnson will exhort the men to fix the fence, some subdivision fences will be built and the herd will graze in the paddocks which still have sound fence posts. It may even be that some sweet potato gardens will be started and that the income from them will help to pay off the loan for the fence.

What is striking about the Ketarovo experience is not the problems of the project: the lack of water in the paddock, the low calving rates, the high mortality, or even the escape of the bull. Rather, it is the way in which the people were pressed to make decisions with inadequate information, only to have those decisions reversed by others when the outcome did not please them. If people are to have the right to make their own decisions, the first decision they should be allowed to make is what sorts of enterprises they want to undertake. It is not enough to tell them that

¹ The \$1.17 per man-day compares with \$1.43 for arabica coffee and \$1.20 for commercial sweet potato (Emmery 1970). Yields measured in Ketarovo indicate that the returns to sweet potato may be higher than this figure.

the nation has chosen them to raise cattle and to ask if they will accept the challenge. Rather, the agricultural officer must be able to talk with them about many alternatives and he must have some idea of the experiences of other farmers with these different businesses. Regular farm management data such as the information in this paper must be gathered from co-operating farmers in the region. Only in this way can people make realistic plans for their businesses.

Such farm management extension is the exact opposite of the kind of supervision expected by so many of the agencies connected with the Ketarovo project. To many of these people, supervision is direction: the agricultural officer becomes the manager. Such direction produces beautiful projects if enough time is spent by the alien manager, but the people themselves learn nothing except to doubt their own abilities. Farm management extension requires sitting for many hours with the people, so that a meaningful exchange of ideas can take place.

Johnson possessed the skills of a good extension agent and he practised them when he could. His efforts, however, were hampered at every turn and he did not have the benefit of good data gathered by farm management analysts to help him in advising the people. He did not know, for example, the calving rates in other Goroka projects. He was also prevented from turning to technical experts in other departments.¹

In sum, if good officers like Johnson are to be fully utilized and if the people are to be helped to make their own decisions, agricultural extension work must be reoriented to focus on the farmer rather than on specific commodities. Good information must be gathered to give support to the officers and sufficient time must be allowed to both the farmers and the officers to do their work properly.

¹ Recognizing the need for some sort of record-keeping by the Ketarovo people and others who had cattle projects, he asked the local Business Development officer if he would be willing to instruct a number of young men from such projects in the rudiments of book-keeping. The officer was willing, but the DASF District training officer felt that Johnson had exceeded his authority and the acting regional rural development officer unfortunately agreed with him: Johnson was severely chastised for this infraction of Administration customs.

Appendix

Sources of numerical data and assumptions made

Figures

Figure 3.3

Net production of beef = Increase in inventory + Sales - Purchases of stock. The money values are converted into kilograms at the rate of 73¢/kg, the ruling price at the DASF abattoir during the study period.

Inventory values were arbitrarily assigned, as follows:

Breeding stock (heifers and cows):	0-1 yr	\$ 75/head
	1-3 yr	155
	3-6 yr	200
	6+ yr	120

Fattening stock (steers and spayed heifers):	0-1 yr	\$ 75/head
	1-2 yr	125
	2-3 yr	150
	3+ yr	150

Inventory numbers were taken from Johnson's stock schedule and from review reports usually based on stock-takes for the actual project. For 1973, records are completely lacking, but Johnson's personal count in July 1973 is very close to what I have calculated must have existed on the project.

Sales: for Johnson's plan, the number of animals sold and their weight remains the same, but actual prices were used rather than the 64¢/kg estimated by Johnson. For the actual project, abattoir records and Development Bank statements allowed me to determine the exact amount of each sale, save for two animals sold for singsing and one used in a Ketarovo singsing. The weights of these animals were known, however, and they were valued at 73¢/kg.

Purchase of stock: as Johnson's projected prices differed little from actual purchase prices his purchase figures have

been used for the planned purchase values. DASF records provided the prices of loan animals bought and farmer interviews gave the prices of private animals bought.

Separating breeding and fattening enterprises: net production of beef calculations were made for breeding and fattening stock separately. However, steers born to cows in the project would not have existed if the breeding enterprise did not exist. Thus, the kilograms of these steers were transferred from the fattening in arriving at the final figures.

Figure 3.9

Fencing and land improvement = Old paddock fence + New paddock fence + Improved pasture + Material for subdivision fences and yards + Road and pond. The last two were included only in the actual project, as they were not planned. The New paddock fence differed in the planned and actual projects.

Breeding stock = Cows + Heifers + Bull

Fattening stock = Steers + Spayed heifers

Although data were painstakingly sought, it was still necessary to make assumptions in valuing these assets. The data and the assumptions in each case are set out below:

(i) Old paddock fence

<u>Fence length:</u>	1,686 metres (from Johnson's review report)
<u>Wire length:</u>	11,802 metres (for 7-strand fence), or 13 rolls
<u>Star pickets:</u>	441 (one every 3.6 metres between cement strainer posts)
<u>Cement posts:</u>	21 (one every 80 metres)
<u>Prices:</u>	<u>barbed wire</u> , Goroka 1970, \$9.50/roll
	<u>star pickets</u> , Lae, free in store, Stores and Supplies, PNG Administration.
	1971 63¢ each
	1973 66¢ each
	Port Moresby, retail
	1973 105¢ each
	<u>cement posts</u> , Port Moresby, retail
	1973 \$11.25 each

Assumptions: Prices of star pickets and cement posts rise 5 per cent every two years as they did in Lae Stores and Supplies; therefore 1971 commercial price of star pickets was 95¢ each and cement posts \$10.20 each.

Labour expended on fence-building was assumed to be 450 man-days. The people say they worked six weeks and I assume 2-1/2 days a week were put in, with a mean of 30 men working on any one day. Labour was valued at 80¢/man-day.

Depreciation was assumed to be 5 per cent a year for the whole fence, including wire, star pickets and cement posts, and the labour embodied in the fence.

(ii)a. New paddock fence (actual)

Fence length: 7,000 metres (from Johnson's review report)
Wire length: 49,000 metres (7-strand fence); 55 rolls
Wooden posts: 1,912 posts (one every 3.6 metres)
Price: barbed wire, Goroka 1970, \$9.50/roll

Assumptions: Labour expended on the fence was assumed to be one man-day for every post, including the preliminary task of clearing the path for the fence, finding the casuarina tree, chopping it down, carrying it to the fence site, splitting it into fence posts, digging holes, setting up posts and tightening the wire. Thus, total labour input is equal to 1,912 man-days, valued at 80¢/man-day or \$1,529. The value of the posts is assumed to be the value of the labour embodied in them, or 80¢ each.

Depreciation of wire was assumed to be 5 per cent a year, while depreciation of the casuarina posts was 20 per cent a year.

(ii)b. New paddock fence (planned)

Wire length: 87,318 metres (\$931 budgeted for wire)
Fence length: 12,474 metres (7-strand fence; also, Johnson planned to enclose larger area)

Wooden posts: 1,912 posts (one every 6.5 metres, a standard Australian practice with wooden posts)
Price: barbed wire, Goroka 1970, \$9.50/roll

Assumptions: Labour, same as for actual new paddock fence
Depreciation, same as for actual new paddock

(iii) Material for new subdivision fences and yards (actual)

Wire bought: \$70 in 1972
Hardwood posts: 1972: \$102 spent
 170 man-days used in transporting, cutting and splitting
 1973: \$65 spent
 109 man-days used as above

(Above data were gathered from observation and from informants' reports at the time of the work.)

Assumptions: Labour, valued at 80¢/man-day
Depreciation is assumed to be 5 per cent a year on both wire and posts, since the posts are hardwood.

(iv)a. Road and pond (actual)

Posts in payments, 1972: \$60 spent, 100 man-days of work

Assumptions: Labour is worth 80¢/man-day
Depreciation is 20 per cent/year

(iv)b. Improved pasture (planned and actual)

Stylo seed bought in 1972 for \$170

Assumptions: Value of seed is the value of the pasture, and this value does not change as time passes. In fact, of course, the value of the pasture should increase, but it does not seem to have done so.

(v) Fattening stock

Data and assumptions the same as in Fig. 3.3.

(vi) Breeding stock

Data and assumptions the same as in Fig. 3.3, except for bull, a part-Brahman which was two years old in 1970. The DASF assessment of his value at \$350 is assumed to refer to his worth at that time. He is assumed to have a useful life of ten years from 1970 (Rice 1942: 583). Thus we may say that he depreciates.

Depreciation: 10 per cent per year.

Figure 3.10

All amounts are simply added and divided; they are not discounted.

Money spent to buy own cattle: from interviews with Ketarovo cattle owners.

Money given to project gathered from lists kept by Koma recording the names and amounts of money given on the two occasions when money was pooled and from interviews with the leaders who spent money on posts. No lists were kept of contributions to the original paddock fence, but thirty-three of the people who had been involved in the original project gave money in the later poolings, and these men were assumed to have been the contributors to the earlier fence. It was further assumed that they gave in the same proportion as they did later.

Work done on the project was estimated from interviews with Koma and by allocating the totals as follows:

(i) Forty-three people did no work in getting the posts.

Of these, sixteen had clearly done no work on the earlier fences:

- 8 old men
- 2 students
- 1 Seventh Day Adventist
- 1 Pastor
- 1 man working in town
- 1 young man who had been away
- 2 men who were not members of any of the 7 groups

These sixteen were allotted no work days. In addition, seven other men were allotted no work days:

- 4 older cattle owners (not leaders), on the assumption that if they did not work when they owned cattle, they would not have worked when they had no cattle;

Un, as he was a leader and probably did little physical work; and 2 men of Un's clan, chosen at random, because I did not know them well.

Altogether, twenty-three of the forty-three were allotted no working days. Three leaders were allotted 7.5 days each for the first fence, but no days for the second fence. Nine men (three young men, six older men) were allotted 7.5 days each for the first fence and 28.75 days for the second fence. Seven men of Un's clan were likewise allotted 28.75 days for the second fence. The one woman was allotted the maximum number of working days because she was a woman: fifteen for the first fence and 57.5 for the second fence.

(ii) Thirty-two people helped in getting the posts.

Of these, six men and boys who were not members of any of the groups were allotted no work days. The three men of Un's clan were allotted 57.5 days each for the second fence. The remaining twenty-three men were allocated fifteen days for the first fence and 57.5 days for the second fence: three leaders, including Koma, eleven other older men, and nine younger men.

The final count:

<u>Number of people</u>	<u>First fence</u>	<u>Second fence</u>
29	0 days	0 days
3	7.5	0
7	0	28.75
9	7.5	28.75
3	0	57.50
24	15	57.50

If these assumptions are correct, one-third of the people were responsible for three-fourths of the work on the first two fences. Note that herding time, which was mostly spent by Kafukosaro people, was not included in this figure. It is estimated that 1.5 man-days per head was spent on this activity in one year.

Money kept from sale of loan cattle and own cattle.

Cheques were made out to the owners or nominal owners of cattle, so it was possible to identify the amount received by each owner and by each leader for each loan cow by checking abattoir records and the Bank's consolidated statement. Un, as noted, was given the

money for the sale of a loan cow belonging to one of the other groups; this money was never restored to the other group.

Tables

Table 3.4

Purchase of stock and materials: actual figures in Johnson's records and the Development Bank statements.

Labour costs: see notes to Fig. 3.9 and Fig. 3.10. Herding labour of 1.5 man-days per head per year is included. All labour is valued at 80¢/man-day.

Land rent: imputed at \$5/hectare on mean amount of land enclosed during the year.

Development Bank costs: The Development Bank estimates that 24 per cent is the actual cost of administering small loans to Papua New Guineans. Their net costs are the difference between what this rate would give them and the amount they actually collect. For the Ketarovo project, these figures are:

	<u>At 24%</u>	<u>Actual interest</u>
1970	\$ 210	\$ 63
1971	1,213	364
1972	1,102	349
1973 (1/2 yr)	508	161

DASF costs: arbitrarily estimated as \$150 a year.

Sales of animals to the abattoir or for singsing gathered from abattoir records and interviews.

Salvage values (June 1973): stock, from the reconstructed stock schedule using the values assigned in Fig. 3.3; bull as in Fig. 3.9; value of other physical assets gathered from data and assumptions in Fig. 3.9.

Table 3.5

Purchase of stock and materials: from stock schedule prepared by Johnson and from the loan document.

Labour costs: as in Figs. 3.9 and 3.10; herding labour of 1.5 man-days per head per year is included and all labour is valued at 80¢/man-day.

Imputed land rent: \$5/hectare on mean amount of land enclosed during year.

Development Bank costs: as in Table 3.4; the interest that would have been paid at 24 per cent and at actual rates is as follows:

	<u>At 24%</u>	<u>Actual interest</u>
1970	\$ 390	\$117
1971	1,620	486
1972	1,048	332
1973	698	221

DASF costs: as in Table 3.4, \$150/year.

Sales from stock schedule prepared by Johnson.

Salvage values (31 Dec. 1973): stock from Johnson's stock schedule, using values in Figs. 3.3 and 3.9; value of other physical assets are from data and assumptions in Fig. 3.10.

Table 3.6

This table is the same as Table 3.4 except that the Development Bank costs and DASF costs are not included, while the loan costs are added, gathered from Bank statement; similarly, to the benefits is added the loan receipts which is money received from the Bank, data gathered from Bank statement.

Table 3.7

The same as Table 3.5 with the same exceptions as in Table 3.6.

Loan costs: repayments to the Bank calculated from the sales of animals, on the assumption that 75 per cent of the sale price would have been paid to the Bank in each case.

Loan receipts: money received from the Bank; it is assumed that all money would be received from the Bank in the first year of the loan.

Table 3.8

This table shows the results of four financial analyses similar to Table 3.6, differing only in the omission of the costs of the particular factor from each table. The yearly value of the inputs of labour and land are as follows:

	<u>Labour</u>	<u>Land</u>
1969	456 man-days	4 hectares
1970	1,950	87
1971	71	164
1972	359	164
1973	155	164

Paper 4

The financial viability of smallholder cattle projects: the Goilala case

Martin Evans*

Apart from its potential contribution to what is conventionally measured as national income, there are several other features of the smallholder cattle production program which make it a significant part of the style of Papua New Guinea's rural development. For example:

- (i) The introduction of a cattle project means that the villager¹ must attempt to master a totally new and relatively complex technology. Unless the learning costs are to be borne entirely by the project participants, very substantial direct costs of extension work and indirect subsidizing of supporting services will be incurred during the early stages of development. The villager relies heavily on outside advice and of the new types of agriculture, cattle probably gives him the least degree of managerial control over his project. This represents a built-in source of friction between the project participants and the development agencies.²
- (ii) Depending on the minimum size which is advocated, a smallholder cattle project can demand resources from the participants in the scheme on a greater scale and over a longer unbroken period than most of the activities which constitute subsistence

* The author is a former lecturer in Economics at the University of Papua New Guinea.

¹ Following common practice, 'villager' will be used here to mean a Papua New Guinean who does not live in a town.

² Government departments, local council offices, the Development Bank and religious missions.

agriculture. A 'pooling' of these inputs for use by a group larger than the groups which normally determine the traditional structure of economic control is sometimes essential for the establishment of a cattle project.¹ This may put strains on existing mechanisms of social organization and hence have repercussions in other directions as well as the performance of the cattle project.

- (iii) Cattle projects mean fences which is the most unequivocal form of land demarcation. They thus represent an obvious means for co-operating groups to consolidate land claims and for the Administration to resolve conflicts by taking over the disputed area for leasing. Cattle farming may also remove land from the subsistence cycle.
- (iv) Cattle projects take the lion's share of the Papua New Guinea Development Bank's credit supplies to the rural sector. Villagers' experiences with cattle therefore tend to colour their views on credit administration generally.

The importance of some of these factors in determining the development pattern of smallholder cattle projects and their effects on the participating communities are illustrated in the case histories described in other papers in this volume. This paper concentrates particularly on the implications of the fact that the great majority of village-level cattle enterprises are credit-financed by the Development Bank. People participate in cattle projects for a variety of reasons, but an important one is the desire to obtain cash. Giving villagers the means to have cash income should be the primary objective of those development agencies which encourage small-scale cattle production.² Any appraisal of these ventures must, therefore, begin with

¹ When imported materials and much labour are needed for fencing, economies of scale in cattle production can be substantial.

² In some areas it appears that past administrations got people to establish cattle projects mainly to introduce beef into the local diet. The projects originally set up around Pangia in the Southern Highlands are an example. Since the people involved would normally have good supplies of pig-meat, such an objective seems rather misguided.

an examination of their financial performance from the viewpoints of the project participants and their main creditor.¹

The survey

The main purpose of this paper is to provide some understanding of the technical factors which give rise to typical financial problems in cattle project management and which lead to the sort of conflicts of interest described by Langness and von Fleckenstein (this volume). Participants getting into arrears with loan repayments, Department of Agriculture, Stock and Fisheries (DASF) officers refusing to hand over all the proceeds of cattle slaughtering to project owners, disputes over land earmarked to provide an expanded grazing area, and so on, reflect the difficulties which smallholders experience in trying to run cattle projects as business enterprises. The objective here is to clarify the nature of these difficulties and to suggest ways of overcoming them.

In recent years the beef cattle industry in the Goilala has experienced rapid growth in terms of the number of stock carried on village projects and undoubtedly represents an important source of cash income for the local population though it will be some time before this potential is fully realized as some major problems are emerging which must be dealt with first. Though the initial development of cattle raising at the village level was due to the activity of the missions (and they continue to play an important role), the main stimulus in later years has been the availability of Development Bank credit and its advertisement by DASF field staff.

Cattle projects in the Goilala are concentrated in two areas: to the north of Tapini and to the south of Woitape. The area selected to provide the basic data for this study comprises the upper Kunimaipa and Karuama census divisions in Tapini. In January 1973 I carried out a survey of nearly all the cattle projects in the area. The valleys in which the projects were located, the upper Kunimaipa and Inauafunea tributaries (Karuama, Tapala and Meipa), lie approximately north and south of Mount Yule (see Fig. 4.1). The inhabitants of these valleys speak related dialects, what McArthur (1971) has called 'Kunimaipa', and are served by

¹ A complete evaluation of the cattle development program would, of course, involve wider considerations but these lie outside the scope of this paper.

the same council, patrol post (Guari) and religious order (Sacré Coeur at Kamulai and Guarimaipa). The area can be regarded as relatively homogeneous in terms of its more obvious economic and social features. It can be fairly accurately described as 'development-deprived': communications within the area are poor and it is linked to other areas by air transport only (via Tapini); cash cropping has hitherto been confined to small and rather unsuccessful coffee and potato growing experiments; and employment opportunities are restricted to work on the mission stations or the roads (unless migration to Port Moresby is contemplated). Neither is it an easy place in which to raise cattle: serious mineral deficiencies have been found in the natural pasture diet, the terrain is steep and sometimes dangerous and extension staff are in very short supply. But cattle apparently represent the best commercial use of land at present.

Twenty-seven out of the thirty-three projects in these valleys were surveyed.¹ The survey consisted essentially of putting questions to groups of villagers (each project was associated with a particular village) through a Kunimaipa-English interpreter and looking at the projects themselves (stock, yards, fences, pasture, and so on). I was accompanied by the DASF livestock officer for the Goilala sub-district and by an assistant livestock officer, both based in Tapini. The latter originally came from a village in the upper Kunimaipa and acted as interpreter. The information collected in the field was checked, where possible, against data on cattle projects kept at the Kamulai mission and the DASF offices in Tapini and Port Moresby. There were, however, no records adequate for project management purposes at the time of the survey.

In connection with its investigation into the incidence and effects of copper deficiency in the Goilala, the DASF carried out a survey in December 1973 and January 1974 which covered most of the Upper Kunimaipa and Karuama projects which I had visited nearly a year earlier. The data collected on calvings, deaths and turn-offs during 1973 provide a useful adjunct to the data I collected which related to all the years projects had been in existence. In defining base period conditions for the analysis of the future performance of cattle projects in the Kunimaipa-Karuama area, two factors were borne in mind: first, that

¹ The Tapini area contains a total of sixty projects and the Waitape area about thirty.

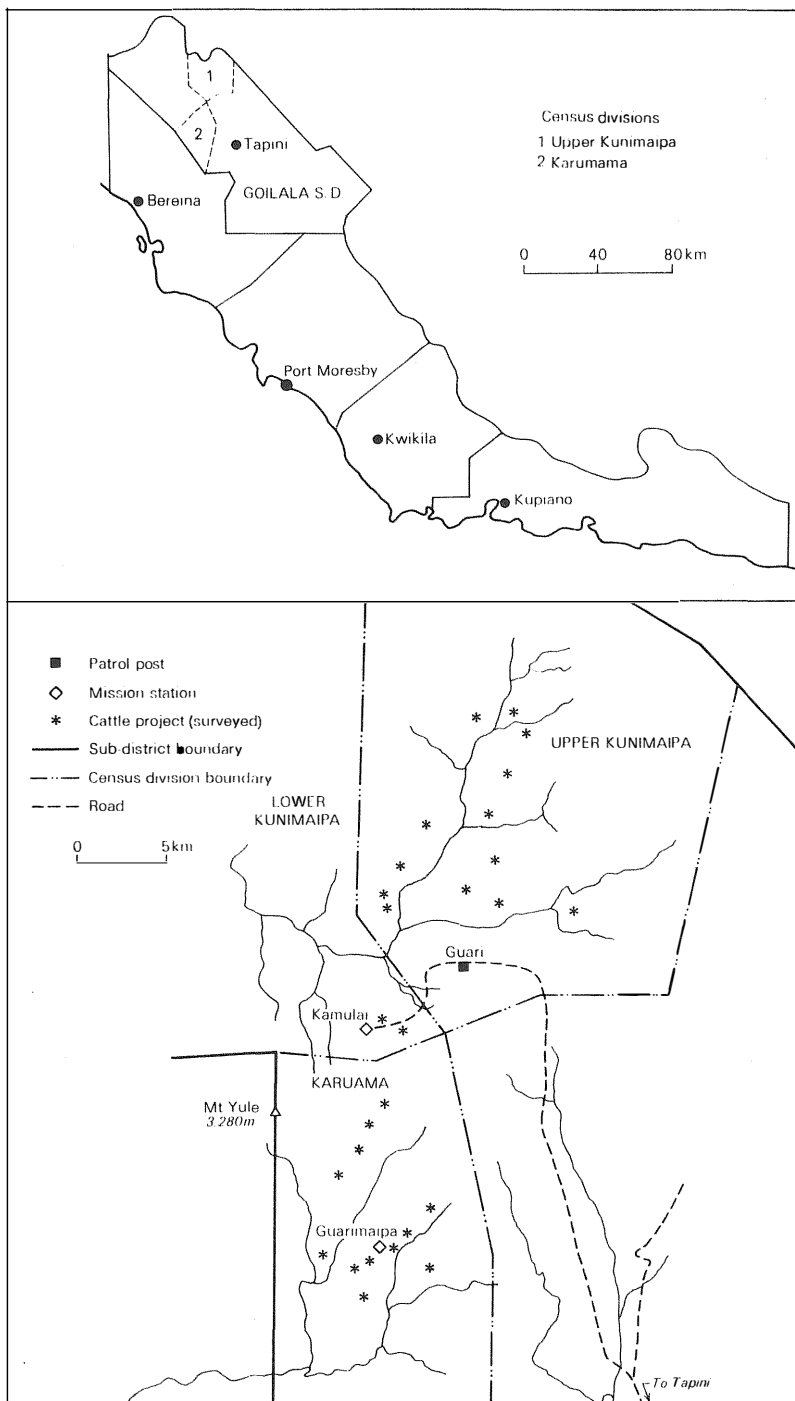


Fig. 4.1. Upper Kunimaipa and Karuama Valleys.

rainfall during much of 1972 had been lower than average, resulting in 'abnormally' low pasture nutrient supplies (hence the mortality figures for many of the newly-established projects surveyed in January 1973 may be 'abnormally' high); second, that the DASF considered some of the responses to its survey questionnaire might have been less reliable than I had reason to suppose the responses to mine were.

The information obtained from the first Kunimaipa-Karuama survey was intended to serve three purposes, viz.

- (i) to provide technical input-output and financial data with which to build up a model of a typical Goilalan village cattle project in 1973, suitable for the analysis of management problems and projection of future performance;
- (ii) to provide some insight into the ramifications of a project within the community associated with it, in terms of the distribution of financial burdens and benefits, the ownership of project assets (mainly stock and land) and decision-making structure; and
- (iii) to provide the documentation needed to initiate a process of maintaining suitable records for the continued monitoring of individual projects.

It is the first of these applications with which this paper is mainly concerned. The data are used to define the existing conditions on an 'average' project. Various possible paths of development from this initial position are considered, each path representing a different type of production strategy and/or level of managerial performance. These projections are used to show the nature and extent of the management improvements which are needed if 'poor' cattle projects are to become 'satisfactory' ones and how credit arrangements affect the financial attractiveness of cattle projects to participants. Present conditions on the Kunimaipa-Karuama projects resemble those in several areas of Papua New Guinea where technical problems exist and extension services are strained. The International Development Association (IDA) credit which was made available to finance the smallholding expansion phase of the national livestock development program was approved on the basis of calculations which, in the case of beef cattle at any rate, assumed an unrealistically high level of managerial performance on smallholder projects in the early years. It is essential that a more realistic basis for assessing the

future prospects for village-level projects is developed. This depends on the systematic collection of management data from these projects - a task which the DASF and Development Bank have only recently begun to undertake. The lack of any provision for obtaining this information must be counted as a serious deficiency in the original planning of the cattle program.

The future availability of extension resources in this program will critically affect its progress. Producing meat from grass profitably is a technically difficult process and expert opinion varies on how the costs of learning this process should be distributed between the groups involved at different points in time. Some extension specialists, for example, consider that a cattle project which has received a relatively high input of advice and decision making from outside will need the same amount after five years as after the first year, if its performance is to be maintained. The corollary of this is that it might be better to let project participants 'learn the hard way' and spread extension resources more thinly over a larger number of projects. Ambitious expansion programs in some areas mean of course that such a policy may be adopted by default. In such cases it is important that the costs levied on project participants are not unreasonable, as they can be, if credit arrangements are not tailored to actual rather than planned performance.

This paper identifies the stages in the development of a smallholder cattle project at which financial strain is most likely to occur and indicates the points in the production system to which extension inputs can best be applied in order to help eliminate these weak points. Technical performance yardsticks are also derived for use in appraising the success of improvement efforts. Alternative loan agreements to those typically used at present are also considered in terms of their effect on the financial attractiveness of cattle projects to villagers. The Development Bank could do quite a lot of rethinking here, as is also suggested by a recent survey of farmers' attitudes to agricultural extension services (ToVue 1974). This showed that problems with loan repayment schedules heads the list of farmers' grievances, while lack of knowledge about lending procedures is cited as another source of discontent.

These sorts of problems with loan-financed enterprises raise important questions about the role of a commercially-oriented credit agency in the delicate process of introducing

new forms of economic activities into small rural communities based on subsistence agriculture. Other contributors in this volume trace the stages in the type of progressive breakdown in relations between project participants and the development agencies which can follow the establishment of cattle projects. It is hoped here to show the extent to which the economic pressures behind these breakdowns may be primarily due to problems with production technicalities or inappropriate credit policy, and hence capable of alleviation through better planning and organization on the part of the development agencies.

Definitions

The functioning of a village cattle project can be considered from several viewpoints. Two can serve as examples.

- (i) A project can be regarded essentially as a process for transforming into cash (or more cash) resources at the command of the groups participating in the enterprise. Attention is focused on the application of technology needed to achieve this transformation.
- (ii) A project can be viewed as an activity which provides the means and reasons for adjusting and redefining social relationships within the participating community. Interest here centres on changes in the behaviour of individuals and groups connected with the project.

Viewpoint (i) could be labeled 'technical' or 'financial' and viewpoint (ii) 'sociological'. An interest in a project which combined elements of both approaches could properly be called 'economic'. This study does not, however, deal with project economics but with project finance; it visualizes a village cattle project as an activity pursued for the purpose of generating a cash income and is concerned to find out what determines a project's ability to do this satisfactorily. This viewpoint is close to that of the Development Bank's and, for this reason alone, is an important one since it is only with the assistance of this institution that the great majority of Papua New Guineans can undertake enterprises such as cattle projects. It is, of course, the viewpoint on which a business-oriented philosophy of 'economic development' is based and which must presumably, therefore, be eventually accepted by the people

whom this type of economic development is intended to benefit. Although for some project participants, for example, the borrowing and repayment of money and acquisition of cattle may represent a sufficient achievement in itself, the development 'agencies' (such as the Administration, DASF, Development Bank, the missions) would interpret such an objective as implying that resources were being consumed, not invested, in cattle projects. As far as these development agencies are concerned cash must be generated as well as absorbed by a project and they would not claim progress had been made until the project participants themselves acknowledged this as the primary justification of the project's existence.

This view of a cattle project as a technical-financial unit is represented diagrammatically in Fig. 4.2. The unit can be regarded as lying at the interface between the economic system to which the project participants already belong (labelled in Fig. 4.2 as the 'village' economy for convenience) and the economic system of the outside world. The unit channels cash in both directions through this interface. Other resources may also flow into the unit from both sides and become transformed into cattle. This paper is concerned with what goes on inside the circle in Fig. 4.2: the technicalities of raising and selling cattle and how these determine the relative magnitudes of cash flows A and B. It is not concerned with what happens to these flows before (after) they enter (leave) the unit, that is, who contributes money for purchasing cattle or repaying loans (flows labelled D) or how the income earned from the project is distributed (flows E), or where and in what quantities the other inputs come from (flows F and C).

The financial concept of project viability. The term 'viable' describes a project which generates outputs on such a scale and of such a type as to render the use of resources in the project worthwhile. With such a general definition, though, it is clear that viability can only be assessed in retrospect by the involved groups themselves and may not necessarily be capable of expression in terms which can be universally understood. Economists have provided themselves with ready-made frameworks for evaluating the viability of projects, principally by promoting the use of a 'standard' catalogue of inputs and outputs which must be measured in each case. The measurement of factors in common units is not always easy, often involving, for example, the imputing of a money wage to unpaid labour or a money cost to the use

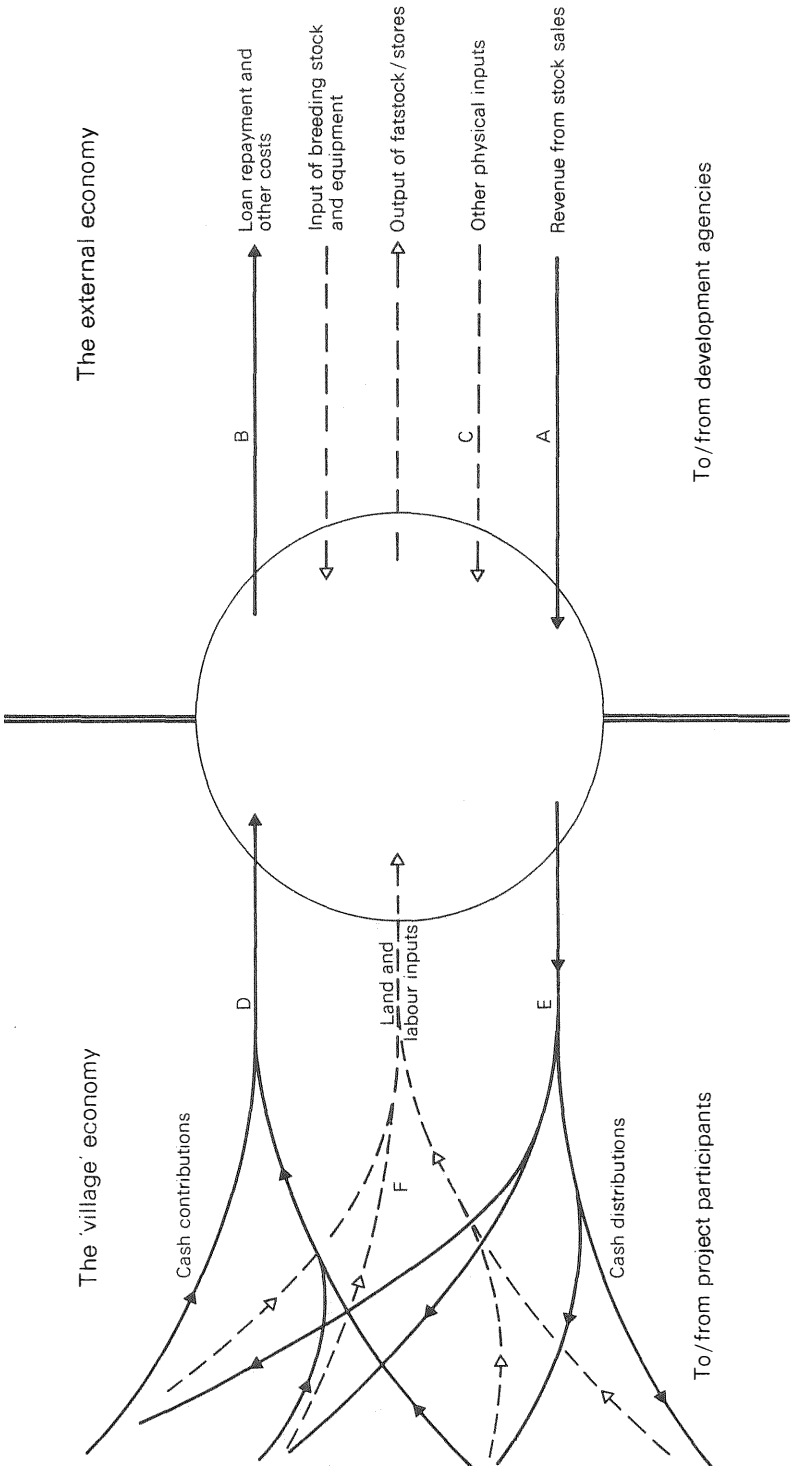


Fig. 4.2. The financial and technical unit of a village cattle scheme.

of land taken rent free. These frameworks may not be very helpful in some situations. We really have little idea what a villager in Kunimaipa-Karuama would include in a list of the inputs and outputs (or sacrifices and rewards) of a cattle project as he sees it. Some guesses can of course be made: it seems very clear, for example, that the ownership of cattle per se and getting more money back from the venture than was put into it are both regarded as important potential benefits from the participants' viewpoint.

This paper does not attempt a comprehensive definition of project viability from the villager's viewpoint. Instead it takes as a minimum condition of satisfactory performance the ability of the project to repay a Development Bank loan under standard credit arrangements for such enterprises. Since the Development Bank will not supply credit unless it believes it has a reasonable chance of recovering its capital and since there are few (if any) other sources of finance in the area which could be used to start cattle projects, ability to meet debt-servicing requirements must clearly be the starting point for a definition of project viability from the participants' viewpoint as well as the Development Bank's.

The next step is to define what constitutes a just acceptable pattern of rewards and sacrifices after obligations to external creditors have been met. A relatively narrow definition of the input-output structure of a village cattle project is employed to this end here in that only flows of resources and products which unequivocally represent cash transactions are considered. This is justified on the grounds that the non-cashable inputs into a cattle project, land and labour, are not very significant from the participants' viewpoint. There is no shortage of grazing land in the Kunimaipa-Karuama and the labour requirements of a typical cattle project in the area are light. It is true that construction of yards and fences involves a considerable outlay of manual effort at the beginning, but it is not at all clear whether, and to what extent, this is regarded by the people who contributed labour in this way as a 'cost' to

be set down against the project for later recoupment.¹ On the other hand, there is little doubt that those who put cash into the venture are hoping to see a return over and above a share in any collective pride arising from the presence of a cattle project in the village. Viability is therefore defined here as a favourable comparison of money returned to project participants (by the project) with money they put into it. This will be qualified later by adding the condition that the breeding herd must maintain at least its initial size but it is clear that the concept is basically a financial one.

It should be stressed that this emphasis on actual cash flows does not mean that other activities associated with village cattle projects should be excluded from an evaluation of the total impact of such enterprises on the welfare of the people involved in them. It has been acknowledged above that the desire simply to 'have' a cattle project is one of the main reasons behind loan applications coming from the Kunimaipa-Karuama. Desire for more money, though, is another strong motive and one which will eventually supersede pure possession in importance, as cattle raising becomes more of a commonplace activity and the area is opened up to outside influences.²

Indicators of financial viability. How should the comparison between incoming and outgoing cash flows be made? First of all, it seems particularly dangerous to attempt any assessment of the efficiency of project income distribution for projects in which collective agreement that individuals and/or sub-groups within the community should contribute certain resources is freely and voluntarily reached. It is safer to regard such projects as communal

¹ The fact that project leaders said they intended in the future to give away cattle to those people who helped them with the project does not, to me, refute the view that help was primarily given because it was requested and not because it was expected that it would result in specific pay-offs from the project later.

It should also be noted that there was no apparent reduction in subsistence agricultural output during the 'construction phase' of these cattle projects.

² Completion of the 'Goilala Highway', which will connect Tapini with the coast, is expected within the next five years or so.

business activities with income accruing to the community as a whole, even though there may exist no recognized institutions for handling community finance and any cash may in fact pass into the hands of the project leaders to be used at their discretion. A valid intra-community income distribution criterion requires detailed anthropological study to reveal what sort of rewards in what amounts and to what individuals or sub-groups are generally considered to represent a just distribution (if such a concept exists at all).

Evaluation of the financial viability of Kunimaipa-Karuama projects will, therefore, be based on overall returns, on capital criteria, and not on any distributional criteria. This raises problems concerning the timing of cash flows which in activities such as cattle raising with long production lags would appear a priori to be an important consideration. It is not easy to say, however, whether project participants in the area display marked time preference in relation to net cash earnings beyond a strong desire, in the case of those who have borrowed money, to repay loans as quickly as possible. Release from this financial obligation also brings release from pressure applied by such bodies as the DASF¹ and the mission² which are closely involved in credit supervision. This suggests that the length of the period of indebtedness to external agencies should perhaps be included among financial criteria of viability, though it should be realized that in the Kunimaipa-Karuama, as elsewhere in Papua New Guinea, it is the usual practice to repay loans given for cattle projects with money obtained from other activities. It is seldom that the initial repayments to the Development Bank are made with cash received from selling cattle³ and there is often

¹ The role of the DASF as a debt collector for the Development Bank, a widespread practice in Papua New Guinea, has been receiving increasing criticism from DASF officers.

² The mission stations at Kamulai and Guarimaipa act as financial clearing houses for loan repayments, purchases and sales for the Kunimaipa-Karuama projects.

³ In fact, most cattle loan repayment schedules drawn up by the Development Bank include small repayments (of the order of \$50 or so) in the first or second year of operation when projects established with breeders only will not yet have produced marketable cattle.

a positive effort made to repay ahead of the agreed schedule so that the whole debt can be cancelled as quickly as possible. Thus the projected period of indebtedness,¹ determined by the particular credit arrangements agreed upon and the projected economic performance of the enterprise, may not correspond with (and will usually be longer than) the actual period.

It should be noted that the term 'indebtedness' as it is used here refers only to the situation where project participants owe money to external agencies, principally the Development Bank. Cash (or its acceptable equivalent in goods or services) which is 'owed' to members of the community associated with the project but who may not (yet) be regarded as full project participants is likely to involve obligations of a quite different nature; it would be misleading to presume any parity between such 'debts' and money owed the Development Bank. Indeed in some Melanesian cultures, particularly those with complex systems of ceremonial exchange, long-standing 'debts' are the rules rather than the exceptions of traditional economic behaviour.² Individuals and groups will juggle with each other to postpone acts of 'repayment' so that they can build up to a much grander 'pay-off'. The manipulation of 'debts' between groups in order to gain an opportunity for mounting a superior display of prestation is the very essence of these exchange systems and hence contrasts sharply with the inflexible loan repayment schedules agreed with the Development Bank and the relative lack of prestige attached to the act of repayment itself. In addition, communities sometimes fear punishment if they get into arrears with external loan repayments and this adds to the desire to shorten the period of this type of indebtedness as much as possible.

Setting aside for the moment the requirements of external credit agencies in relation to a project's financial performance, the extent of external indebtedness emerges as

¹ In theory, the Development Bank loan repayment schedules involve only short periods of relatively light indebtedness for project participants. Whether this is true in practice depends on the accuracy of the predictions of project performance.

² The ceremonial exchange systems of the Kunimaipa-Karuama people centre on the distribution of pork, but no detailed accounts of these have been published to date.

the only empirically-supported criterion for distinguishing which projects are going to be financially more attractive. The use of other criteria based on the magnitude of net cash flows implies assumptions about project participants' attitudes which cannot be defended until information is available about their time preferences regarding such flows. Once the burden of (external) debt is removed (and while money is owing it does seem reasonable to assume that an incoming flow of a given size early on will always be preferred to one of the same size occurring at a later date) on what grounds can it be assumed that villagers in the area generally prefer money now to money later?¹ At present, it must be admitted there are none; most Goilalan villages are as yet too tenuously linked to the monetary sector of the economy to allow reliable statements about attitudes to money to be made, particularly where the sums involved will be larger than most villagers are presently accustomed to.

However, these links will strengthen in time, through activities such as cattle projects and bring increased dependence on cash transactions for securing what will be regarded as an acceptable standard of living. In a context of economic transformation, therefore, the almost certain prospect of increasing monetization of the village economy to some extent justifies the use of the kinds of financial criteria which are applied in fully monetized economies. In other words, as opportunities for investment by villagers become increasingly available so will time preferences with respect to cash flows become more apparent.

Three yardsticks will be used here as a basis for evaluating the financial performance of cattle projects from the participants' viewpoint:

- (i) the number of years during which the presence of external debt means project participants experience negative net cash flows, which cannot be avoided by savings from previous income earned by the project, referred to as the 'period of external indebtedness' (PEI);
- (ii) the internal rate of return (IRR); and

¹ Some anthropologists with whom I have discussed this think that, with respect to money flows in subsistence-based communities, there is often very little evidence to support the economist's usual assumption regarding time preference.

- (iii) the net present value (NPV) of cash flows summed over a finite period (13 years).

These yardsticks are intended for different purposes:

- (i) The PEI is meant to serve as a crude index of inferred discontent among project participants with financial aspects of their cattle enterprise, due to the degree of strain it places on their cash supplies from other activities. Having to put money into the project for several years and repay creditors at the same time will make participants unenthusiastic about the project and hence damage its longer-term prospects. To some extent this index shows the degree of 'subsidy' required to support a project in particular circumstances. It is measured in time periods instead of in the amount of money involved¹ in order to indicate the extent to which villagers' financial investment in other enterprises may be delayed due to the demands of the cattle project.² If a business is being subsidized it means that it can only be kept in operation by the injection of resources obtained from other activities. Investment, involving the transfer of consumption income to another use, is a special form of subsidy and it is to some extent arbitrary to regard a series of negative cash flows as representing a subsidy rather than investment expenditure stretched out over a long period. However, DASF and Development Bank policy is to ask for no equity (beyond a contribution of land and labour) in cattle project investment from Kunimaipa-Karuama villagers so that the only demand (in theory) on their cash holdings is the cost of transporting stock to and from the project site. If, in practice therefore, upkeep of a project means that it continues to drain away cash earned from other activities (such as coffee growing, pig rearing,

¹ The other two criteria take care of the relative magnitudes of the yearly losses and profits incurred.

² Another unattractive implication of a long PEI is that project participants are likely to become impatient to demonstrate to others that their enterprise is really earning income. They will not want a project which involves them in conspicuous loss-making for a long time.

road work) beyond, say, the first or second years of its life, then this can be regarded as subsidization.

- (ii) The purpose of calculating IRRs is primarily that of comparability. It is a widely used measure of both economic and financial project performance, and is a favoured criterion of the World Bank and IDA which lend money to the Development Bank for livestock development programs. It is regarded here as a planner's yardstick, though the concept of a rate of return on capital may not be foreign to people accustomed to receiving 'interest' in ceremonial transactions.
- (iii) The NPV is regarded here as the most useful measure of the financial performance of cattle projects under alternative conditions. The difficulty of meaningfully interpreting a rate of return index for investments which result in relatively large positive net cash flows in earlier years and then negative net cash flows in later years weighs ¹ against the IRR as a general ranking criterion. An 8 per cent discount rate is chosen as the opportunity cost of capital to Goilalans. This is the minimum expected annual rate of interest which will be paid to shareholders in the Papua New Guinea Investment Corporation. A minimum investment of \$100 is all that is required from any individual or group and it would not be difficult to organize share buying among villagers in the Goilala.²

The use of these appraisal criteria is discussed later.

¹ This will be illustrated by the conceptual problem of reconciling the very high IRRs with the modest NPVs shown by some of the store/breeder-rearing simulations. The IRR, of course, will tend to vary inversely with the PEI.

² Investment opportunities in savings and loans societies are limited to those Goilalans resident in Port Moresby, so that the interest payable on deposits (about 4 per cent per annum) would be a less realistic cost to assume for capital.

The technology of small-scale beef cattle production

The DASF's and Development Bank's current policy for new projects in the area at the time of the survey was to establish herds with a minimum of twelve breeders. Hence in the early years of a project's life, nearly all female calves will be retained and recycled within the system. When this expansion phase is completed, female calves in excess of breeder cull replacement requirements will be sold off the project as potential breeding stock or retained and fattened for sale as beef animals. Male calves will either be retained until ready for slaughter as steers (apart from a few high quality animals that are suitable for rearing as bulls) or sold off earlier as yearling stores.

A typical project consists of an area of natural hillside vegetation of between 1.5 and 3 hectares per breeder, fenced off with wooden posts and barbed wire. This paddock may be subdivided by internal fences. All projects have pens and crushes and some have small covered yards as well.

Project participants are encouraged to improve pasture quality by planting up paddocks with introduced plants such as elephant grass and the legume stylo. Apart from fresh pasture, the only other sources of nutrition are salt licks and hand-fed garden vegetables. The relatively high rainfall in the Kunimaipa-Karuama means that continuous grazing is necessary for proper pasture management.

At present, bulls are rotated around the projects, spending about three months on each. It is hoped to increase the supply of bulls until there will be one for every pair of adjacent projects. Separation of calves and young heifers from steers, heifers of mating age and the bull, is an essential requirement for good husbandry so that all paddocks should be subdivided into two grazing areas at least. Ideally, three or four subdivisions are needed.

Breeding stock acquired with Development Bank loans arrive by boat at a point near Bereina, are held for a fortnight for treatment against tick and then walked up to the mountains. Other stock are supplied from mission and DASF herds at Kamulai and Tapini respectively. Until recently, cattle ready for slaughter were walked down to the coast but now they can go to the new abattoir at Tapini, from which the meat is flown to Port Moresby.

Management problems on the Kunimaipa-Karuama projects.

Where low standards of technical performance occur, they can usually be attributed to one of the following factors, or a combination of them:

- (i) project participants' lack of knowledge of beef cattle production;
- (ii) too few visits by extension workers due to the inaccessibility of projects and their distance from base;
- (iii) lack of bulls available for breeding;
- (iv) specific physical conditions, particularly copper 'deficient' pasture and rough terrain; and
- (v) the different objectives with regard to the project, of project participants and the development agencies.

These factors manifest themselves in a number of specific problems, the most important of which are listed below.

- (i) Overstocking. Once the first area of pasture has been fenced off project participants are often reluctant to fence off further areas despite increases in the number of cattle carried on the project. This is partly due to a real lack of understanding about the relationship between stocking density and nutrient intake, and partly due to the importance attached to possessing cattle per se relative to that attached to fattening them for eventual sale. The effect of overstocking is steady deterioration in pasture quality and hence reduction in feed supplies.
- (ii) Poor quality pasture. In few cases have the more nutritious non-indigenous pasture species available been properly established in the paddocks by extensive planting. It is more common to find that only a small area has been planted, the remainder ignored and left under its original flora. The vegetation is often burned off in the traditional fashion and unless this is closely followed by the planting of stylo or something similar, bracken will quickly take hold and be very difficult to eradicate. Again the reason for this situation is probably a combination of a lack of appreciation of the need to upgrade pasture quality and relative indifference as to whether the cattle grow quickly or slowly.

- (iii) Mixing of cattle. In some cases heifers which would normally be considered too young for mating are kept in the same paddock as the bull. This results in difficult births which frequently cause the death of the heifer and often of the calf as well. Many of the mortalities in 1972 and 1973 were almost certainly due to the premature mating, before arrival in the area, of a batch of very young heifers supplied to projects in 1972.
- (iv) Sub-standard equipment. Some of the yards and crushes are poorly laid out or made of timber which is too flimsy. This considerably increases the difficulty of handling stock for routine inspection, veterinary treatment and other operations such as branding. Again, it reflects the spreading of small extension resources over a large number of widely scattered projects, resulting in a lack of expert supervision during project construction.
- (v) Excessive retention of stock. Many projects keep steers on long after they have reached a slaughterable age. In some cases it is because the cattle have not reached or maintained a slaughterable condition due to poor nutrition, but in others the reasons are more complicated. For example, project participants may simply want to maintain the number of cattle on the projects, since each animal is usually identified as the 'property' of an individual participant or a sub-group of participants. Turning an animal off for slaughter means loss of ownership, at least temporarily. This tendency to carry cattle unnecessarily has probably been exacerbated by the slowness with which new calves enter the system due to the chronic shortage of bulls.¹
- (vi) 'Avoidable mishaps'. If an animal gets into difficulties or becomes sick, project participants often do not know what should be done for it and expert advice is too far away to be summoned in time. Similarly, breeding opportunities may be missed if cows are not recognized as being on heat. Substantial loss of condition in stock may occur

¹ At the time of the survey, for example, only one out of fifteen projects in the Upper Kunimaipa Valley carried a bull.

because the early signs of nutritional stress go unnoticed.

- (vii) Copper deficiency. The DASF has established from the analysis of blood and foliage samples that the copper intake of cattle on certain projects in the Kunimaipa is nutritionally inadequate. Certain compounds present in the pasture prevent the copper from being available. The effect of a copper deficient diet is most serious for young cattle which may be considerably weakened as a result. At present, the only effective treatment appears to be direct injection of copper at frequent intervals, but research into the problem is continuing. Other elements besides copper are also suspected by the DASF to be unavailable to cattle but this has yet to be confirmed by trials.¹

Apart from the copper difficulty, the extent to which these problems of cattle husbandry will diminish in the next few years is clearly a function of the size of the extension 'input' into the projects, the rate at which participants are able to learn from experience, demonstration and direct training, and the rate at which they are 'converted', where appropriate, to the value systems favoured by the development agencies (that is, they become 'properly motivated'). Since the rate at which project participants learn will itself be mainly a function of the number of visits by extension workers and the quality of the assistance they give, it is clear that the extension input into village cattle projects will be a crucial factor affecting their future technical performance.

DASF field staff are in short supply at present and the situation is likely to get worse rather than better during the next four or five years, until the output of graduates from training institutions has caught up with the demands of

¹ An indication of the severity of the mineral nutrition problem in the area is that the Development Bank and DASF held discussions in 1974 on the possibility of replacing, free of charge to project participants, loan-purchased cattle which had died during the year. At the time of writing, the outcome of these discussions was not known.

agricultural development programs.¹ The number of extension officers which the Goilala cattle industry requires will depend mainly on the number of projects which are planned and what has to be done to make projects viable.

Projecting the future performance of village cattle projects

At present few projects in the Goilala have reached the stage where they are regularly turning off cattle for slaughter.² By January 1973, for example, only six projects in the Upper Kunimaipa had turned off cattle, a total of sixteen steers,³ and no finished animals had yet been produced by the more recently established Karuama projects. The largest breeding herd on any project at this time numbered thirteen head. Clearly the projects in the Kunimaipa-Karuama area must expand considerably before they can be considered fully operational, in terms of the technical objectives set for them.

The rate of expansion of a project and its growth pattern in general will be determined by three groups of factors:

- (i) changes in the standard of technical performance, reflected in such indicators as calving rates, mortality rates, fattening rates, and so on;
- (ii) changes in the business environment of the project, particularly with regard to prices for inputs and outputs and credit arrangements; and
- (iii) the type of management strategy adopted by the project participants as shown by their decisions concerning such things as culling rates, stocking rate, average age at calving, and so on.

¹ In many areas the missions provide unofficial agricultural extension services and the impact of these may be considerable. Both the DASF and the Development Bank readily admit that the Goilalan cattle industry could not have been established without the help of the missions. This underlines the gravity of the existing situation with regard to extension resources.

² A total of eighty-three head were turned off from Goilala projects between 1 June and 20 December 1973, but many of these had been held back on projects until the new slaughterhouse at Tapini was ready.

³ Some of these were Mission animals fattened up on village projects, i.e. they did not all represent full production cycles.

A simulation model for smallholder cattle projects

In order to take adequate account of the above factors and to determine systematically their effects on project performance, a computer model of the technical and financial structure of a village-scale cattle enterprise was used. The model projects changes in the size and composition of the herd, the production of fat or store cattle and the financial position of the enterprise.

Model structure. The basic model consists of two sets of equations. The first (Appendix 5.1, nos. 1-11) comprises difference equations which determine the inventory levels of the different categories of cattle at points in time and planned leakages (turn-offs and culls) from these. The second group of equations (Appendix 5.1, nos. 12-15) determines the financial profile of the project by relating the prices received for these outflows to costs incurred in maintaining the project.

The model shown in Appendix 5.1 can be used to plot the physical and financial growth path of a self-expanding project, that is, no heifers are turned off for slaughter so all those which survive until breeding age are assumed to be retained as breeders or potential breeders. In order to simulate a situation where a project stabilizes its breeding herd at a certain size and then starts selling off heifers which are surplus to replacement requirements, modifications need to be made to this basic model. These changes are shown in Appendix 5.2.

It will be noticed that there are no feed-beef production functions explicitly specified in the models. This is because the effect of changing pressure of stock numbers on a fixed pasture resource can be simulated using the existing equations in a number of ways:

- (i) The variable costs and/or weights for distributing them associated with the different categories of cattle can be varied non-linearly. Thus extra equations can be incorporated which show variable costs to be partly a function of the numbers and type of cattle on the project. For example, rising costs associated with turning-off steers (average age and weight at turn-off assumed unchanged in the model) will have the same result, when subtracted from the turn-off revenue received, as would be given by specifying a falling-off in average weight at slaughter as stock numbers increase.

- (ii) The prices received for slaughtered cattle can be varied in the model so as to reproduce, ceteris paribus, the financial effect of changing average slaughter weights due to alterations in stocking rates.

Model operation. The model will generate values for all endogenous variables (those on the left-hand sides of the equations) for each period 0 to N given:

- (i) the initial conditions of the system, defined by specifying values for variables B, E1 and E2 in period 0;
- (ii) values for the exogenous variables (all variables which do not appear on the left-hand sides of equations 1-15) for each period, 0 to N;
- (iii) values for the parameters b_1 to b_{11} for each period 0 to N.

The result is a time profile of the project.

Model application. The starting values given to variables B, E1 and E2 represent the number of breeders, heifers and steers respectively with which the project is stocked in its first year of operation. Changing financial circumstances during the life of the project due, for example, to shifts in the demand for beef or supply of credit are simulated by specifying particular time paths for the price, cost and loan variables. Changing technical conditions caused, perhaps, by the increasing experience of project participants or a greater input of extension services are simulated by specifying particular time paths for calving and mortality rates, and so on. Finally, management strategies can be simulated by specifying particular combinations of values for both the economic variables and the technical parameters.

There are two main advantages in using this type of dynamic model over conventional budgeting procedures: the ease with which 'sub-models' of particular processes, such as the impact of intensifying extension work on standards of technical performance, can be incorporated into the analysis, and the opportunity afforded for evaluating the impact of several changes in conditions which are occurring simultaneously.

Data used in the model. Base values for the parameters are estimates derived from an analysis of input-output relations for the projects surveyed in the Upper Kunimaipa.

Briefly, the estimation involved the reconstruction, backwards from 1973 to the date of project establishment, of cattle inventories and flows for each project. In nearly all cases, the 1973 survey of existing stock numbers, records kept by the DASF and Mission relating to previous years, and project participants' recall of stock arrivals, births, deaths and turn-offs were in good agreement. For one project, however, it was impossible to build up an historical picture consistent with data from these different sources, so it was excluded from the calculations. The average age of the Kunimaipa projects at the time of the survey was about five years. On the other hand, the Karuama projects have been established rather too recently to allow technical data from them to be used with much confidence.

Base prices (including interest rate) relate to the period 1970-72, when most of the Karuama projects were being set in operation.

The main issues. The simulation model is used here to project the future behaviour of the 'average' Kunimaipa-Karuama¹ cattle enterprise under different conditions, in order to answer the following questions concerning its financial prospects.

- (i) What level of technical performance must be reached on the project, and what is the minimum rate of improvement (if any) from the existing level which is acceptable?
- (ii) What form of credit arrangement is best for the project?
- (iii) What management strategy should be recommended?
- (iv) How are the answers to questions (i) to (iii) altered by changes in prices?

¹ Though the base period technical production parameters in the model are estimated from Kunimaipa data only assumptions about initial stocking levels and establishment costs reflect the Karuama situation more. This is because projects in the latter area are all Development Bank-financed (cf. the Mission-initiated projects in the Kunimaipa), which makes their financial structure more relevant to an analysis of future developments.

The order of the first three questions represents my view of their relative importance. Information about the technical performance of smallholder cattle projects in many parts of the country is woefully inadequate. In many cases, the basic data needed for input-output analysis have been recorded, but nothing has been done with them. However, steps are now being taken at both regional and national levels to rectify this situation.¹ Then, once the current technical position of projects is known, any changes in this position needed to attain or maintain the financial viability of projects can be determined. Given estimates of the magnitude of necessary improvements, the future demand for extension input into the cattle industry can be projected. The planners can then compare the costs of increasing the supply of extension services, in order to achieve specified technical targets for project performance, with the financial benefits which project participants will receive.

Since input-output data on beef production may not be available (and it obviously cannot be in hitherto unexploited areas) when the DASF and Development Bank construct planning budgets for the appraisal of loan applications, there is a danger that incorrect assumptions may be made about technical performance. The result will be an inappropriate schedule of loan repayment which makes financial demands on the project at the wrong stages in its development.² It seems clear that this is, or will be, a problem common to many areas, including the Kunimaipa-Karuama. There is therefore need to review the methods used in designing credit agreements between the Development Bank and project participants.

¹ The DASF intends to carry out a sample survey of projects in the Markham Valley to determine calving and mortality rates, and the Development Bank intends to mount similar surveys in all Districts of projects it has financed. The possibility of establishing a national data bank which would include input-output statistics for smallholdings is currently being investigated by government.

² It is the policy of the Development Bank, at its higher levels, to review project performance and make recurrent adjustments to the loan repayment schedule in individual cases to avoid undue financial stress. In practice, however, this flexibility is seldom evident to project participants mainly because of the activities of other development agencies involved in implementation of the credit agreement (see below).

Project management strategies need to be planned which are suitable for the particular characteristics of the area, particularly with regard to expected changes in the supply of extension services. The length of the beef production cycle and the relative inexperience of many project participants in cattle farming mean that management strategies must be thought out in anticipation of secular changes in the important technical and economic variables.

The question of how factor and product prices affect project viability will become increasingly important as, for example, the store cattle market becomes more volatile with the phasing out of the large-scale cattle stations' role as breeder-suppliers to the smallholder sector. Papua New Guinea per capita beef consumption is expected to increase, while the possibility of production for export is also being investigated.

Using the model

Method. It is the essence of the simulation approach to quantitative problems that no optimal solution is sought. The method is adopted either because the system being investigated has such a complex structure that the possibility of obtaining comprehensible answers can be ruled out, or because the conditions under which an optimal solution can be obtained are a too rigid representation of real world constraints for the answer to be useful. In this case, the latter position prevails. It thus appears a more fruitful approach to examine the changes in cattle projects' performances which can be expected under a 'realistic' range of technical production conditions, than to solve for a set of conditions which would give the 'best' performance if such conditions prevailed.¹ No such optimal solutions are therefore looked for. Instead, the objective is to identify those circumstances (production technology, prices, credit and management strategy) which would produce acceptable improvements in the financial position of project partici-

¹ In its present form the model can readily be applied to the problem of determining, for example, the minimum rates of change required in the technical production coefficients in order to sustain predetermined growth rates in physical output or annual income. Substantial modification would be required, however, to solve for time paths of technical coefficients given a constraint in the form of net present value.

pants, and to examine the implications of these results for future planning in the beef industry.

Future situations

(i) The level of technical performance. Levels of technical performance should not be made objectives in themselves because the optimum level from the point of view of economic efficiency will vary with changes in input and output prices. In the case of smallholder cattle projects, however, while the greater part of the output accrues (in theory) to the project participants, the input costs are distributed between this group and the development agencies. At any point in time, therefore, there are two 'optimum' levels of technical performance depending on the group involved. Since this paper is concerned only with project (financial) viability from the participants' viewpoint, however, the prices of inputs supplied by the development agencies can be ignored. The only constraint which will be considered here will be the future availability of these inputs (in terms of the amounts that the development agencies are willing to supply, free of charge, to project participants). Table 4.1 lists the main inputs into a village cattle project, classified according to source of supply.

(a) Technical performance indicators. The technical performance of cattle production as a means for converting feed into beef is essentially reflected in the following parameters:

- (1) the calving ratio, births per cow or heifer-in-calf¹ per period;
- (2) mortality ratios, unintended deaths per head per period;
- (3) average breeding age, average age at first calving; and
- (4) average rate of liveweight gain, average change in weight of non-breeding stock per period.

¹ To avoid confusion, the following terms for female breeding stock will be used:

heifer:	female which has not yet calved
heifer-in-calf:	female carrying her first calf
'breeder':	female suitable for breeding
cow:	female which has calved at least once

Table 4.1

Sources of supply for the main inputs into smallholder
beef production in the Kunimaipa-Karuama

Project participants	Inputs supplied by	
	Development agencies (initially)-project participants (later)	Development agencies
A1. Initial stock* (heifers, steers, cows)	B1. Bulls	C1. Veterinary (specialized know- ledge and treatment, area pest and disease control)
A2. Space (land area for project)	B2. Management (major decision making, planning, recording and accounting)	C2. Transport and marketing II (subsidy of live freight costs, arranging sales of stock)
A3. Labour I (construction and maintenance of yards and fences)	B3. Nutrition II (improved pasture, special supplements)	C3. Slaughtering and processing***
A4. Labour II (upgrading pasture)	B4. Stockmanship II (specially acquired knowledge of cattle husbandry plus practice in its application; use of patent veterinary aids)	
A5. Capital works and equipment** (yards, fences, tools)		
A6. Nutrition I (mineral licks, vege- tables, unimproved pasture, water)		
A7. Stockmanship I (care and attention given to stock based on traditional knowledge and intuition)		
A8. Transport and marketing I (contribution towards live freight costs, labour on drives)		

* There may be an element of subsidy (i.e. cost to the development agencies) involved in some cases of initial stock purchasing.

** The Mission also supplies much fencing wire free of charge to project participants.

*** A small cost borne by the project participants (slaughtering levy) is ignored for the purposes of this table.

Table 4.2

Technical parameters of smallholder cattle production

	CBR (Calf/ breeder ratio)	BMR (Breeder mortality rate)	NBMR (Non-breeder mortality rate)
<u>Aggregate ratios</u>			
1. Upper Kunimaipa projects: from establishment date to January 1973	0.29 (n=14)	0.13 (n=14)	0.12 (n=14)
2. Karuama projects: from establishment date to January 1973	0.19 (n=12)	0.08 (n=12)	0.05 (n=12)
3. Upper Kunimaipa and Karuama projects: from establishment date to January 1973	0.24 (n=26)	0.10 (n=26)	0.08 (n=26)
4. Upper Kunimaipa projects: January 1973 to January 1974	0.51 (n=7)	0.22 (n=7) 0.12 (n=6)	0.06 (n=7)
5. Karuama projects: January 1973 to January 1974	0.29 (n=9)	0.08 (n=9)	0.09 (n=9)
6. Upper Kunimaipa and Karuama projects: January 1973 to January 1974	0.34 (n=16)	0.12 (n=16) 0.09 (n=15)	0.07 (n=16)
<u>Estimated from individual project ratios</u>			
7. Upper Kunimaipa projects: from establishment date to January 1973	0.31 (n=12) (s=0.24)	0.13 (n=12) (s=0.14)	0.15 (n=12) (s=0.18)
8. Upper Kunimaipa and Karuama projects: January 1973 to January 1974	0.37 (n=16) (s=0.36)	0.12 (n=16) (s=0.18)	0.10 (n=16) (s=0.20)

n = sample size

s = standard deviation (about an arithmetic mean)

The calving ratio measures the rate of production of new animals from a fixed capacity to produce; it is a compromise index of the foetal abortion rate among heifers-in-calf and cows on the one hand, and of the mating interval and conception rate for cows on the other. It is not possible, however, to calculate precisely this parameter from the Kunimaipa-Karuama data. Cows could not always be distinguished with any reliability from heifers which were supposed to be carrying their first calf, nor was it always clear just which females were of breeding age and had been run with the bull during its last stay on the project.¹ Only an approximation of the calving ratio could therefore be calculated: the ratio of the number of births to the number of females of breeding age. The less precise category of 'breeder' - females which should be included in the breeding herd - is therefore the denominator. This calf to 'breeder' ratio reflects not only foetal mortality rates, conception rates and the mating interval, but also the likelihood of a heifer being mated once it attains breeding age. Given the importance of the bull supply constraint on production in the area, this ratio is in fact a useful indicator of technical performance.

In relation to parameters (3) and (4), the age of cows had simply to be guessed in many cases, particularly on the longer-established projects, and no figures relating to growth of stock and feed intake were obtained.

The following parameters are therefore used here to measure technical performance:

- (1) calf/'breeder' ratio (CBR), the ratio of births per period to the number of breeders at the beginning of the period (January 1973 survey data), or as the ratio of births during the year to the number of animals classified as cows and half the number classified as heifers at the beginning of the year (DASF December 1973/January 1974 survey data), that is,

$$CBR = [(M1+F1)_t + C_{m,t/t-1}] / B_{t-1}$$

or

$$CBR = [(M1+F1)_t + C_{m,t/t-1}] / [COWS_{t-1} + 1/2HEIFERS_{t-1}]$$

respectively, where M1, F1 and B are as defined

¹ The 1973-74 DASF patrols reported the same problem.

in Appendix 4.1, C_m is calf mortalities, and the subscript $t/t-1$ denotes the period between time $t-1$ and time t ;

- (2) 'breeder' mortality rate (BMR), the number of unintended breeder deaths (B_m) per breeder per period, that is,

$$BMR = Mb_{t/t-1} / B_{t-1}$$

or

$$BMR = Bm_{t/t-1} / [COWS_{t-1} + 1/2 HEIFERS_{t-1}];$$

- (3) 'non-breeder' mortality rate (NBMR), the number of unintended deaths among calves (C_m), steers and 'non-breeder' heifers (SH_m), per 'non-breeder' (SH) per period, that is,

$$NBMR = (C_m + SH_m)_{t/t-1} / STEERS_{t-1}^1 + 1/2 HEIFERS_{t-1} + 1/2 CALVES_{t-1};$$

- (4) average age at first calving (AFC); and
 (5) average age at turn-off (ATO).

Allowing for the relative crudity of its calculation here, the CBR provides a rough index of:

- (1) the segregation of stock into sex/age groups necessary in a discriminatory breeding program;
- (2) skill in detecting oestrus;
- (3) the availability of suitable bulls for breeding;
- (4) the care and attention given to the health and nutrition of breeders during gestation-parturition.

Thirty-six per cent of breeder deaths in the Kunimaipa-Karuama up to 1973 occurred during calving. It seemed desirable, therefore, to measure the death rates among breeding and non-breeding stock (BMR and NBMR, respectively) separately, as different forms of corrective action might be required (such as improving the general standard of nutrition as opposed to ensuring that immature female stock

¹ Animals classified as steers in the DASF 1973 74 survey.

are not run with the bull).¹ These parameters indicate:

- (1) the care and attention given to stock, the level of nutrition, husbandry skills and veterinary expertise available;
- (2) the standard of breeding management; and
- (3) the possible existence of special environmental factors (such as pasture containing non-available copper).

The AFC reflects:

- (1) the availability of bulls for breeding;
- (2) the extent to which immature females are kept apart from bulls; and
- (3) the length of breeding cycle (calf to calf) preferred by project participants.

The ATO indicates:

- (1) the average rate of liveweight gain among non-breeding stock, which is largely determined by the level of nutrition;
- (2) the capability for deciding when stock are ready for turn-off; and
- (3) the views of project participants regarding the merits of maintaining large numbers of stock on projects as opposed to disposing of large numbers off them.

(Before the slaughterhouse at Tapini was constructed in mid-1973, marketing facilities were also a factor. Slaughterable steers had to be retained on projects until a sufficient number had accumulated to warrant arranging a drive to the coast.)

Table 4.2 shows parameter values for the Kunimaipa-Karuama projects. The 1st, 2nd, 3rd and 6th rows relate to data collected during my January 1973 survey, while the 4th, 5th and 7th rows relate to data collected by the DASF (from the same projects included in the January 1973 survey) during

¹ The correlation between BMR and NBMR in the Kunimaipa is significant at the 10 per cent level ($r = 0.53$, $n = 12$). This implies that factors affecting the health of all stock rather than just breeding stock are mainly responsible for the mortalities.

December 1973 and January 1974. Estimates derived from the earlier survey data thus represent averages for a number of years, while estimates derived from the later survey data represent values for (approximately) one year only.

The aggregate ratios represent births and deaths summed over all the projects surveyed expressed as a proportion of the sum of all animals in the relevant inventories on these projects. The last two rows show (arithmetic) mean values and their standard deviations for samples of projects¹ and are included to give an indication of the degree of dispersion in the data.

The figures in rows 1 and 7 can in some respects be considered the most reliable estimates of technical parameters, since they relate to several years' production experience. These values have been accepted independently by three DASF officers who have worked on cattle in the area as probably correct. Comparison of figures for the years up to 1973 and the beginning of 1974 for both census divisions (rows 3 and 6) suggest some improvement in the CBR might have occurred. (Treatment of herds grazing suspected copper deficient pastures began in earnest in 1973 and the supply of bulls was also increased.) The figures for the Upper Kunimaipa possibly indicate greater improvements in the calving and non-breeder mortality position. If the differences in mortality rates between the Upper Kunimaipa and Karuama shown by the earlier survey are real, they may reflect the fact that the condition of stock on the more recently established projects (Karuama) has had less time in which to deteriorate.

Table 4.3 compares the earlier Upper Kunimaipa parameter values with those which Vudal Agricultural College recommends its students to use when preparing budgets for Papua New Guinea highlands projects² and with values which some DASF officers in the Animal Industry Division would like to see achieved on Goilala projects.³ In addition to the parameters

¹ The sample size for Upper Kunimaipa projects is smaller than that used to estimate aggregate ratios because three projects were excluded from the calculations to allow the parameters to be correlated with each other.

² Personal communication, D.J. Ryan of Vudal Agricultural College.

³ Personal communication, Dr J. Eccles, regional veterinary officer, Port Moresby.

given in Table 4.2, AFC and ATO values are also shown here. For Upper Kunimaipa, the latter represent nothing more than guesses about the situation as it existed in early 1973, based on what information could be obtained regarding the ages of stock, field observation and discussions with DASF and Mission personnel.

In relation to the Vudal figures, which are presumed to reflect field conditions, the Kunimaipa CBR appears 'normal', while the mortality rates seem very high. If the overall figures for Kunimaipa-Karuama projects are accepted, it is clear that considerable improvements in all three parameters will be needed to meet the development agencies' definition of satisfactory technical performance. It is also my feeling that, on technical grounds, there is scope for shortening both the breeding and production cycles.

(b) 'Lower'- and 'higher'-cost improvement in technical performance. Table 4.4 summarizes the important production relations of a cattle project by showing which of the inputs listed in Table 4.1 are particularly likely to improve technical performance (as reflected in the five parameters) when greater amounts of these inputs are used per head of cattle.¹ The purpose of this table is to suggest that measures intended to improve the technical performance of village cattle projects fall into two economic categories of significance for planning: those involving the use of more inputs at a relatively low total cost to both project participants and the development agencies² and those involving the use of more inputs at a relatively high total cost to both groups.

- (1) The 'low cost' improvements. Measures aimed at improving the AFC and ATO are first of all relatively simple to understand and implement and hence do not demand large quantities of the

¹ It should be noted that in the AFC row of Table 4.4 only those inputs which are likely to lower AFC towards the 'recommended' age (when applied in increasing quantities) are shown. Inputs needed to eliminate breeding from immature females are not specified.

² Though costs incurred by the development agencies and non-financial costs in general are not considered in the analysis in this paper, it is nevertheless useful at this stage to categorize improvements in terms of their total cost implications.

Table 4.3

Technical performance 'standards'
for smallholder cattle production

	Upper Kunimaipa projects: from establishment date to January 1973	Vudal Agricultural College farm management data for students' budgeting exercises	DASF (unofficial) 'targets' for Goilala projects
Calving ratio	0.29 - 0.31 (estimated)	0.30 - 0.40 (at first) 0.60 - 0.65 (later)	0.60 - 0.65
Mortality rate	0.12 - 0.15 (estimated)	0.05	0.03 - 0.05
Age at first calving (months)	38 (assumed)	27-1/2	30 (maximum 38)
Age at turn-off (months)	38-1/2 (assumed)	27	27

Table 4.4

The main determinants of the technical parameters of beef production

Parameters	Inputs														
	Initial stock	Space	Labour I	Labour II	Capital Works	Nutrition I	Stockmanship I	Transport I	Bulls	Management	Nutrition II	Stockmanship II	Veterinary	Transport II	Slaughtering, etc.
Calf/'Breeder'				X		X	X		X		X	X	X		
'Breeder' mortality		X	X	X	X	X	X				X	X	X		
'Non-breeder' mortality				X		X	X				X	X	X		
Age at first calving									X	X					
Age at turn-off				X		X				X	X				

X indicates that use of more of the input (column) per head of cattle will result in an improvement in the corresponding parameter (row). (For some inputs, this clearly only applies if the input is added in combination with extra supplies of other inputs such as Labour II and Nutrition II.)

management input (B2 in Table 4.1). It is true that the initial improvement in AFC may be costly to the development agencies if they have to increase the supply of bulls into a cattle-raising area, but once several projects in the same area are in operation it soon becomes a matter of just choosing male calves for rearing as bulls and arranging for the mature animals to be sent to appropriate projects nearby. Cost to project participants is virtually nil (assuming they accept the changes involved as desirable).

Improving the ATO costs them the work involved in planting improved pasture species (though further fencing (inputs A3 and A4) may be needed for rotational grazing in order to speed up the rate of liveweight gain in some cases), while development agencies have only to provide the new plants and instructions for using them. The main factor involved here is education: getting project participants to appreciate the need for turning off stock faster than they do at present and training them to recognize when animals are ready for marketing. The costs of this education would not appear to be heavy: a slightly longer visit by the didiman¹ and the opportunities for greater revenue missed by the project participants while they are still learning about cattle from experience with their own project.

- (2) The 'high cost' improvements. Improving the CBR, BMR and NBMR will almost certainly involve a greater outlay of resources.² Average stock nutrition levels will need to be raised, involving extra work in upgrading and maintaining pastures, and the costs of

¹ Agricultural extension officer.

² However, a biological characteristic of Brahman cattle is that their breeding performance tends to improve after the first year or two, so that part of any increase in the CBR will be 'autonomous'.

purchasing mineral licks.¹ Improved breeding management may also depend on subdividing the grazing area into more paddocks and/or establishing new ones. Closer supervision of projects (more frequent patrols by extension officers), the training of project participants on special cattle management courses and the more intensive application of veterinary services will account for the major portion of extra costs borne by the development agencies.

(c) Relating output to input. At present, we have no information about the nature of the production (response) function which relates the level of technical performance on cattle projects in the Kunimaipa-Karuama to the levels of inputs, particularly those inputs supplied (initially, at least) by the development agencies. We are in the position of only being able to observe a single point on the function. It is therefore not possible to cost changes in technical performance and determine the input levels which would generate the greatest profit in cattle production.

There are, however, other important questions concerning cattle project economics which have not yet been answered. In particular, it is not known what levels of technical performance must be attained before projects become financially viable. The comparison of model budgets which assume different steady-state parameter values will provide misleading answers. In the field situation, changes in technical performance will not be instantaneous but gradual, taking several years to move towards some final level.² The simulation model used here reproduces this type of process, so as to determine the financial prospects of cattle projects which are undergoing continuous change in their average levels of technical performance.

¹ Of the twenty-seven projects in the Upper and Lower Kunimaipa and Karuama census divisions surveyed by the DASF in December 1973/January 1974, only three had used licks since January 1973.

² This will be true for the majority of improvements which depend on increasing use of a combination of inputs. Where only a single input is involved (for example, a copper concentrate injection), the response may be very abrupt.

(d) Projections of parameter change. The analytical problem here is that of specifying parameter time paths which represent feasible future situations, that is, that the projected improvements imply 'realistic' patterns of input use. With virtually no knowledge of the form of the relevant production function this must obviously depend largely on guesswork.

DASF officers consider that the attainment within five or six years of the 'target' figures for the calving ratio and mortality rates given in Table 4.3 is a reasonable objective to aim at. On this basis, four projections of change in the CBR, BMR and NBMR will be initially considered here.

- Path 1: no change in parameter values, using the Upper Kunimaipa January 1973 survey estimates as a guide to base positions.
- Path 2: steady improvement in parameters with 'target' values being reached after ten years.
- Path 3: steady improvement in parameters with 'target' values being reached and maintained after five years.
- Path 4: 'target' parameter values are maintained right from the start.

Paths 1 and 4 will be used to illustrate the financial implications of the extremes of the technical possibilities for cattle production, while paths 2 and 3 are intended to compare the effects on project viability of slower and faster rates of improvement respectively, crudely reflecting situations of lesser and greater input availability.

It is assumed that inputs will be applied at steady rates and that their marginal productivity declines with increased level of use. The form of response function chosen results in half the desired improvement (difference between year 2 and year 7 or 12 values) being achieved by year 4 ('slow' path) or year 3 ('fast' path), half the remaining difference being achieved by year 6 (or year 4), and so on. Values for other years are interpolated between these points. See Fig. 4.3 and Appendix 4.4.¹ The reasons behind the shape of the CBR path are explained below.

¹ The four decimal place 'precision' in Appendix 4.4 has no special significance. It merely reflects the fact that the 'target' calving ratio of 0.65 was interpreted as a desirable birth-survival rate, rather than a CBR.

For changes in ATO and AFC, three possibilities will be considered.

- Path A: no change in parameter values, using the assumptions for the Upper Kunimaipa projects (Table 4.3, column 1) as a guide to base positions.
- Path B: improvement in parameters, so that the AFC is reduced to 32-1/2 months¹ and the ATO to 29-1/2 months within five years.
- Path C: an AFC of 32-1/2 months and an ATO of 29-1/2 months is maintained right from the start.

Time paths for these parameters follow from assumed linear trends in the proportions of the different age groups contributing to breeder inflow and turn-off. This reflects the belief that the improvements involved depend more on changing project participants' attitudes to the manipulation of stock numbers than on using increased quantities of scarce inputs (see Appendix 4.5).

(e) Initial parameter values. Projects are assumed to begin from levels of technical performance estimated or assumed from the January 1973 Upper Kunimaipa survey results in the case of parameters BMR, NBMR, AFC and ATO. For the CBR, however, the position is different. It is the aim of the DASF and Development Bank to start projects off in the Goilala with in-calf heifers and it is common for the initial stock to come in batches. It is therefore assumed in the model that six in-calf heifers arrive on the new project in year 0, followed by another six in year 1. An overall calf birth-survival : cow ratio of 65 per cent is assumed for these animals and their offspring. This is equivalent to a calving percentage of 69 per cent (assuming a calf mortality rate of 12 per cent) which seems a reasonable performance to expect from heifers bulled before delivery to projects.

(ii) Management strategies

(a) The options available. The main considerations relevant to planning a long-term strategy for cattle project

¹ These somewhat curious-looking figures follow from the assumptions made about the proportions of heifers-in-calf and slaughtered fatstock that come from the various age groups.

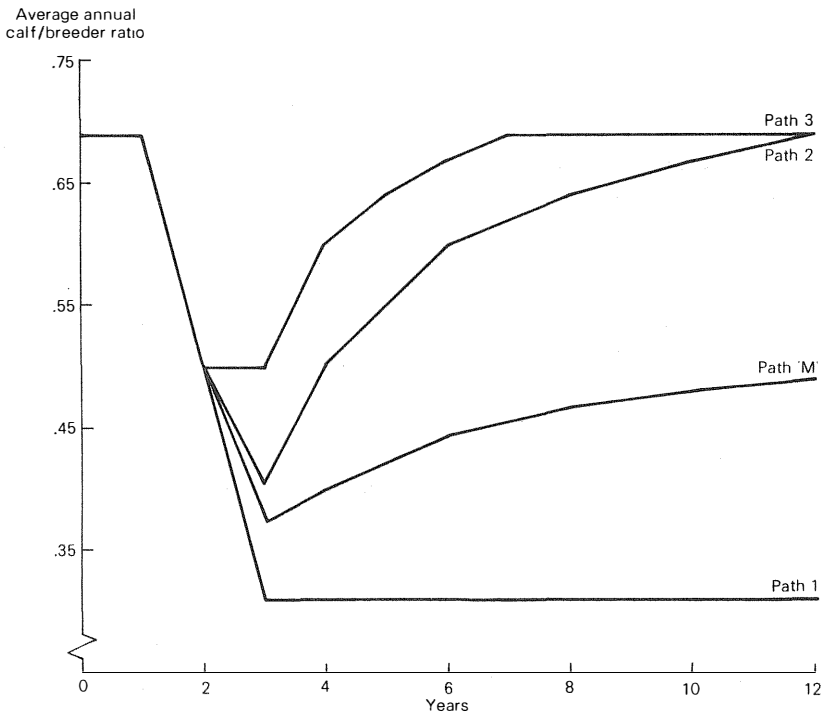
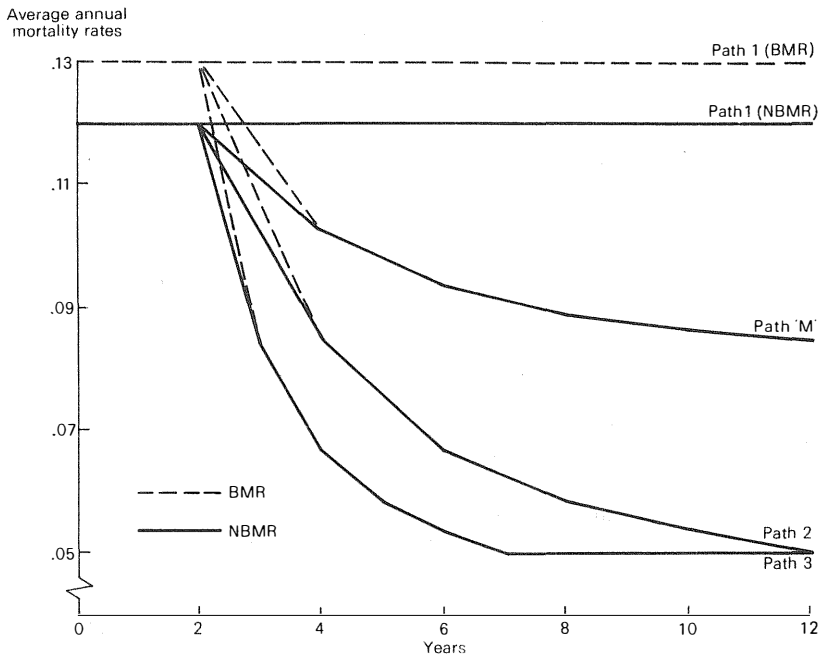


Fig. 4.3. Time paths of technical performance parameters.

development are:

- (1) whether expansion of the breeding herd should continue for a long period or whether it should be stabilized after a short period; this is a question of short-run versus long-run gains: stabilization at a lower herd size will release more heifers for fattening at an earlier date, but the level of turn-off will be higher for the herd stabilized at a later date;
- (2) whether fattening for beef or rearing as stores and potential breeders should be the objective; again, selling off yearlings will bring revenue to the project earlier but at a lower rate per head than would be obtained by turning off fatstock;
- (3) what the breeder culling rate should be; if cow beef prices are high relative to breeding heifer prices, it may pay to cull more heavily;
- (4) whether growth of the breeding herd should be achieved through self-expansion or whether extra breeders (over and above the initial project-establishing inventory) should be brought in from outside the projects.

The size of stabilized herd to aim at will depend on the availability of land, labour and capital for the construction of new paddocks. Generally, there is no shortage of land technically suitable for cattle grazing (ignoring the mineral availability problem) in the Kunimaipa-Karuama area. Agreement among project participants in each village about what land should be used for the original paddocks was reached without much difficulty in most cases. The January 1973 survey showed that project participants in only eleven out of twenty-five¹ villages considered that the presence of a cattle project would mean they would have to extend the area normally cultivated during the subsistence gardening cycle. Labour and contributions of cash are likely to be contributed by project participants if the cattle herd is clearly expanding. Participants on the majority of projects surveyed said they wanted to expand the herd when they had

¹ Replies to this question about garden and project land were ambiguous in two cases.

enough money. (Too much weight should not be given to this response, however, because the villagers may have been influenced in their answers by the presence of the two DASF officers, not to mention myself as some sort of 'expert/investigator' from outside the area.) Also, if cattle numbers are increasing, the Development Bank would in most cases have little hesitation in arranging a new loan for further investment, provided that the original loan has been (substantially) repaid.

At present the inaccessibility of projects in the Kunimaipa-Karuama rules out a general strategy of rearing stock for sale as yearling stores and breeders. However, improvement in communications and the development of cattle raising in new adjacent areas may make such a strategy worthwhile in the future, and so it will be considered in the analysis here.

A lower limit to the culling rate will be determined by genetic and environmental factors, but apart from this culling is largely a matter of economic strategy.

A considerable 'artificial' expansion of the breeding herd through further buying-in of heifers would probably mean direct financing by project participants, since in a situation where the existing herd has not grown, the Development Bank is unlikely to consider the financial prospects of the project to be very promising. On the majority of projects, the general opinion of participants was that they would spend cash to buy more cattle (not just replacements), but the qualification on the usefulness of this answer noted above applies again here.

(b) Expansion/stabilization strategies. The following situations are analysed:

- (1) where the breeding herd on a project does not grow appreciably above its initial establishment size (twelve breeders), no further investment in paddocks will be needed;
- (2) where the breeding herd does grow appreciably, stabilization will be considered at two alternative levels, namely at approximately fifteen and twenty breeders. Both these strategies will mean investment in new paddocks.

(c) Assumptions about investment for project expansion.

Investment here relates to capital expenditure on equipment, not stock.

- (1) Once the management policy has been decided on (for example, beef fattening from a twenty-breeder herd or store/breeder rearing from a fifteen-breeder herd), future grazing requirements can be predicted perfectly. Thus it is assumed that the level of investment which is made will be just sufficient for the projected state of the enterprise at the end of the planning horizon.
- (2) No new investment is considered necessary during the first five years of the project's life. This assumes that the original paddocks were made large enough to accommodate projected herd expansion.¹
- (3) Nutrient supplies per unit area of pasture remain unchanged. This is to preserve a constant relationship between pasture nutrient requirement and pasture area.
- (4) Both the original and new paddocks have square boundaries.
- (5) The area of the original paddock is twenty hectares.²
- (6) When the new paddock is to be larger than the original, then at least one internal fence will be used to divide the new paddock in two, this fence running parallel to a boundary fence.

Given these assumptions and the projected demand for pasture nutrients in terms of the number of steer equivalents on the project, the cost of the investment in new paddock fencing can be calculated. Details are given in Appendix 4.6. It should be noted that these costs relate to base period prices.

¹ Clearly this implies projections of nutrition levels over the first five years also.

² This is based on DASF officers' estimates of the average size of twelve-breeder project paddocks in the area and the fact that such projects used on average eighteen rolls of barbed wire during construction.

(d) The timing of new investment. This is clearly a critical question - a year or two's difference in the timing of expenditure on new paddocks may result in quite different cash flow patterns for any one type of project. The main considerations involved are the build-up of grazing pressure on existing pasture and the capacity to finance the new investment. Two decision criteria have been adopted in the project models used in this study:

- (1) when the investment is to be financed directly by project participants themselves, the expenditure will be made when the first positive net cash flow appears, or when apparent overstocking in the original paddock to the extent of 20 per cent excess steer equivalents is reached, whichever occurs earlier;
- (2) when the investment is to be financed by a Development Bank loan, the physical capital input will be made when apparent overstocking to the extent of 10 per cent excess steer equivalents is reached.

The grazing pressure on a project in its fifth year is thus assumed to be the maximum level consistent with maintaining adequate nutrition supplies, so that above this level the condition and performance of stock would deteriorate.

These decision criteria are clearly rather arbitrary. They are simply intended to reflect the fact that when expenditure has to be made by project participants out of their own cash reserves, then they will seek to delay this expenditure if the cattle enterprise is still showing negative net returns. Grazing pressure inside the original paddock can be relieved temporarily by out-grazing and supplementary feeding. The January 1973 survey showed that on all projects cattle were hand-fed with vegetables (and occasionally grass) and that sixteen out of the twenty-seven projects practised outgrazing (twelve out of fifteen on the grassy slopes of the Upper Kunimaipa Valley and only four out of twelve in the thickly wooded Karuama). The second investment decision rule assumes that the need to delay construction of new paddocks due to cash shortage will be less compelling if the money required can be borrowed.

(e) Fattening versus breeding. A possible choice is envisaged here for the future (when communications improve) between rearing and fattening cattle to an eventual turn-off for slaughter at 2-1/2-3-1/4 years and rearing cattle for turn-off as stores and potential breeders at one year of age. Projects which adopt the latter strategy are therefore assumed to have no inventories of steers and heifers over one year old, except for those heifers which have been retained as potential breeders for the project's own herd. Grazing requirements at a given size of breeder inventory will thus be less for store/breeder-rearing projects than for the fattening projects and hence involve less investment in new paddocks.

(f) Expansion through purchase of more stock. Poor communication between the Kunimaipa-Karuama and the lowlands at present also prevents the importing of stores into the area for fattening on projects. For many other parts of the country, fattening of bought-in stock is an effective way of reducing financial stress on a smallholder project in its early years of operation when breeding capacity is still being expanded. This is not yet feasible for the Kunimaipa-Karuama projects, though the Mission does supply a few steers from its stations at Kamulai and Guarimaipa for fattening on village projects. However, the position may change in the future when the road to Tapini is opened.

(iii) Prices and credit arrangements

(a) Initial assumptions. Prices for inputs and outputs (including the rate of interest on Development Bank loans), which are assumed in the first instance here to remain constant throughout the life of the project, reflect conditions in the period 1970-72 when most of the fully loan-financed projects in the Karuama villages were established.¹ These assumptions are set out in Tables 4.5 and 4.6. The variable costs shown are based on average expenditures on veterinary supplies and mineral licks estimated from the January 1973 survey (viz. \$1 per head per annum for all types of stock for veterinary aids; 50¢ per breeder and 38¢ per non-breeder per annum for mineral licks). The price per

¹ The results in this paper will therefore remain applicable to future conditions only if the rates of inflation in prices for the main inputs and outputs of cattle projects are approximately the same after this date.

Table 4.5

Basic assumptions 1: prices considered as constant
throughout project life

Inputs

1. Heifers for project establishment (potential breeders)	\$100.00 per head
2. Freight charge for delivery of heifers from Port Moresby*	\$ 10.00 per head
3. Sundry costs incurred through holding stock at Bereina for treatment against tick	\$ 2.55 per head
4. Barbed wire	\$ 12.00 per roll
5. Variable costs per annum	\$ 1.50 per breeder \$ 1.38 per non-breeder
6. Slaughtering levy (Tapini)	\$ 8.00 per head
7. Capital loan: interest per annum on reducing balance	6%

Outputs

1. Price for dressed carcass: steers (and fat heifers)	\$.71 per kg
2. Price for dressed carcass: cull cows	\$.55 per kg
3. Price received from local sale of animals which have died on project	\$ 15.00 per head
4. Price for yearling steers	\$ 85.00 per head

* It is current policy to equalize transport charges for stock movement within Papua, so this is a standard charge.

Table 4.6

Basic assumptions 1: 'salvage' values of assets
at the end of project life

1. Breeders	\$ 80.00 per head
2. Calves (0 < 1 year old)	\$ 40.00 per head
3. Heifers (1 < 2 years old)	\$ 95.00 per head
4. Steers (1 < 2 years old)	\$ 85.00 per head
5. Steers and heifers (2+ years old)	\$120.00 per head
6. Fencing, yards, improved pasture	none

head received for local sale of prematurely deceased cattle was also estimated from information about such sales obtained during the survey.

Table 4.7 shows the cash expenditure by project participants over thirteen years, the bulk comprising repayment (at interest) of a Development Bank loan of \$1,390 made in year 0. Since the main outflows, including new investment in paddock expansion, occur within the first seven or eight years of the project's life, and the time shape of expenditure is basically similar for the variations in project performance which are simulated, it is considered that thirteen years is a sufficient period over which to evaluate the project. Extending this period would simply change the absolute values of the quantitative appraisal criteria but would not alter the relative positions of project simulations ranked by these.

Table 4.8 shows the breakdown in project financing between villagers' and Development Bank purchases, and also the extent of subsidy of village projects by the Mission. The figures relating to the latter should be regarded as indices of the order of magnitude of Mission support rather than as precise estimates of it.

(b) Subsequent variations. The first part of the analysis is concerned with the effect of different rates of change in technical performance and different management strategies on the financial performance of village cattle projects. Future project performance is simulated assuming that constant price and credit conditions (shown in Tables 4.5 to 4.7) prevail. For the second stage of the analysis, this

Table 4.7

Basic assumptions 2: the capital expenditure pattern (fixed costs)
for a project established with 12 breeders

Year of project life	Total transport charges for estab- lishment stock (\$)	Other costs (\$)	Loan repayment (\$)	Total (rounded to nearest \$)
0	75.30	5.56	-	81
1	75.30	-	50.00	125
2	-	-	50.00	50
3	-	-	50.00	50
4	-	-	260.00	260
5	-	15.00*	400.00	415
6	-	15.00	400.00	415
7	-	15.00	706.00	721
8	-	15.00	-	15
9	-	15.00	-	15
10	-	15.00	-	15
11	-	15.00	-	15
12	-	15.00	-	15
 <u>plus -</u>				
year 1**	-	paddock area expansion costs***	-	paddock area expan- sion costs + 'other costs' where applicable

* assumed cost per annum of repairs to fencing.

** for criteria determining the timing of new investment see p.184.

*** at \$120 per kilometre of extra external fencing and \$90 per kilometre of extra internal fencing (see Appendix 4.6).

Table 4.8

Basic assumptions 3: sources of finance for cashable inputs into a
project established with 12 breeders

	I n p u t s p u r c h a s e d b y	
Loan from Development Bank to project participants	Project participants directly	Mission and given free of charge to project participants
12 in-calf heifers @ \$100 per head Total \$1,200	Transport and quarantine of in-calf heifers @ \$12.55 per head Total \$150.60 (years 0 and 1)	3 rolls of barbed wire @ \$12 per roll Total \$36.00 (year 0)
15 rolls of barbed wire @ \$12 per roll Total \$180	Tools, fencing materials other than wire, mineral licks Total \$5.56 (year 0)	Tools, fencing material other than wire, mineral licks Total \$12.00 (years 1-4)
1 consignment of seed of superior pasture species Total \$10	Materials for repairing fences, extra seed and mineral licks Total \$15.00 (years 5-12)	
	Veterinary expenses per breeder \$1.50p.a. per non-breeder \$1.38p.a. (years 0-12)	
Total value of loan \$1,390		
[repayed @ 6% p.a. over years 1-7]	Materials for paddock expansion (year 1)	

assumption is relaxed and the sensitivity of the earlier results to variations in price levels and credit arrangements is examined.

Initial conditions. For nearly all the simulated variations in future project performance, the history for the first three years is assumed to be the same, viz:

- Year 0 paddock area cleared, fences and yards constructed, first six in-calf heifers arrive.
- Year 1 first calves born (at a calf/breeder ratio of 0.69), second six in-calf heifers arrive.
Breeder mortality = 13 per cent
Non-breeder mortality = 12 per cent
- Year 2 second batch of calves dropped by heifers which arrived in year 0 (at a calf/breeder ratio of 0.31), first calves of heifers which arrived in Year 1 are born (at a calf/breeder ratio of 0.69) giving an overall calf/breeder ratio of 0.50.
Breeder mortality = 13 per cent
Non-breeder mortality = 12 per cent
- Years 3-12 what happens now depends on the particular conditions simulated. (See section on projections of parameter change and Appendix 5.4).

It should be noted that the breeder culling rate (planned leakage from the breeder inventory) does not vary with the breeder mortality rate (unplanned leakage). Hence the equilibrium culling rate of 10 per cent, reached in year 9, implies an expected breeder herd life (in equilibrium) of just under 4-1/2 when mortality rates are at their assumed maximum (13 per cent) and of just under 6-3/4 years when mortality rates are at their minimum (5 per cent).

Table 4.9 summarizes the initial conditions for project simulations and values for other technical parameters which are fixed for all years of a project's life.

Quantitative results from the simulation model

Note on presentation of results. The financial history of each simulated project will be summarized by the three measures noted earlier, viz:

Table 4.9

Basic assumptions 4: model parameters

Parameter	Value		
1. Dressed carcass weight of fat steers and heifers	220 kg	1-12	
2. Dressed carcass weight of cull cows	227 kg	1-12	
3. Non-breeder mortality rate (NBMR: parameter b_1 in Appendix 4.1)	0.12	1,2, then varies	
4. Breeder mortality rate (BMR: b_4)	0.13	1,2, then varies	
5. Calf/breeder ratio (CBR: b_6)	0.69	1	
	0.50	2, then varies	
6. Breeder culling rate (b_5)	0.000	1-6	
	0.050	7	
	0.075	8	
	0.100	9-12	
7. Proportion of age group in year t_{-1} used for breeding in year t			
	female calves, < 1 yr (b_2)	0.25)	
	heifers, 1 < 2 yrs (b_3)	0.66)	1,2, then varies
	heifers, 2+ yrs	1.00)	
8. Proportion of age group in year t_{-1} slaughtered for beef in year t			
	non-breeding stock, 1 < 2 yrs (b_7)	0.5)	
	non-breeding stock, 2 < 3 yrs (b_8)	0.5)	1,2, then varies
	non-breeding stock, 3+ yrs	1.0)	
9. Weights for apportioning variable costs:			
	calves (b_9)	0.16)	
	non-breeding stock, 1 < 2 yrs (b_{10})	0.40)	1-12
	non-breeding stock, 2+ yrs (b_{11})	0.44)	

(i) the net present value (NPV) of cash flows from the project (thirteen years at a discount rate of 8 per cent);

(ii) the internal rate of return on project participants' capital (IRR) implied by these cash flows;¹

(iii) the number of years during which project participants are in overall debt to external agencies - in this case the Development Bank - and net cash flows to project participants are negative, despite the bringing forward of the accumulated net cash flows of earlier years, denoted by PEI.

Space does not allow revenue profiles to be shown for each simulation, but selected examples of project net income streams, before and after loan repayment, are illustrated in Appendix 5.7.

A yardstick for comparison: the static project.

Assuming:

(i) that the price and credit conditions shown in Tables 4.5 to 4.8 do not change; and

(ii) that the level of technical performance shown below,

CBR = 0.31	AFC = 38 months
BMR = 0.13	ATO = 38-1/2 months
NBMR = 0.12	(CULLING RATE = 0.10 at equilibrium)

which is considered to correspond to that of Upper Kunimaipa projects up to 1973, does not change, then the thirteen-year financial prospects for a project in this situation can be summarized as follows:

<u>NPV</u>	-\$204	<u>IRR</u>	1%	<u>PEI</u>	5 years
------------	--------	------------	----	------------	---------

Thus if projects continued to operate in the future at the same level of technical performance as in the recent past, and under the same credit arrangements, it is clear that they will not be financially attractive propositions from the project participants' point of view. The figures above show that the projects would only just repay the initial outlay of participants' funds and require several years of subsidizing from other activities. One response in this

¹ The IRR is computed by linear interpolation, with a maximum permitted interpolation interval between discount rates of 5 per cent.

situation might be to deliberately run down the herd by culling breeders more heavily. Table 4.10 shows the effect on project performance of culling at an equilibrium rate of 16 per cent instead of 10 per cent, with no change in other conditions. It is appropriate in this case to include the asset value of livestock inventories in the revenue streams of the last year.¹ Though there is little to be gained by a policy of heavy culling, such a strategy of 'salvage' at least allows a modestly attractive return on capital to be earned by the project participants.

Effect of improved technical performance

(i) 'Low-cost' improvements. It can be seen from Table 4.11 that a reduction in the average age at turn-off for fat steers and heifers (ATO) from 38-1/2 to 29-1/2 months, and in the average age at first calving (AFC) from 38 months to 32-1/2 months during years 3-7, is sufficient by itself to generate a moderate rate of return on capital.² An extension program aimed at persuading project participants to at least turn off earlier would seem to be worthwhile. Earlier calving depends partly on the availability of bulls and may not be as easy to achieve. Both types of improvement may be needed to make projects with no other forms of improvement in technical performance attractive at the assumed opportunity cost of participants' capital investment (8 per cent annual interest).

(ii) 'High-cost' improvements. Table 4.12 shows that substantial improvements in the financial performance of projects will result from the calf/breeder ratio increasing over time in the manner specified. The non-linear form of these parameter time paths means that the biggest improvements occur earliest, so that a halving of the time taken to reach the CBR ceiling (69 per cent) results in a less than doubling of the net present value of the project.

¹ For reasons explained later, net residual assets will not normally be included here in the calculations of a project's financial performance.

² It should be stressed that this is a hypothetical illustration of the gains which could accrue from a lowering of the ATO and AFC. As mentioned earlier, the existing values of these parameters are hard to estimate reliably.

Table 4.10

Effect of heavy culling, other parameters
remaining unchanged at year 2 values

Culling rate (at equilibrium)	Year of 1st culling	Steer equivalent*		% Turn-off**		NPV (\$)	IRR (%)	PEI (yrs)
		yr 9	yr 12	yr 9	yr 12			
0.10	7	14.6	11.4	14.7	15.4	112	11	5
0.16	6	12.1	7.7	20.0	20.9	147	12	5

* See Appendix 4.6 for details.

** Steers, heifers and cull cows turned-off as a proportion of total stock number numbers.

Table 4.11

Effect of 'low cost' improvements (reducing average age at
turn-off and calving), other parameters remaining
unchanged at year 2

ATO (yr 7: months)	AFC (yr 7: months)	Steer equivalents (yr 7)	% turn-off (yr 7)	NPV (\$)	IRR (%)	PEI (yrs)
38.5	38	17.3	10.3	-204	1	5
29.5	38	16.3	12.4	-60	6	5
38.5	32.5	17.9	10.5	-140	4	5
29.5	32.5	17.0	12.7	47	10	5

Table 4.12

Effect of improving the calf/breeder ratio,
other parameters remaining unchanged at year 2 values

Rate of change in CBR		Steer equivalents (year 12)	% turn-off (year 12)	NPV (\$)	IRR (%)	PEI (yrs)
<u>zero:</u>	Path 1*	11.4	15.4	-204	1	5
<u>slow:</u> (0.31 to 0.69 over years 3-12)	Path 2	27.0	14.0	458	19	5
<u>fast:</u> (0.31 to 0.69 over years 3-7)	Path 3	30.7	14.1	706	23	5

* See pp. 178-9, Fig. 4.3 and Appendix 4.4 for details.

Table 4.13 shows the financial outcomes which could be expected from reductions in both breeder and non-breeder mortality rates without any improvement in the calving situation. The slower path of reduction in mortality rates gives an improvement in the level of technical performance which is just sufficient to make the project financially attractive, if the external indebtedness problem is ignored. Gains from reducing mortality rates are not as spectacular as the potential rewards of improving calving performance above present levels.

Table 4.13

Effect of improving the mortality rates, other parameters
remaining unchanged at year 2 value

Rates of change in BMR and NBMR		Steer equivalents (year 12)	% turn-off (year 12)	NPV (\$)	IRR (%)	PEI (yrs)
<u>zero:</u>	Path 1	11.4	15.4	-204	1	5
<u>slow:</u>	Path 2	20.6	14.2	34	9	5
(BMR 0.13 to 0.05 NBMR 0.12 to 0.05 over years 3-12)						
<u>fast:</u>	Path 3	22.8	14.3	132	11	5
(BMR 0.13 to 0.05 NBMR 0.12 to 0.05 over years 3-7)						

If the calving and mortality figures can be improved simultaneously, then the financial prospects begin to look good, as indicated in Table 4.14.

Table 4.14

Effect of improving the calf/breeder ratio
and mortality rates simultaneously, other
parameters remaining unchanged at year 2 values

Rates of change in CBR, BMR and NBMR		Steer equivalents (year 12)	% turn-off (year 12)	NPV (\$)	IRR (%)	PEI (yrs)
<u>zero:</u>	Path 1	11.4	15.4	-204	1	5
<u>slow:</u>	Path 2	48.4	13.2	774	23	5
<u>fast:</u>	Path 3	60.4	13.3	1329	29	5

(iii) 'Low-cost' and 'high-cost' improvements combined. Table 4.15 illustrates the order of magnitude of improvement in financial returns to project participants which would occur if reduction in the length of breeding and production cycles were introduced at the same time that calving and mortality rates were being improved. It can be seen that a lowering of the average age at turn-off for steers and heifers (ATO) would have a particularly beneficial effect in conjunction with the 'high-cost' improvements, reducing the number of years in which the project must be subsidized as well as yielding an attractive net income stream.

Table 4.15

Effect of introducing 'low-cost' and 'high-cost'
improvements simultaneously, other parameters
remaining unchanged at year 2 values

'Low-cost' improvements	'High-cost' improvements								
	None			Slow change in CBR, BMR & NEMR			Fast change in CBR, BMR & NEMR		
None	-204	1	5	774	23	5	1,329	29	5
ATO reduced	-60	6	5	1,222	30	4			
AFC reduced	-140	4	5	1,111	26	5			
Both ATO and AFC reduced	47	10	5	1,550	33	4			

Effect of management strategy

(i) Level at which breeder herd is stabilized. A policy of stabilizing the breeding herd after sufficient numbers have built up and switching heifers surplus to replacement requirements into beef fattening is preferable to sustaining expansion of the breeding herd at the highest possible rate. This is shown in Table 4.16. However, with regard to the net present values and internal rates of return which are compared, it is important to note that it is assumed that on all projects any further investment in new fencing which is required takes the form of a single cash outlay in one year only. Projects following a continuous expansion strategy in practice would probably construct the total extra fencing required by year thirteen over a number of years and not all at once. Hence continuous expansion may be presented in a rather more unfavourable light in Table 4.16 than is warranted. (The sensitivity of the ranking of projects implied by Table 4.16 to assumptions about the timing of new investment expenditure will be examined on pp. 203 and 205.)

Table 4.16

Stabilization of breeding herd compared with continued expansionA. Technical performance assumptions

CBR: 0.31 to 0.69 over years 3-12
 BMR: 0.13 to 0.05 over years 3-12
 NBMR: 0.12 to 0.05 over years 3-12
 other parameters remain unchanged at year 2 values

Number of breeders		Steer equivalents (year 12)	% turn-off (year 12)	New investment in year 8 (\$)	Average annual net revenue yrs 7-12 (\$)	NPV (\$)	IRR (%)	PEI (yrs)
yr 8	yr 12							
16	22	48.4	13.2	230	499	774	23	5
16*	16	39.1	19.8	145	648	1,228	29	5

* breeder numbers stabilized in year 8

B. Technical performance assumptions

CBR)
 BMR) as for A above
 NBMR)

ATO: 38.5 to 29.5 months over years 3-7
 AFC: 38.0 to 32.5 months over years 3-7
 other parameters remain unchanged at year 2 values

(yr 6)								
15	29	52.7	16.1	258	727	1,150	34	4
15**	15	31.7	25.3	114	858	2,039	40	4
(yr 9)								
21***	21	42.8	25.3	164	857	1,932	37	4

** breeder numbers stabilized in year 6

*** breeder numbers stabilized in year 9

C. Technical performance assumptions

CBR: 0.31 to 0.69 over years 3-7
 BMR: 0.13 to 0.05 over years 3-7
 NBMR: 0.12 to 0.05 over years 3-7
 other parameters remain unchanged at year 2 levels

(yr 6)				(yr 5)				
15	27	60.4	13.3	289	692	1,329	29	5
15#	15	38.8	20.8	144	873	1,965	36	5
(yr 9)								
21##	21	51.4	19.4	246	826	1,699	32	5

breeder numbers stabilized in year 6

breeder numbers stabilized in year 9

The advantage of stabilization in terms of increased rate of turn-off is clearly demonstrated in Table 4.16. This is particularly evident when the average age of turn-off and calving is being reduced simultaneously with improvement in the calving and mortality rates (example B, Table 4.16). Subject to the qualification concerning investment timing mentioned above, it could be said that there is little to choose between stabilizing at 15-16¹ breeders or at 20-21. Difference in financial results between the two sizes of breeders-stabilized projects are much smaller than between these and the breeders-expanded projects.

(ii) Turning off fatstock or turning off stores and breeders. If all steers and those heifers which are not needed for the breeding herd could be turned off projects in their second year of life and sold as stores and potential breeders, revenue would be coming into the project in year 2. Projects which follow a policy of turning steers and heifers off fat would not get any revenue until year 3 and the size of these gross income streams increases more slowly at first than those generated by store and breeder sales. With the type of loan repayment schedule shown in Table 4.7, this means that selling cattle as yearling stores and potential breeders becomes more attractive, compared with the alternative of selling cattle off fat, as the project participants' rate of time preference increases. This is shown in Table 4.17. Large positive net cash flows generated early on by the store/breeder-rearing projects greatly reduce the extent of subsidy needed. This is shown by comparisons of average annual net income streams in the first half of the project's life and the number of years of external indebtedness (columns 6 and 11). The income streams eventually generated by the fattening projects in the latter half of their lives, however, are larger in most cases than for the store/breeder-rearing projects (column 7). This is also suggested by the switch-over in ranking by the net present value criterion which occurs in two cases when discount rates are changed (columns 8 and 9).

The very high internal rates of return shown by the store/breeder-rearing project also reflect the large positive net cash flows generated by these projects in years 2 and 3 when bank repayment demands are low. It

¹ The breeder inventories in Table 4.16 are rounded off to the nearest whole number.

Table 4.17

Fattening cattle for slaughter compared with rearing cattle for sale as stores and breeders

Turning steers & heifers off as		Rate of improvement in		Steer equivalents (year 12)	Average annual net revenue (\$)		NPV at discount rate of		IRR (%)	PEI (yrs)
Fatstock	Stores & breeders	CBR	BMR & NBMR		Yrs 1-6	Yrs 7-12	4%	8%		
✓	-	slow	zero	20.6	-105	333	843	458	19	5
-	✓	slow	zero	18.4	18	338	1,364	922	46	2
✓	-	zero	slow	27.0	-123	201	241	34	9	5
-	✓	zero	slow	22.2	-33	107	170	60	12	3
✓	-	slow	slow	39.1	-97	648	2,001	1,228	28	5
-	✓	slow	slow	30.7*	-3	556	2,185	1,474	50+	2
✓	-	fast	fast	38.8	-81	872	3,024	1,965	36	5
-	✓	fast	fast	30.3**	20	689	2,843	1,974	50+	1

* Breeder numbers stabilized at 16

** Breeder numbers stabilized at 15

should be borne in mind, however, that the loan repayment schedule shown in Table 4.7 was devised by the Development Bank on the assumption that the project involved would be fattening cattle for slaughter. It is possible that a different schedule would have been drawn up for project participants who intend to sell cattle off as yearlings.

(iii) The rate of culling from the breeding herd.

Project performance was simulated under two different breeder culling regimes (parameter b_5 in Appendix 4.1). These are shown in Table 4.18.

Table 4.19 shows the implications of these culling rates for the average herd life of the initial batch of breeders when average mortality rates are changing.

Table 4.18
Assumed breeder culling rates

	Year												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Rate of culling													
'normal'	0	0	0	0	0	0	0	0.05	0.075	0.10	0.10	0.10	0.10
'heavy'	0	0	0	0	0	0.05	0.05	0.10	0.16	0.16	0.16	0.16	0.16

Table 4.19
Average length of life (years) on project of breeders
which arrived in year 0

Rate of improvement in breeder mortality			
	Zero	Slow	Fast
	(0.13 in all years)	(0.13 to 0.05 over years 3-12)	(0.13 to 0.05 over years 3-7)
Culling rate	4.7	5.3	5.4
	'normal'		
	4.3	4.7	4.9
	'heavy'		

Table 4.20

Average life expectancy (years) for heifers
entering the breeding herd in year 12

		Breeder mortality rates (yrs 3-12)	
		Not improved	Improved
Culling rate	'normal'	4.3	6.7
	'heavy'	3.5	4.8

It can be seen from Table 4.20 that a 'target' breeder mortality rate of 5 per cent per annum means an average herd life of just under seven years when the culling rate is 10 per cent per annum. At the other extreme, if there were no improvement in the mortality figures from the present position and a 'heavy' culling policy was adopted, then the average breeder herd life would only be about 3-1/2 years.

As suggested by the results shown in Table 4.10, a practice of culling breeders heavily on projects where the level of technical performance is low or improving only slowly would improve the financial performance. This can be seen by comparing rows 1 and 3 with rows 2 and 4 respectively in Table 4.21. The effect of the extra revenue realized by selling a greater number of cull cows more than offsets, during a project life of thirteen years, the foregone income from fat steer sales. When both calving and mortality rates are improving simultaneously, however, Table 4.21 shows that it is probably better to build up breeder numbers as fast as possible and then stabilize them for the remaining years of the project rather than restrict breeder herd growth by heavy culling.

(iv) The timing of new investment expenditure. It would seem unlikely, particularly when projects are expanding rapidly, that expenditure on extra paddocks sufficient to meet anticipated grazing requirements in the thirteenth year of a project's life will be made all at once. Rather, the new grazing area would be added to the original paddock in stages. Hence the assumption that extra paddocks are financed by a single cash outflow will now be relaxed and

Table 4.21

Effect of the breeder culling rate

Rate of improvement in		Culling rate		Overall breeder leakage rate		Steer equivalents		No. of breeders		% turn-off (year 12)	NPV (\$)	IRR (%)	PEI (yrs)
CBR	BMR & NBMR	Yr 6	Yr 12	Yr 6	Yr 12	Yr 6	Yr 12	Yr 6	Yr 12				
slow	zero	0	0.10	0.13	0.23	23.3	27.0	11	12	14.0	458	19	5
slow	zero	0.05	0.16	0.18	0.29	22.6	20.5	11	9	17.6	642	23	5
zero	slow	0	0.10	0.07	0.15	21.5	20.6	12	11	14.2	34	9	5
zero	slow	0.05	0.16	0.12	0.21	20.7	14.8	12	8	19.3	209	14	5
slow	slow	0	0.10	0.07	0.15	27.3	39.1	14	16*	19.8	1,228	28	5
slow	slow	0.05	0.16	0.12	0.21	26.6	37.0	13	16	16.6	1,093	28	5
fast	fast	0	0.10	0.05	0.15	32.5	51.4	15	21**	19.4	1,699	32	5
fast	fast	0.05	0.16	0.10	0.21	31.8	46.9	15	20	16.7	1,611	33	4

* Stabilized at 16 breeders in year 8

** Stabilized at 21 breeders in year 9

the effect on financial performance of allowing expenditure to be made in two stages will be examined.

It is assumed now that the first stage of investment, sufficient to meet half the total extra grazing area needed by year twelve will occur when apparent overstocking to the extent of 20 per cent excess steer equivalents is reached (or 10 per cent, if the new investment is being financed by a Development Bank loan).

The second stage of investment will occur when overstocking by 20 per cent (10 per cent) of the new total grazing area is reached and a sum equal to that made in the first stage will be spent in order to meet total grazing requirements in year twelve.

Since two smaller separate paddock areas are now being added on to the original, it means that the total outlay of cash will be greater than in the case of a single larger extra paddock area, divided by internal fencing, being constructed to meet future requirements at one go.

As it turns out, there is virtually no difference between the financial performances of projects where investment in new paddocks is made in a single outlay and those where it is split into two stages. This is illustrated by two examples in Table 4.22. Given that cash is generally in short supply, however, it is to be expected that the latter strategy might appear more attractive to project participants.

(v) The financing of new investment by further loan. Table 4.23 shows that repayment schedule assumed to apply to a second loan for financing expansion of the paddock area. The rate of interest charged is the same as for the original loan, that is, 6 per cent per annum. Whether the second investment is financed by a loan in this manner or directly out of project participants' own cash reserves in fact makes virtually no difference to the financial performance of projects. This is shown in Table 4.24.

Table 4.22
Effect of the timing of further investment

Rate of improvement in	Breeder culling rate	Level at which breeder herd stabilized	Investment in extra paddock area (\$)		NPV (\$)	IRR (%)	PEI (yrs)
			Stage 1	Stage 2			
slow	'normal'	-	90 (yr 8)	-	458	19	5
slow	'normal'	-	64 (yr 8)	64 (yr 12)	446	19	5
slow	'normal'	16 (yr 8)	145 (yr 6)	-	1,228	28	5
slow	'normal'	16 (yr 8)	103 (yr 6)	103 (yr 10)	1,221	28	5

Table 4.23

Repayment schedule for second loan
(loan made in year k)

Year	k	k+1	k+2	k+3	k+4
Proportion of total debt outstanding which is repaid	0	0.25	0.25	0.5	balance

Table 4.24

Comparison of direct and loan financing of investment expenditure for paddock area expansion

Rate of improvement in CBR	No. of breeders (yr 12)	Breeder culling rate	Second investment \$	NPV (\$)	IRR (%)	PEI (yrs)
slow	12	'normal'	90	458	19	5
slow	12	'normal'	90	454	19	5
slow	22	'normal'	230	774	23	5
slow	22	'normal'	230	771	23	5
fast	27	'normal'	289	1,329	29	5
fast	27	'normal'	289	1,323	29	5

D = direct L = loan

Effect of credit arrangements. The results so far have shown that, over a wide range of production conditions and management strategies, the loan repayment schedule of Table 4.7 means that a beef-fattening project must be paid for out of participants' other cash-earning activities for five to six years¹ if repayments to the Development Bank are to be made on time. Even though the long-term financial position may be promising, there is a danger that project participants will lose enthusiasm for a cattle project which runs at a loss in its early years. This will be self-defeating because improvements in technical performance and managerial decision-making, necessary for the long-term financial success of the enterprise, will not be maintained if participants' interest in it declines.

The type of repayment schedule shown in Table 4.7 (which is the arrangement actually made for a twelve-breeder project in the Karuama) is probably the result of two factors: inaccurate prediction of project performance by the Development Bank and its field advisers and a desire by the Development Bank to be repaid as quickly as possible. Even if it were assumed that the 'target' levels of technical performance were maintained from the start, such as CBR = 0.69, BMR = 0.05, NBMR = 0.05, ATO = 29.5 months and AFC = 32.5 months (paths 4 and C, p. 179) and breeder numbers stabilized at twenty, there would still be four years dependence on cash contribution to the project from non-cattle activities.² It seems clear, therefore, that the Development Bank's credit policy for cattle projects in the area will not be inappropriate because of unrealistic projections alone. Instead, it represents a compromise between ensuring an attractive pattern of net cash flows to project participants and limiting the length of time the Bank's money is at risk and, more importantly, tied up in one particular project.

In this section the effect on financial performance - from the project participants' viewpoint - of different types of credit arrangement is explored. This may give some indication of the possibilities available for modifying

¹ That is, 4 to 5 years of negative net cash flows while still owing money to the Development Bank (PEI) plus the negative net cash flow in year 0 when no repayments are due.

² The NPV (at 8 per cent discount rate) of such a project would be \$4,081, the IRR over 50 per cent, and average net income per annum for years 7-12, \$1,367.

current lending policies in a way that would suit both creditor and debtor to a greater extent than at present.

Particular attention is given here to the position of 'marginal' projects - those projects which show poor financial results under the technical performance and management situations which have been assumed for them in this paper.

(i) Same repayment schedule, lower interest rate. While it is not seriously expected that the Development Bank would countenance a reduction in the rate of interest for loans repayable over no shorter periods than the present agreements provide for, it is possible that other means of subsidizing participants in failing cattle projects could be introduced. For example, the government might make discretionary payments to the Development Bank so that the latter could charge a reduced rate of interest on loans. Table 4.25 below sets out a repayment schedule similar in 'shape' to that in Table 4.7 but representing repayment of an initial loan of \$1,390 at a rate of 3 per cent annual interest instead of 6 per cent.

Table 4.25

Repayment schedule for \$1,390 at 3 per cent per annum

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
\$	0	50	50	50	100	200	300	400	520	0	0	0	0

The hypothetical effects of applying such an alternative credit arrangement to projects which will have an internal rate of return of 10 per cent or less under the existing schedule (Table 4.7) are illustrated in Table 4.26. It can be seen from this table that even where there are no improvements in technical performance above recent levels in the area, a halving of the rate of interest charged on loans would make the rate of return to project participants' own capital slightly superior to its opportunity cost (row 1). When minimal improvements in technical performance are effected (rows 3 and 4), the internal rates of return become quite respectable under these credit arrangements. In all

Table 4.26
Effect of repaying at half the current rate of interest
on the financial performance of 'marginal' projects

Rate of improvement in		Reduction in ATO & AFC	Breeder culling rate	NPV (\$)		IRR (%)		PEI (years)	
CBR	(N) BMR			3% int.	6% int.	3% int.	6% int.	3% int.	6% int.
zero	zero	no	'normal'	10	-204	9	1	4	5
zero	zero	no	'heavy'	135	-79	15	6	3	5
zero	zero	yes	'normal'	325	47	23	10	3	5
zero	slow	no	'normal'	250	34	17	9	4	5

cases the number of years during which the project must be subsidized is reduced.

(ii) Different repayment schedule, same interest rate.

Two possible ways to overcome the external indebtedness problem are:

- (a) to let the loan be repaid over a longer period with no repayments or only small ones during the early years;
- (b) to set repayments as a fixed proportion of each year's net income (when this is positive) so that project participants will not have to inject cash into their projects beyond the first year.

Certain practical difficulties involved in administering such a credit arrangement such as (b) can be readily perceived, but discussion of these is deferred until later. In this section the effect on project financial performance of the following loan schemes are examined.¹ (Interest is assumed to be charged at 6 per cent per annum.)

Scheme 1 No repayments are due until the sixth year of the project's life, while the final repayment is due in the twelfth year, as shown in Table 4.27. This contrasts with the repayment schedule of Table 4.7 where repayments are begun in the second year and concluded in the eighth.

Scheme 2 The first repayment is due when net income from the project is positive and in this and subsequent years $2/3$ of the net income is repaid to the creditors and $1/3$ is retained by the project participants.

Scheme 3 On the same principle as scheme 2, except that $3/4$ of each year's net income is repaid to creditors and $1/4$ goes to project participants.

¹ The schemes considered here do not exhaust the possible forms of loan which could be used. For example, schemes involving a grace period before repayment without capitalization of unpaid interest are not experimented with.

Table 4.27

Alternative repayment schedule
for \$1,390 at 6 per cent per annum

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
\$	0	0	0	0	0	100	200	300	300	400	500	513	0

Table 4.29 shows the effect of these arrangements on the financial results of the 'marginal' projects listed in Table 4.26 plus selected situations which yield internal rates of return of less than 30 per cent under the existing repayment schedule (Table 4.7).

It can be seen that none of these alternative arrangements can improve the financial positions of the 'static' project (see p. 192), beyond a small increase in NPV if heavy culling is practised (row 2). For the other two 'marginal' projects shown (rows 3 and 4) the position improves with schemes 2 and 3, but scheme 1 is unworkable. Only for those projects with an IRR greater than 10 per cent under the original repayment schedule do all the alternative arrangements have beneficial effects (rows 5-7).

(iii) Different repayment schedules, higher interest rate.
It is now assumed that interest is charged at 9 per cent per annum.

Scheme 4 No repayments are due until the sixth year of the project's life, with the final payment due in the twelfth. The schedule assumed is shown in Table 4.28.

Table 4.28

Alternative repayment schedule
for \$1,390 at 9 per cent per annum

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
\$	0	0	0	0	0	150	250	350	450	500	550	680	0

Table 4.29

Effect of alternative repayment schedules, at the current rate of interest, on project financial performance

Rate of improvement in CBR		Reduction in AFC & ATO	Breeder culling rate	Breeder numbers (years 12)	NPV (\$)				IRR (%)				PEI (years)			
(N)BMR					current scheme	scheme 1	scheme 2	scheme 3	current scheme	scheme 1	scheme 2	scheme 3	current scheme	scheme 1	scheme 2	scheme 3
zero	zero	no	'normal'	6	-204	(n.f.)	(n.f.)	(n.f.)	1	(n.f.)	(n.f.)	(n.f.)	5	(n.f.)	(n.f.)	(n.f.)
zero	zero	no	'heavy'	4	-79	-12	(n.f.)	(n.f.)	6	MS	(n.f.)	(n.f.)	5	1	(n.f.)	(n.f.)
zero	zero	yes	'normal'	7	-47	(n.f.)	160	195	10	(n.f.)	29	25	5	(n.f.)	0	0
zero	slow	no	'normal'	11	34	(n.f.)	107	99	9	(n.f.)	23	19	5	(n.f.)	0	0
slow	zero	no	'normal'	12	458	532	518	506	19	45	34	30	5	0	0	0
slow	slow	no	'normal'	22	774	848	834	824	23	45	37	35	5	0	0	0
slow	slow	no	'normal'	16	1,228	1,303	1,281	1,274	28	50+	42	40	5	0	0	0

(stabilized at 16 breeders in year 9)

n.f. means that the alternative repayment schedule would result in a negative IRR

MS means that there is a multiple solution to the IRR

Scheme 5 The first repayment is due when net income from the project is positive and in this and subsequent years $3/4$ of the net income is repaid to the creditors and $1/4$ is retained by the project participants.

Table 4.30 shows that none of the projects yielding an IRR of 10 per cent or less under the original arrangements could survive financially on repayment schedules based on an interest rate one and a half times that which existed in the base period (rows 1-4). The NPVs of the three other projects shown (rows 5-7) are reduced but their IRRs and PEIs improve.

In terms of the theoretical yield from project participants' capital, therefore, it is clear that if the Development Bank allowed repayment over a longer time period it could charge a substantially higher rate of interest on its loan and still improve the financial performance of projects. With the two examples shown, there is also no possibility of credit agreements 'forcing' a project into a negative income situation. On the basis of these criteria the fixed repayment schedule appears better than the variable one.

Sensitivity to turn-off returns. Given the high probability that demand for beef in Papua New Guinea, particularly from sources close to urban centres, will remain strong over the next decade or so, any reductions in average returns per head of fatstock slaughtered is more likely to be due to lower weights at slaughter than to lower prices per unit weight.

All simulations of project performance so far have assumed that fat steers and heifers dress out at an average weight of 220.4 kilograms and cull cows dress out at 227 kilograms (see Table 4.9). It is now assumed that average dressed carcass weights of steers, heifers and cull cows are only 204.5 kilograms, that is, a reduction of just over 7 per cent for steers and heifers and 10 per cent for cull cows. Average age at turn-off remains as originally assumed (see pp. 178-9). The new assumptions are intended to reflect a situation where pasture deterioration due to drought or similar nutritional factors cause loss of weight among stock. Cows removed from the breeding herd will probably be given the poorer pasture and steers and heifers grazed on the better. Hence the assumption that weight loss is greater

Table 4.30

Effect of alternative repayment schedules, at one and a half times the current rate of interest, on project performance

Rate of improvement in CBR (N)BMR		Reduction in AFC & ATO	Breeder culling rate	Breeder numbers (year 12)	NPV (\$)			IRR (%)			PEI (years)		
					current scheme	scheme 4	scheme 5	current scheme	scheme 4	scheme 5	current scheme	scheme 4	scheme 5
zero	zero	no	'normal'	6	-204	(n.f.)	(n.f.)	1	(n.f.)	(n.f.)	5	(n.f.)	(n.f.)
zero	zero	no	'heavy'	4	-79	(n.f.)	(n.f.)	6	(n.f.)	(n.f.)	5	(n.f.)	(n.f.)
zero	zero	yes	'normal'	7	47	(n.f.)	(n.f.)	10	(n.f.)	(n.f.)	5	(n.f.)	(n.f.)
zero	slow	no	'normal'	11	34	(n.f.)	(n.f.)	9	(n.f.)	(n.f.)	5	(n.f.)	(n.f.)
slow	zero	no	'normal'	12	458	211	214	19	35	25	5	0	0
slow	slow	no	'normal'	22	774	528	529	23	37	31	5	0	0
slow	slow	no	'normal'	16	1,228	982	990	28	45	37	5	0	0

(stabilized at 16 breeders in year 9)

n.f. means that the alternative repayment schedule would result in a negative IRR

Table 4.31

Effect of lower average slaughter weights on project financial performance

dressed carcass weight of

(steers and heifers: 220 kg/head) Assumption W1
(cull cows: 227 kg/head)

(steers and heifers: 204 kg/head) Assumption W2
(cull cows: 204 kg/head)

Rate of improvement in		Reduction in AFC & ATO	Breeder culling rate	Breeder numbers (years 12)	NPV (\$)		IRR (%)		PEI (years)	
CBR	(N) BMR				W1	W2	W1	W2	W1	W2
zero	zero	no	'heavy'	4	-79	-189	6	2	5	5
zero	slow	no	'normal'	11	34	-91	9	6	5	5
slow	zero	no	'normal'	12	458	306	19	15	5	5
zero	zero	yes	'normal'	7	47	-69	10	6	5	5
slow	slow	no	'normal'	22	774	573	23	19	5	5
slow	slow	no	'normal'	16						
(stabilized at 16 breeders in year 9)					1,228	949	28	24	5	5
slow	slow	no	'heavy'	16	1,093	870	28	24	5	5

among the cull cows than the young fatstock.¹

Table 4.31 shows that in these circumstances minimal improvements, such as reducing the average age at turn-off and calving and reducing the mortality rate, which were previously just enough to give an 'adequate' return on capital, are no longer sufficient by themselves (rows 2 and 4). An improvement in calving performance would now be essential if average slaughter weights remained permanently at these lower levels (row 3).

Discussion of results

The usefulness of simulation exercises for development planning. In a situation where much important input-output information is lacking, in this case data on the future availability of extension services in the Kunimaipa-Karuama and in the effect of given input levels of these on the performance of projects, projections can be of indicative value only. It is clear that the results presented in the previous section can in no sense be regarded as forecasts of future project performance. However, if the assumptions about future technical circumstances, relative prices and credit arrangements which are used in the simulations span the range of 'reasonable' possibilities, then the upper and lower limits of what can be achieved in relation to projects' financial performances can be delineated. Thus the 'fast' path of improvement in the level of technical performance is regarded here as a rate which could be realized in particularly favourable circumstances and the 'zero' path as a possible outcome of particularly unfortunate circumstances. The most likely rate of improvement is considered to be somewhere between these two extremes, but it is difficult to be more precise than this at present. The main objective of the study throughout has been to indicate likely orders of magnitudes in relation to the financial prospects of small-scale cattle projects - even such minimal information has hitherto been unavailable.

The cattle project model used here makes many simplifying assumptions and imposes a rigidity in the pattern of options available to project participants and the development agencies which may not exist in practice. For example, the Mission does put some of its steers out to fatten on village projects so that a little extra revenue can be earned by

¹ The dressing out percentage is assumed to be unchanged.

participants, some projects may receive all their initial establishment stock in the first year instead of arriving in batches over two years, project participants may make repayments to the Development Bank before the agreed dates¹ for each year and so reduce the amount of interest payable.¹ Compared with the variation of other factors, however, these possibilities are minor considerations. Technical production conditions, relative prices and the type of loan repayment system adopted will have the biggest effect on the financial viability of projects from the participants' viewpoint. If the figures produced here are accepted as valid, it should be possible now to examine plans for agricultural extension work and credit servicing in the area with a somewhat better idea of what is needed.

This paper only deals with financial outcomes evaluated from the project participant's position. The figures can therefore only be used as an indication of the changes which are needed in technical performance levels and credit arrangements to give satisfactory results to the villagers in terms of the cash going in and the cash coming out of a project. The economics of achieving a given result defined in this way will of course depend on the costs of supplying the necessary agricultural extension and credit services and using project participants' non-cash resources.

Evaluating the possibilities: application of appraisal criteria. Three measures of a project's financial performance over thirteen years have been used throughout this paper: the net present value of cash flows (discounting at 8 per cent per annum), the internal rate of return on project participants' cash inputs, and the number of years during which the existence of external debts means that the project cannot be self-supporting. For choosing between extension programs and credit policies which involve the same outlay by the development agencies, it is suggested that the one to select should be that one which, according to the simulated results presented above, would produce the highest NPV with a PEI of zero.

Many project evaluation exercises include in the cash flow of a project's final year an estimate of the market value of the assets projected to exist at that date. This is often considered necessary when the size of the investment

¹ The Development Bank calculates interest on the daily balance outstanding and charges the account twice a year.

varies considerably between the projects being ranked. On a smallholder cattle project, the livestock inventory represents by far the largest component of total asset value.

These net residual or 'salvage' values have not been included in the financial analysis of cattle project performance in this paper,¹ for the following reasons:

- (i) The purpose of the exercise here is to show how different technical and economic circumstances affect the financial viability of projects. It is not concerned with the question of whether or not a beef cattle industry should be established in the Goilala. That decision has already been taken and it is assumed that livestock extension services in the area are being supplied as the major part of an ongoing program of rural development which will not be abruptly terminated after thirteen years.
- (ii) Inclusion of 'salvage' values will not affect the ranking of projects considered here. All revenue is derived from turnoff and mortality sales, so there will be a very close correspondence between income and the value of livestock, particularly in the last year when changes in technical conditions since the previous year will be very small or nil.
- (iii) Apart from some usefulness as a collateral for further loans, project assets are likely to be valued by participants on social rather than financial grounds (for example, prestige derived from conspicuous possessions).²

Minimum improvement targets. It is clear that the level of technical performance on village cattle projects will be the decisive factor affecting their long-term financial prospects, particularly if the Development Bank does not make substantial changes in its lending policies. Future agricultural extension services into the Kunimaipa-Karuama must, at least, be planned so as to achieve the minimum improvements in performance which are needed. This implies

¹ Except when winding up a project is considered as a deliberate management strategy (for example, see p. 166).

² It is true that the PEI criterion probably has some social significance, but it is mainly intended to indicate the inhibiting effect on the establishment of other enterprises which a loss-making cattle project may induce.

a technical definition of a project which can be considered just viable in financial terms. Such a project will be referred to henceforth as the 'minimum' project.

Where existing credit arrangements allow little scope for reducing the PEI, those projects which generate a positive NPV (at an 8 per cent per annum discount rate) can be considered financially viable. This criterion, however, would classify as viable some projects in which breeder numbers would decline over the years. For example, a project which has succeeded in shortening the length of its breeding and fattening cycles (reduction in ATO and AFC) in the manner specified above (see pp. 178-9). but makes no other improvements over base period conditions, would be considered as financially viable on these grounds. Its breeder numbers, though, would have fallen away to seven by the thirteenth year. Similarly, a project which simply reduces its average mortality rates along the 'slow' improvement path but achieves nothing else would also be financially viable despite the net loss over the years of one breeder.

Projects which have a shrinking cattle herd are unlikely to be regarded as successful by the participants. Others will regard it as a demonstration of inability to manage the business properly and the participants will lose their new-found prestige as a result. In addition, positive growth in cattle numbers is probably needed so that project participants can repay obligations to those in the community who were not initially regarded as full participants in the enterprise, but who nevertheless contributed cash, labour or land to it.¹ The January 1973 survey indicated that in most cases such repayment would take the form of distributing female calves, the steer calves remaining the property of the owner(s) of their mothers. In very few cases was repayment in cash considered to be likely. Unless the calf/breeder ratio is very high, total stock numbers cannot be

¹ The question of ownership of cattle and participation in Kunimaipa-Karuama projects is a very involved one which cannot be unravelled during a short interview. For example, in all but two cases the cattle were considered to 'belong to the whole village', but when it came to the distribution of offspring, a sub-village group was often tentatively identified as the people who owned the original cattle and who would keep their calves as well.

maintained without reducing turn-off and culling rates if breeder numbers are falling. Such measures, however, will adversely affect financial performance, so that the project would be considered a failure on these grounds.

It seems, therefore, that a purely financial definition of project viability will in practice be an inadequate guide to evaluating the progress of existing projects and proposals for new ones. Another criterion must be included to complement the financial yardsticks and it seems reasonable to use the rule that breeder numbers should not fall below their establishment level, in this case twelve.¹ A project which at least maintains its herd at its initial size would probably not be regarded by villagers as having deteriorated in any sense, even if it could not be said to have been particularly successful.

Figure 4.3 and Appendix 4.4 show (as Path 'M' and 'minimum', respectively) time paths for the simultaneous improvement of the technical parameters NBMR, BMR and CBR which will result in the breeding herd remaining steady at twelve head over years 6-12. (Under these conditions the breeding herd would drop to ten in year 2, rise to eleven in year 4 and regain its full size in year 6.) These paths, which have been constrained to conform closely to the functional form of the 'slow' and 'fast' paths, can therefore be regarded as minimum patterns of improvement in technical performance. Thus the minimum target of extension planners should be to aim at raising the calving rate steadily to 0.49 and reducing mortality rates to 0.085, or to 50 per cent and 8 per cent respectively in round figures.²

¹ The Development Bank's condition that stock numbers must be maintained at the level it has financed does not apply when losses have occurred due to drought or disease.

² The calving and mortality rates needed to sustain a given steady growth rate in breeder numbers are related as follows:

$$C = [2(r+\alpha+\beta)(1+r)^{n-1}]/(1-\delta)^{n-1}$$

where: C is calving rate per period
 r is breeder herd growth rate per period
 α is breeder mortality rate per period
 β is breeder culling rate per period
 δ is non-breeder mortality rate per period
 n is number of periods from birth taken for a female to enter the breeding herd.

Projects which achieve these objectives in the manner specified by the 'minimum' time paths of change in the technical parameters will have the following characteristics:

breeder numbers (year 6)	:	12
(year 12)	:	12
steer equivalents (year 6)	:	22.8
(year 12)	:	25.1
% turn-off (year 6)	:	7.4
(year 12)	:	14.1

Under the investment assumption adopted above (see p.183) no new investment in an expansion of the paddock area would be needed, provided the pressure on pasture supplies of the 'excess' number of steer equivalents could be relieved by outgrazing.

Table 4.32 summarizes the financial results of such a project under alternative loan repayment schedules.

Table 4.32

The 'minimum' project: effect of different credit arrangements on financial performance

Technical performance assumptions:

CBR:	0.31 to 0.49 over years 3-12
BMR:	0.13 to 0.085 over years 3-12
NBMR:	0.12 to 0.085 over years 3-12
Culling rate:	0.10 ('normal')
ATO:	38.5 months throughout
AFC:	38.0 months throughout
other parameters	remain unchanged at year 2 levels

Type of credit arrangement	NPV (\$)	IRR (%)	PEI (years)
existing scheme	311	16	5
scheme 1*	384	41	0
scheme 2	376	31	0
scheme 4	n.f.	n.f.	n.f.
scheme 5	63	18	0

* See pp. 208-14 and Table 4.7; n.f. means that the repayment schedule would result in a negative IRR.

It can be seen that this project, where the breeding herd stays at its initial establishment size, generates a respectable NPV and IRR with the existing repayment schedule. Average annual net income received by participants during the last six years of the project's life would be \$289. The project still remains viable and has a more attractive pattern of net income flows when the interest rate is increased by half as much again (to 9 per cent per annum), provided that the fixed repayment schedule is replaced by one based on repayment as a proportion of income (scheme 5).

A reduction in the average dressed carcass weight of cull cows and young fatstock from 227 to 204 kilograms per head and from 220 to 204 kilograms per head respectively would reduce the NPV to \$166 and the IRR to 12 per cent under existing credit arrangements.

Changes in credit arrangements needed. Within the constraints of its basic policy of asking that loans for cattle projects be repaid within eight years of approval, the Development Bank offers a fair deal to borrowers. Interest rates are not high by international standards and little repayment is asked for in the early years of the loan's life. The best opportunity is given to borrowers to reduce the size of their total debt by the Bank calculating interest on a daily basis.¹

Unfortunately, eight years is likely to be too short a period during which to repay a loan for most cattle projects. In situations where project participants are learning about beef cattle technology for the first time and agricultural extension workers are facing unfamiliar problems specific to the locality, it is inevitable that technical performance and managerial decision-making do not obtain 'satisfactory' levels for some time. Where loans are repaid on or ahead of schedule it usually means that the project has been subsidized by cash earned from other

¹ Many loans for projects in the Kunimaipa-Karuama are dated from early July. The Development Bank charges interest to accounts at the beginning of June and December. If repayment each year is not made until the final date agreed (usually early May) then a \$1,390 loan is very slightly cheaper (by about \$11) than is assumed in Table 4.7. For convenience of calculation, the repayment schedules in this paper are based on a single interest charge made at the end of each year.

activities. The 'period of external indebtedness' (PEI) used above was devised as a simple measure of the extent to which a given credit arrangement may generate negative net income flows to project participants. Repayment ahead of schedule, while reducing the overall size of the debt, may mean that the project runs at a loss from the participants' viewpoint, for even longer than under the agreed schedule. This is illustrated below. Table 4.33 shows the effect on the financial performance of some 'marginal' projects of loans being repaid one year ahead of schedule, that is, the first repayment of \$50 is made on the day from which the loan is dated. The final repayment in year six is \$152 less than the scheduled terminal amount. In all three cases repayment ahead of schedule increases the PEI by one year. In only one case is this compensated for by an improvement in both NPV and IRR.

It is clear that if future changes in technical performance of Kunimaipa-Karuama projects do broadly follow the projections experimented with in this paper, then the Development Bank should give serious consideration to changing its lending policies. Two possibilities, both likely to be more satisfactory than present credit arrangements, were considered above:

- (i) the period of loan repayment is shifted backwards by five years so that the first repayment is made in the sixth year (year 5) instead of the second (year 1);
- (ii) repayments are calculated as a proportion of net income, when this is positive.

In both cases, the Bank could charge a higher interest rate to compensate for its reduced liquidity, though it is not suggested that it would necessarily have to raise the interest rate by as much as a half. This example was deliberately set very high in order to clear the 'margin of error' which can reasonably be imputed to the simulation results.

The Bank would probably prefer a fixed schedule of repayments agreed in advance with the borrower(s). However, it may be desirable to build more flexibility into lending schemes beyond the usual caveat that the Bank has the right to vary the credit arrangements any time at its discretion. As argued previously, though the Bank may not in fact press for repayment if a project has been going badly, the existence of an agreed schedule of debt clearance makes the

Table 4.33

Effect of early loan repayment on financial performance

ER repayment one year ahead of schedule
 NR repayment on agreed final dates

Rate of improvement in		Reduction in AFC & ATO	Breeder culling rate	NPV (\$)		IRR (%)		PEI (yrs)	
CBR	(N)BMR			NR	ER	NR	ER	NR	ER
zero	zero	no	'normal'	-204	-210	1	3	5	6
zero	zero	yes	'normal'	47	105	10	11	5	6
zero	slow	no	'normal'	34	30	9	9	5	6

project participants (and development agencies acting 'on their behalf' in dealings with the Bank) anxious to meet the obligations originally taken on. It might be a good thing if a more convincing demonstration of the Bank's willingness to risk its money in the enterprise was forthcoming. The project participants are encouraged to risk their resources, including cash, in a venture involving an alien technology and unfamiliar economics, and it does not seem unreasonable for the Bank to share rather more of this risk than it appears to be doing at present. This would seem particularly necessary when problems arise which are not foreseen by the development agencies and are beyond the control of the project participants.¹

A system of repayment in which the borrowers agree to give the Bank a fixed proportion of their net income each year could be devised so that the Bank and the project participants share the risk of failure more equally. A net income accruing to project participants each year for a predetermined period would be specified as the minimum amount acceptable to them. When the actual net income of the project falls below this minimum, the proportion repaid to the Bank would be fixed at an amount that would reduce the return on the investments of both parties by the same fraction. If net income of the project is negative in a year when repayment would normally be expected then the repayment due in the following year would be adjusted accordingly.

Calculation is simpler if the NPV rather than the IRR is used as the measure of the return on the investment of both the Development Bank and the project participants. In this case the amount owing to the Development Bank in any year t is given by²

¹ Such circumstances may show up the degree of risk-bearing undertaken by the different development agencies. For example, the cost of eliminating the effects of copper deficiency on project performance in the Kunimaipa-Karuama has so far been borne almost entirely by the DASF and very little by the Development Bank.

² See Appendix 4.8 for the derivation of this formula.

$$N_{bt} = \frac{f_{pt} N_t + Z_p - \lambda Z_b}{\lambda f_{bt} + f_{pt}}$$

$$\text{where } \lambda = V_{pt}^1 / V_{bt}^1$$

$$Z_p = V_{pt} - f_{pt} N_{pt}$$

$$Z_b = V_{bt} - f_{bt} N_{bt}$$

$$\text{and } N_t = N_{pt} + N_{bt}$$

N_{bt} is the repayment due to the Bank in year t

N_{pt} is the net income due to project participants in year t

N_t is the total net income actually generated by the project in year t

f_{bt} is the Bank's discount factor for cash flows in year t

f_{pt} is the project participant's discount factor for cash flows in year t

V_{pt}^1 is the present value of project participant's net income for the period 0 to n years expected in year t as a result of net income streams actually received during years 0 to $t-1$ inclusive, and projected net income streams expected to be received during years t to n .

V_{bt}^1 is the present value of the loan repayment streams for the period 0 to n years expected by the Bank in year t as a result of repayments already received during years 0 to $t-1$ inclusive, and projected repayments expected to be received during years t to n .

$V_{pt} = V_{pt}^1 (N_{pt}^1 - N_{pt})$, where N_{pt}^1 is the net income

originally projected as being due to project participants in year t .

$V_{bt} = V_{bt}^1 - f_{bt}(N_{bt}^1 - N_{bt})$, where N_{bt}^1 is the loan

repayment originally projected as being due to the Bank in year t .

The principle behind this approach to credit arrangements is that both the Bank and the project participants start out with expectations about the returns each party will receive from the cattle project during a finite period of operation and that:

- (i) these expectations will be determined by the best available projection of the financial performance of the enterprise over the specified period;
- (ii) it is agreed that when net income generated by the project exceeds or equals the projected amount for that year, the project participants shall have the option of either repaying the minimum amount specified (the given fraction of projected net income) or more than this (that is, the given fraction of actual net income);
- (iii) it is agreed that when net income generated by the project falls below the projected amount for that year, the project participants and the Bank both have their net incomes reduced according to the formula above. Application of this rule will ensure that the expectations, at time t , of both parties about the total return on their investment will be reduced by the same proportion.¹

(i) Examples of the application of the 'equi-loss' rule. Table 4.34 shows cash flow projections for a smallholder cattle enterprise which is improving its calf/breeder ratio along the 'slow' time path (see pp. 178-9 and Appendix 4.4), and which is operating under the loan repayment scheme 3. With this scheme, the Bank takes 3/4 of each year's net income (when it is positive) and the project participants keep the remaining 1/4 (see p. 211). The NPV of such a project would be \$506.

¹ If expectations are regularly disappointed, then projections of future financial performance should be revised to take account of this new information.

Table 4.34

Cash flow analysis for alternative loan repayment scheme 3*

Technical performance assumptions:

CBR	: 0.31 to 0.69 over years 3-12
BMR	: 0.13 throughout
NBMR	: 0.12 throughout
ATO	: 38.5 months throughout
AFC	: 38.0 months throughout
Culling rate:	'normal' (0.10 at equilibrium)

Year	Net income from project (\$)	Debt outstanding at start of year (\$)	Repayments owing to bank (\$)		Net income due to project participants (\$)	
			actual value	discounted at 6% p.a.	actual value	discounted at 8% p.a.
0	-81	1,390	0	0	-81	-81
1	-72	1,473	0	0	-72	-67
2	4	1,562	0	0	4	4
3	126	1,655	94	79	32	25
4	222	1,655	167	132	55	41
5	228	1,577	171	128	57	39
6	254	1,491	190	134	64	40
7	338	1,379	253	168	85	49
8	323	1,193	242	152	81	43
9	480	1,008	360	213	120	60
10	504	687	378	211	126	58
11	522	327	327	173	195	83
12	533	0	0	0	533	212
Total			1,390		506	

(All figures have been rounded to the nearest whole number)

* See p. 211.

(a) Suppose that in year 8, net income is not \$323 as projected, but only half this amount, that is, $N_8 = \$161$. Given that

$$\begin{aligned} Z_b &= 1238, & Z_p &= 463 \\ f_{bt} &= 0.627, & f_{pt} &= 0.540 \\ \text{and } \lambda &= 506/1390 = 0.364, \end{aligned}$$

then the repayment due to the Bank in year 8 is given by

$$\begin{aligned} N_{b8} &= \frac{0.540(161) + 463 - 0.364(1238)}{0.364(0.627) + 0.540} \\ &= \$129. \end{aligned}$$

Hence, the net income due to the project participant is $\$(161-129) = \32 . A reduction in total repayment of \$113 will reduce the NPV now expected by the Bank by a little over 5 per cent to \$1,319. Similarly a reduction in net income received by project participant of \$49 will reduce the NPV now expected by them by the same percentage to \$479.

(b) Suppose that in year 8, unforeseen expenditure by the project participants resulted in a total net income for that year of $-\$100$. Application of the 'equi-loss' rule would mean that the Bank would have to meet \$55 of this extra cost leaving the project participant with a net outlay of \$45. The NPV's expected by the two parties after this adjustment would now be 13-1/2 per cent less in both cases than the amounts expected before the adjustment.

(ii) Practical considerations in using variable repayment schedules. Given the likely scarcity of agricultural extensions resources in Papua New Guinea during the next few years, it is important that any new type of credit arrangements for small-scale projects should not demand more servicing than existing schemes.

The suggestions that loans be made repayable over a longer period than is allowed at present does not require any changes in debt servicing if the repayment schedule is fixed. The 'equi-loss' or variable repayment suggestion does, however, mean that certain records would have to be kept for each project as an essential condition for the proper supervision of the credit agreement.

The basic requirements are records of project income and expenditure. All cattle which are turned off at present must go through the Tapini slaughterhouse. There is therefore no difficulty about recording the payment received by each project for this output. Local sales of turn-offs¹ within the villages and mortalities are more of a problem. Understatement by project participants about the revenue earned from such transactions could result in the Bank bearing the heavier share of any year's calculated 'loss'. One solution might be to write into the credit agreement a price which will be presumed to have been received by project participants for each animal which disappears from the project² and is not recorded as passing through Tapini. This price would be set at such a level as to encourage shipment of turn-offs to Tapini rather than on-the-spot disposal, until (if at all) the local demand for beef results in a higher price than the 'export' demand. There would seem to be no entirely satisfactory way of dealing with revenue from selling meat off animals which have died from sickness or accident. Historic data may allow a reasonably accurate estimate to be made of the probability that a mortality could have produced an edible (and saleable) carcass, if no reliable information about the particular circumstances in individual cases is available.

On the expenditure side it is only necessary that project participants produce receipts for those minor items such as salt licks, veterinary aids and materials for repairing fences, which were not already budgeted for, and obtain the Bank's prior approval for major unplanned expenditure on such items as replacement stock and extensions of yards and fences.

It may be objected that a credit arrangement which provides some protection for project participants against the failure or poor performance of their enterprise effectively removes much of the incentive for them to manage it properly. This argument can only be valid if it is believed that participants are primarily seeking non-monetary benefits from their cattle projects. If this is true, then it is inappropriate for a

¹ In the event of slaughtering regulations being relaxed and village slaughter floors allowed in the future, fat as well as store cattle and breeders will come in this category.

² The price would be varied according to the sex and age group of the cattle involved.

Bank to provide the means for establishing these projects. If it is not true, then there is no reason to assume that project participants will not make the effort to ensure that the enterprise is a financial success, provided that it lies within their power to do so.

Development Bank financing of agricultural projects: some general comments¹

The Development Bank is frequently criticized for its lending policies, both in relation to its management of existing loans (as here) and with regard to the criteria it is presumed to apply when considering new applications. Evidence of farmer dissatisfaction with the Bank was cited earlier, and the press often carries reports of adverse pronouncement on Bank activities by various parties. The main areas of complaint relate to demands for longer loan repayment periods and for less 'hurrying' by the Bank's agents for repayments; the need for the Bank to bring its policies more into line with the Eight-Point Plan and to be less 'rigid' in outlook; and to a belief that credit is beyond the reach of the ordinary Papua New Guinean since the Bank favours 'big-men' as customers.² There is no doubt that many people do regard the Bank as being unreasonably 'tight' with its money and over-insistent about rapid repayment of loans.

Providing technical assistance and financial aid to large numbers of small enterprises operating in widely varying social and economic environments poses formidable problems in administration for the development agencies involved. It is important, therefore, to determine which of the criticisms of the Bank are really justified.

(i) Cost of loans. Under the regulations governing its operations, the Bank is obliged to earn sufficient income to cover its administrative costs. Four-fifths of the loans are for initial capital expenditures of under \$3,000. Present interest rates charged for these are in fact only

¹ This section draws heavily on a paper I contributed to a seminar on 'Improving access to government services' held at the University of Papua New Guinea in November 1974.

² These views were quoted in five separate reports which appeared in the Post-Courier during 1974.

made feasible by the effective subsidy obtained from large-scale loan operations.

(ii) 'Favoured' clients. In societies where the 'big-man' phenomenon is found, it seems inevitable that this type of leader is more likely to both seek, and obtain approval for, loan finance. They can command more resources (land, labour and underwriting of debt) than others in the community and by their nature are likely to be innovators looking for opportunities to advance their standing further. The question which should perhaps be asked is whether a system of credit which (if it does) tends to favour community leaders is in harmony or conflict with traditional economic values and whether or not displacement of these values by new ones is to be encouraged. Cases of resentment at the sight of more resources going to those who have a lot already can be matched just as often by cases of resentment at the singling out of station employees, with little standing in their own communities, for special help from development agencies.

(iii) Loan security. The Bank recognizes that it can ask for little security for loans for small agricultural projects. What is usually sought is an undertaking from the borrower's community that no one else will make a claim on the land for a specified period. (This is formalized in the Clan Land Usage Agreement but it has no legal status.) Lending in these circumstances is little more than a game of bluff where the basic integrity of both sides must be taken for granted.

(iv) Repayment schedules. There is little doubt that these cause most of the problems which project participants have in using credit. This being the case, the overall picture of the loan position with regard to indigenous rural projects given by the Bank's own figures poses some interesting questions. Compared with the performance of credit institutions with similar functions in many parts of the developing world, the Bank's record looks very good: it has a very low proportion of bad debts and also turns back a very small proportion of applications. On first sight this might seem to suggest that access to Bank credit is difficult for the average villager, implying that DASF officers are over-zealous in filtering out project proposals which are marginal in terms of the effective loan security offered by the would-be borrower; that is, if finance were freely available and applications were freely made for it,

then a much higher proportion of financial failures would be expected (and accepted).

There is, however, another interpretation of the Bank's figures. This is that the cost of project failures (as commercial enterprises) is always borne, initially at least, directly by the Bank's clients and not directly by the Bank itself.¹ It was said earlier that an important motive for applying for loans in many cases is the opportunity it affords for obtaining assets quickly, thereby bringing prestige and enhanced status to the borrower. Less importance may be attached at first to the expected financial performance of the enterprise, so that during this early phase repayments are made on or ahead of schedule even though the loan capital cannot be recovered from the project itself. It is later that a poor financial profile brings disillusionment and frustration, often resulting in withdrawal of group interest in what was initially a joint venture, since those who helped with contributions to meet repayment demands during the early enthusiastic days now realize there is little chance of getting much in return.

In the previous section it was argued that the repayment schedules actually operating should be carefully adjusted so that they always match the time shape of the projects' net revenue streams, and that where this involves prolongation of the repayment period beyond what is considered 'usual', interest rates could be altered (i.e. a supply schedule for credit is imposed). It may not be possible, however, to adequately 'compensate' for the reduced level of overall Bank lending which a slower recycling of funds between projects implies. This means balancing the welfare gains of project participants whose financial positions are eased by flexible repayment arrangements (for example, the 'equi-loss' principle) against the welfare loss to potential participants in projects who are effectively denied credit due to a shortage of loan funds. This is an exercise for the policy makers, but this paper should have indicated the orders of magnitude which are involved in the relevant calculations. It would seem particularly important in this context to gauge the effect which projects experiencing long PEIs have on loan applications in adjacent locations (and on further applications from the same projects). It is the writer's contention that this effect is certainly negative.

¹ Banks can always indirectly pass on the cost of project failures to its good customers by charging interest rates which reflect an assumed proportion of bad debts.

It would be grossly misleading to leave the matter here, however, with the implication that revision of the formulae for calculating repayment schedules will solve the problems of both the Bank and its clients. Two major problem areas remain; in field administration of credit usage and with regard to national development policy on risk-bearing.

Administrative problems. Applications for loans for agricultural projects go first to the rural development officers (RDOs) of the DASF who carry out the initial evaluation of the proposal, usually on the basis of a draft budget. If approved by the RDO, the application then goes to the Bank's branch office for final vetting. The Bank thus relies heavily on DASF field staff for supervision of both technical and financial aspects of a project's progress. This system of administration is itself the cause of many problems at the loan application stage, since the would-be borrower has to deal, indirectly and sometimes directly, with at least two separate agencies and this can lead to misunderstandings between all three parties. Sometimes other agencies, such as religious missions, take on the role of financial clearing houses for loan-financed projects in their area and this can add further to the borrower's confusion about credit application and supervision procedures so that the whole business may appear lengthy and uncertain to him. Though the Bank tries to ensure that applications received are dealt with quickly, the original request for a loan might remain as a note on the didiman's desk for several months while some technical problem relating to the proposal is investigated. The applicant may not always be sure whether his project has been rejected, or not yet considered, or not yet accorded official status. This sort of delay helps to reinforce the notion that credit is difficult to obtain, thereby putting off potential borrowers.

This emphasizes the need for good communications between agency headquarters and field staff. There are numerous cases known where rigid application in the field of procedures clearly conceived at high levels as guidelines only have produced deep misunderstandings between agencies and project participants. Bank policy at the top, for example, is to be fairly flexible on repayment schedules and to try to avoid pressing borrowers too hard if genuine difficulties with their project put them into arrears. At the project level, though, this attitude is often conspicuous by its absence and field staff are accused of misreading

situations and insensitivity. There seem to be two main reasons for this breakdown in administration: first, DASF field staff may only half understand the financial system they are dealing with and so take refuge in rigidly following semi-official rules of operation in order to avoid making errors; secondly, there is sometimes a lack of clear definition of the roles of the DASF, and Bank and the local administration in the supervision of loan-financed projects. Examples can be cited where the different authorities have issued apparently conflicting instructions regarding the collection of debts and the withholding of proceeds from sales. The result in both cases is a negative demonstration effect: the project is known to be in trouble with the relevant agency and potential borrowers are discouraged from applying for loans.

Risk-bearing. The Bank is under considerable pressure to demonstrate its willingness to carry its operations into the least developed areas of the country, which raises the question of whether this form of finance is the best instrument for stimulating new business activities in such places. Poorer communications and market accessibility are likely to reduce financial rates of return on investments in the more deprived areas, while the problems of mastering new technologies and systems of transaction in a short period of time put these investments into the high-risk category. Government needs to make a clear statement on how it believes the risks of project failure should be shared between itself, the Bank and the project participants in these situations.¹ A project need not be denied loan finance if the government is willing to support it with a direct grant.

¹ Again it should be stressed that a high demand for loans in a newly-developing area should not be taken to mean either an understanding, or approval, of the credit system. As noted above, much of the demand may stem in the first instance from a desire to own valuable assets and the whole project may be seen by the borrower largely in terms of his traditional accumulation system in which the precise date of repayment may be unimportant.

Conclusion

The calculations presented in this paper suggest specifically that Goilalans in the Kunimaipa-Karuama area can expect to earn a good overall rate of return on their cash expenditures in cattle projects, provided that over the next ten years the average technical performance of these projects (as indicated by calving and mortality rates and the length of breeding and fattening cycles) can be progressively raised above recent levels. If no such improvements are forthcoming, then the projects must be considered as non-viable since only a selling-out will yield (just) satisfactory financial results. The extension input into the smallholder cattle program in this area will be the single most critical factor determining whether or not the necessary improvements in project performance will be realized. To achieve success, much closer supervision of all stages of project development is needed, from the initial loan application through paddock construction, pasture improvement and initial stocking to eventual turn-off and loan repayment.

Within the framework of the Development Bank's nationally-applied policies on financing small-scale cattle developments, it is considered that the loan arrangements drawn up with borrowers in the Kunimaipa-Karuama are fair and reasonable. However, the other major conclusion which emerges from this study is that the Bank needs to review its overall lending policies regarding cattle schemes in order to eliminate certain aspects of typical credit agreements which are financially unattractive to smallholders and that the government needs to work out with the Bank methods of redistributing the risk-bearing involved in new investment in this type of agricultural development.

These recommendations are relevant to the present orientation of the national livestock development program which is towards the establishment of small-scale enterprises - starting with twelve to fifteen breeders in the case of cattle. It is perhaps time to question whether this emphasis on small-scale cattle projects may not be misplaced in some circumstances. It is probably said to be justified by considerations of income distribution and the supply of grazing land. For a given availability of agricultural extension and educational resources, however, the more projects there are to be serviced and the more dispersed they are, the lower must be the average standard of management achieved on them. This means a greater likelihood

of financial loss in the early years which, under present development policies, is largely borne by the project participants. A common response to this is that resources invested in a cattle project by a large number of people effectively pass into the hands of a smaller number of individuals who are willing to carry on with the project, despite loss of interest and renunciation of involvement in it by the rest. While this paper specifically avoided introducing any income distribution criteria for evaluating project viability, it would nevertheless be probably correct to say that most policy-makers would consider this type of response to be generally undesirable.

Where land availability is no constraint, therefore, it would seem worthwhile to consider the alternative to small-scale cattle projects, namely enterprises on a scale closer to that of a ranch. This would allow internal economies of scale to be exploited (mainly lower fencing and yarding costs per beast) and also allow a greater input of extension resources and infrastructure works to each project. This could improve average project performance considerably. Such schemes would be run by trained staff, with equity in the enterprise being held by the groups or individuals who contributed the land. Labour used in site construction would be paid wages in order to maintain clear-cut definitions of ownership, that is, only those who had rights of use over the land now used in the project would be eligible to apply for shares (which could then, of course, be freely traded). A Development Bank loan could be used to establish the project in the usual way. Cattle production and ownership along these lines might well achieve a better distribution of cash income among the rural population of an area than would a larger number of smaller projects.

Where a large area of land is not available for grazing as a single project, small-scale cattle projects can probably only be justified if extension and credit services can be efficiently used. This means good communications and a concentrated location of projects.¹ If these conditions cannot be met, small-scale cattle projects are not likely to make much of a contribution either to evening up the distribution of income within an area or to raising its average per capita value, without substantial cost to the national agricultural economy.

¹ In the Central District, for example, the Rigo sub-district would appear to be a better area for developing a cattle industry (on these grounds) than the Goilala sub-district.

Acknowledgements

The work reported here could not have been undertaken without the active assistance and co-operation of the Department of Agriculture, Stock and Fisheries. In January 1973, I was able to join Mr R. Tozer and Mr R. Gomia, then livestock officer and assistant livestock officer respectively, on a routine patrol visiting the Kunimaipa and Karuama cattle projects. I have also consulted with these officers and Dr J. Eccles, regional veterinary officer, on several occasions in Port Moresby. I have also had useful discussions with Mr N. O'Sullivan, manager of the Papua New Guinea Development Bank's Boroko Branch which provides the loans to projects in the Goilala and with the Fathers at Kamulai Mission who initiated cattle farming in the Kunimaipa and Karuama. I enjoyed the hospitality of the Kamulai Mission on both my visits to this area. Most of all, I am greatly obliged to those people of the Kunimaipa and Karuama valleys who gave me hospitality in their villages and information about their cattle enterprises. Finally, I gratefully acknowledge the support of the Reserve Bank of Australia which financed this research from its Economic and Financial Research Fund.

Appendix 4.1

The smallholder cattle project model

1.1 Equations

(Note: the subscripts t and t-1 denote current and previous year respectively)

$$\begin{aligned}
 I_t &= (1-b_1)(b_2F1_{t-1} + b_3F2_{t-1} + F3_{t-1}) + E1_t & 1 \\
 B_t &= (1-b_4-b_5)B_{t-1} + I_t & 2 \\
 F1_t &= (b_6/2)(1-[b_1/2])B_{t-1} & 3 \\
 F2_t &= (1-b_1)(1-b_2)F1_{t-1} & 4 \\
 F3_t &= (1-b_1)(1-b_3)F2_{t-1} & 5 \\
 M1_t &= (b_6/2)(1-[b_1/2])B_{t-1} & 6 \\
 M2_t &= (1-b_1)M1_{t-1} + E2_t - M5_t & 7 \\
 M3_t &= (1-b_1)(-b_7)M2_{t-1} & 8 \\
 M4_t &= (1-b_1)(-b_8)M3_{t-1} & 9 \\
 O_t &= (1-[b_1/2])(b_7M2_{t-1} + b_8M3_{t-1} + M4_{t-1}) & 10 \\
 C_t &= b_5B_{t-1} & 11 \\
 R1_t &= (O_t.P1_t) + (P6_t.M6_t) & 12 \\
 R2_t &= (C_t.P2_t) + P3_t[b_4B_{t-1} + b_1(F2_{t-1} + M2_{t-1} + M3_{t-1})] & 13 \\
 V_t &= (V1_t.B_{t-1}) + V2_t[b_9(F1_{t-1} + M1_{t-1}) + b_{10}(F2_{t-1} + M2_{t-1}) + \\
 & \quad b_{11}M3_{t-1}] & 14 \\
 N_t &= R1_t + R2_t - [V_t + K_t + L_t + (E1_t.P4_t) + (E2_t.P5_t)] & 15
 \end{aligned}$$

1.2 Variables

(Endogenous)

- I inflow into the breeding herd during the year of first-calf heifers from within the project
- B number of breeders at the end of the year
- F1 number of female calves (0 < 1 year old) at the end of the year
- F2 number of heifers (1 < 2 years old) at the end of the year
- F3 number of heifers (2 < 3 years old) at the end of the year
- M1 number of male calves (0 < 1 year old) at the end of the year
- M2 number of steers (1 < 2 years old) at the end of the year
- M3 number of steers (2 < 3 years old) at the end of the year
- M4 number of steers (3 < 4 years old) at the end of the year
- *(M5 number of young bulls taken from within the project at the end of the year)
- *(M6 number of bulls sold off from the project during the year)
- E1 inflow into the breeding herd during the year of first-calf heifers or cows from outside the project
- E2 inflow of steers (1 < 2 years old) during the year from outside the project
- O number of steers turned off the project during the year
- C number of cows culled from the breeding herd during the year
- R1 gross revenue from sales of turned-off steers and bulls during the year
- R2 gross revenue from sales of culled breeders and cattle which died on the project during the year
- N net revenue

* Since bull sales were not included in the simulations of project performance, an equation explaining their formation was not needed in the present model.

(Exogenous)

- V variable costs incurred during the year
- V1 average variable costs per breeder
- V2 average variable costs per non-breeder
- K 'fixed' costs incurred during the year (including stock transport charges)
- L loan repayment (including interest) made during the year
- P1 average price (net of slaughtering levy) received for turned-off steers and heifers
- P2 average price (net of slaughtering levy) received for culled breeders
- P3 average price received for local sale of cattle which have died on the project
- P4 average price paid in cash for heifers brought on to the project from outside
- P5 average price paid in cash for steers brought on to the project from outside

1.3 Parameters

(Note: all parameter values lie between 0 and 1)

- b_1 average annual mortality rate per non-breeder age-group (NBMR)
- b_2, b_3 proportions of heifer age-groups providing the annual inflow of new breeders
- b_4 average annual mortality rate for the breeding herd (BMR)
- b_5 annual culling rate for the breeding herd
- b_6 average annual calf/breeder ratio (CBR)
- b_7, b_8 proportions of steer age-groups providing the annual turn-off
- b_9, b_{10}, b_{11} weights for apportioning variable costs among different age-groups

Appendix 4.2

The smallholder cattle project model:
stabilized herd modification

The following equations:

$$I_t = (b_4 + b_5) B_{t-1} + E1_t \quad 1a$$

$$F2_t = (1-b_1) F1_{t-1} - b_2 I_t \quad 4a$$

$$F3_t = [1-b_7][(1-b_1) F2_{t-1} - b_3 I_t] \quad 5a$$

$$O_t = [1-(b_1/2)][b_7(M2+F2)_{t-1} + b_8(M3+F3)_{t-1} + (M4+F4)_{t-1} - (1/(1-b_1))(b_3 b_7 + b_8(1-b_2-b_3)) I_t] \quad 10a$$

replace equations 1, 4, 5 and 10 in the basic model (Appendix 4.1) respectively. In addition, a new equation is included:

$$F4_t = [1-b_8][(1-b_1)F3_{t-1} - (1-b_2-b_3) I_t] \quad 16$$

where F4 is number of heifers (3 < 4 years old) at the end of the year.

Appendix 4.3

The smallholder cattle project model:store/breeder sale modification

The following equations:

$$I_t = (b_4 + b_5)B_{t-1} + E1_t \quad 1b$$

$$HS_t = (1-[b_1/2])F1_{t-1} - I_t \quad 10b.1$$

$$SS_t = (1-[b_1/2])M1_{t-1} \quad 10b.1$$

$$HR_t = P4_t \cdot HS_t \quad 12b.1$$

$$SR_t = (P5_t \cdot SS_t) + (P6_t \cdot M6_t) \quad 12b.2$$

$$R2_t = (C_t \cdot P2_t) + P3_t (b_4 B_{t-1}) \quad 13b$$

$$V_t = (V1_t \cdot B_{t-1}) + V2_t [b_9 (F1_{t-1} + M1_{t-1}) + b_{10} I_t] \quad 14b$$

$$N_t = HR_t + SR_t + R2_t - [V_t + K_t + L_t + (E1_t \cdot P4_t)] \quad 15b$$

where HS is heifers sold as potential breeders
 SS is steers sold as fatteners
 HR is revenue from potential breeder sales
 SR is revenue from fattener sales

replace equations 1, 10, 12, 13, 14 and 15 respectively.

Equations 5, 7, 8, 9 and 10 of the basic model (Appendix 4.1) are not used.

Appendix 4.4

Technical performance parameters I: assumed time paths

Year	Non-breeder mortality rate (b_1)				Breeder mortality rate (b_4)				Calf/breeder ratio (b_6)			
	Path 1 (zero)	Path M ('minimum')	Path 2 (slow)	Path 3 (fast)	Path 1 (zero)	Path M ('minimum')	Path 2 (slow)	Path 3 (fast)	Path 1 (zero)	Path M ('minimum')	Path 2 (slow)	Path 3 (fast)
0	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.6915	0.6915	0.6915	0.6915
1	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.6915	0.6915	0.6915	0.6915
2	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.5000	0.5000	0.5000	0.5000
3	0.12	0.1113	0.1025	0.0850	0.13	0.1163	0.1075	0.0850	0.3085	0.3547	0.4043	0.5000
4	0.12	0.1025	0.0850	0.0675	0.13	0.1025	0.0850	0.0675	0.3085	0.4005	0.5000	0.5957
5	0.12	0.0981	0.0763	0.0587	0.13	0.0981	0.0763	0.0587	0.3085	0.4233	0.5479	0.6436
6	0.12	0.0937	0.0675	0.0544	0.13	0.0937	0.0675	0.0544	0.3085	0.4459	0.5957	0.6675
7	0.12	0.0915	0.0631	0.0500	0.13	0.0915	0.0631	0.0500	0.3085	0.4572	0.6197	0.6915
8	0.12	0.0894	0.0587	0.0500	0.13	0.0894	0.0587	0.0500	0.3085	0.4684	0.6436	0.6915
9	0.12	0.0883	0.0565	0.0500	0.13	0.0883	0.0565	0.0500	0.3085	0.4740	0.6556	0.6915
10	0.12	0.0872	0.0544	0.0500	0.13	0.0872	0.0544	0.0500	0.3085	0.4796	0.6675	0.6915
11	0.12	0.0861	0.0522	0.0500	0.13	0.0861	0.0522	0.0500	0.3085	0.4852	0.6795	0.6915
12	0.12	0.0850	0.0500	0.0500	0.13	0.0850	0.0500	0.0500	0.3085	0.4909	0.6915	0.6915

Appendix 4.5

Technical performance parameters II: time paths assumed

Year	Parameters affecting average age at turn-off (ATO)				Parameters affecting average age at first calving (AFC)			
	Path A		Path B		Path A		Path B	
	turn-off proportion of 2 < 3 yr olds (b_7)	turn-off proportion of 3 < 4 yr olds (b_8)	turn-off proportion of 2 < 3 yr olds (b_7)	turn-off proportion of 3 < 4 yr olds (b_8)	breeder inflow proportion of 1 < 2 yr olds (b_2)	breeder inflow proportion of 2 < 3 yr olds (b_3)	breeder inflow proportion of 1 < 2 yr olds (b_2)	breeder inflow proportion of 2 < 3 yr olds (b_3)
0	0.5	0.5	0.5	0.50	0.25	0.66	0.25	0.66
1	0.5	0.5	0.5	0.50	0.25	0.66	0.25	0.66
2	0.5	0.5	0.5	0.50	0.25	0.66	0.25	0.66
3	0.5	0.5	0.6	0.66	0.25	0.66	0.35	0.73
4	0.5	0.5	0.7	0.84	0.25	0.66	0.45	0.80
5	0.5	0.5	0.8	1.00	0.25	0.66	0.55	0.86
6	0.5	0.5	0.9	1.00	0.25	0.66	0.65	0.93
7	0.5	0.5	1.0	1.00	0.25	0.66	0.75	1.00
8	0.5	0.5	1.0	1.00	0.25	0.66	0.75	1.00
9	0.5	0.5	1.0	1.00	0.25	0.66	0.75	1.00
10	0.5	0.5	1.0	1.00	0.25	0.66	0.75	1.00
11	0.5	0.5	1.0	1.00	0.25	0.66	0.75	1.00
12	0.5	0.5	1.0	1.00	0.25	0.66	0.75	1.00

Appendix 4.6

Reinvestment in paddock area expansion

Formulae for calculating the amount of new fencing required

Let A_n = area of extra grazing required
 A_o = area of original grazing

and define $e = A_n/A_o$

- (i) If $e < 1$, assume that one fence of the original paddock area will provide all the fencing needed for one side of the new paddock area.

Assuming also that the original paddock area is 20 hectares (0.2 sq. km.), then the cost of new fencing is given by

$$1.34e^{1/2}c_1$$

where c_1 is the cost of external fencing per kilometre.

- (ii) If $e > 1$, assume that one fence of the original paddock area will provide part only of the fencing needed for one side of the new paddock area. The cost of the new fencing is given by

$$0.447(c_1[(4e^{1/2}) - 1] + c_2e^{1/2})$$

where c_2 is the cost of internal fencing per kilometre.

[Note: Given the assumed relative costs of internal and external fencing, it would be slightly cheaper (about a 4 per cent reduction in cost) to site the extra grazing area so that the whole of the original paddock area lies within the square of the new total grazing area. However, since this design allows less flexibility in the siting of new paddocks it was not used in the model.]

Cost assumptions

External fencing: 10 rolls of barbed wire per kilometre at \$12 per roll = \$120 per kilometre

Internal fencing: 7.5 rolls of barbed wire per kilometre at \$12 per roll = \$90 per kilometre

Sundries: Other inputs (tools, materials, etc.) at \$3.10 per kilometre of external fencing.

1. For the beef fattening project simulations, the total number of steer equivalents on the project in year t is given by:

$$SE_{1t} = 0.4(M1_t + F1_t) + 1.0(M2_t + F2_t + M5_t) + 1.1(M3_t + F3_t + M4_t + F4_t + M6_t) + 1.3B_t$$

2. For the store/breeder-rearing project simulations, total SE in year t is given by:

$$SE_{2t} = 0.4(M1_t + F1_t) + 0.5(SS_t + HS_t) + I_t + 1.3B_t$$

Appendix 4.7

Project net income streams in selected simulationsI Key

	Rate of improvement in		Reduction in AFC & ATO	Breeder culling rate (at equil.)	Level at which breeder herd stabilizes	Steers/heifers turned off as		Year when paddock area expanded	Type of loan repayment schedule
	CBR	(N)BMR				Fatstock	Stores/ Breeder		
Simulation 1	zero	zero	no	'normal'	-	✓		-	current scheme (Table 5.7)
Simulation 2	slow	zero	no	'normal'	-	✓		8	current scheme (Table 5.7)
Simulation 3	fast	zero	no	'normal'	-	✓		7	current scheme (Table 5.7)
Simulation 4	zero	zero	yes	'normal'	-	✓		-	current scheme (Table 5.7)
Simulation 5	slow	slow	no	'normal'	-	✓		6	current scheme (Table 5.7)
Simulation 6	slow	slow	yes	'normal'	-	✓		6	current scheme (Table 5.7)
Simulation 7	slow	slow	no	'heavy'	-	✓		6	current scheme (Table 5.7)
Simulation 8	slow	slow	no	'normal'	16 (year 8)	✓		6	current scheme (Table 5.7)
Simulation 9	slow	slow	no	'normal'	16 (year 8)		✓	6	current scheme (Table 5.7)
Simulation 10	'minimum'*	'minimum'	no	'normal'	12 (year 6)	✓		-	current scheme (Table 5.7)
Simulation 11	slow	zero	no	'normal'	-	✓		8	loan scheme 1 (p. 211)
Simulation 12	slow	zero	no	'normal'	-	✓		8	loan scheme 2 (p. 211)
Simulation 13	slow	slow	no	'normal'	-	✓		6	loan scheme 3 (p. 211)
Simulation 14	slow	slow	no	'normal'	-	✓		6	loan scheme 4 (p. 212)
Simulation 15	slow	slow	no	'normal'	-	✓		6	loan scheme 5 (p. 214)

* See p.222.

II Income streams

B = before debt service () denotes a negative figure

A = after debt service

Simulation number	Project net income (\$) in year												
	0	1	2	3	4	5	6	7	8	9	10	11	12
1	B (81)	(72)	4	126	222	199	184	220	245	262	244	225	203
	A (81)	(122)	(46)	76	(38)	(201)	(216)	(486)	245	262	244	225	203
2	B (81)	(72)	4	126	222	228	254	338	323	480	504	522	533
	A (81)	(122)	(46)	76	(38)	(172)	(146)	(368)	323	480	504	522	533
3	B (81)	(72)	4	126	222	256	295	295	481	559	584	602	611
	A (81)	(122)	(46)	76	(38)	(144)	(105)	(411)	481	559	584	602	611
4	B (81)	(72)	4	149	304	233	240	269	281	303	284	260	234
	A (81)	(122)	(46)	99	44	(167)	(160)	(437)	281	303	284	260	234
5	B (81)	(72)	4	123	221	233	39	381	497	550	619	783	868
	A (81)	(122)	(46)	73	(39)	(167)	(361)	(325)	497	550	619	783	868
6	B (81)	(72)	4	147	305	285	65	506	626	800	924	1043	1168
	A (81)	(122)	(46)	97	45	(115)	(335)	(200)	626	800	924	1043	1168
7	B (81)	(72)	4	123	221	233	205	453	629	679	737	779	823
	A (81)	(122)	(46)	73	(39)	(167)	(195)	(253)	629	679	737	779	823
8	B (81)	(72)	4	123	221	233	124	381	497	740	886	999	1090
	A (81)	(122)	(46)	73	(39)	(167)	(276)	(325)	497	740	886	999	1090
9	B (81)	(72)	299	333	160	234	294	337	519	715	804	825	843
	A (81)	(122)	249	283	(100)	(166)	(106)	(369)	519	715	804	825	843
10	B (81)	(72)	4	123	219	215	224	298	364	426	443	453	458
	A (81)	(122)	(46)	73	(41)	(185)	(176)	(408)	364	426	443	453	458
11	B (81)	(72)	4	126	222	228	254	338	323	480	504	522	533
	A (81)	(72)	4	126	222	128	54	38	23	80	4	9	533
12	B (81)	(72)	4	126	222	228	254	338	323	480	504	522	533
	A (81)	(72)	4	42	74	76	85	113	107	160	168	174	283
13	B (81)	(72)	4	123	221	233	39	381	497	550	619	783	868
	A (81)	(72)	4	31	55	58	10	95	124	137	155	586	868
14	B (81)	(72)	4	123	221	233	39	381	497	550	619	783	868
	A (81)	(72)	4	123	221	83	(211)	31	47	50	69	103	868
15	B (81)	(72)	4	123	221	233	39	381	497	550	619	783	868
	A (81)	(72)	4	31	55	58	10	95	124	137	155	196	547

Appendix 4.8

Formula for calculating variable loan repaymentunder an 'equi-loss' credit agreement

Let

V'_t = net present value of all project income expected at the start of year t if the future performance of the project goes as planned.

V_t = net present value of all project income expected at the end of year t if the future performance of the project goes as planned.

N'_t = net income generated by project in year t according to the planned budget.

N_t = net income actually generated by the project in year t.

f_t = discount factor to be applied to net income in year t.

n = number of years of project life.

Subscripts b, p denote Development Bank and project participants respectively.

Then $V'_t = \sum f_i N'_i + f_j N'_j + f_t N'_t$ (i = 1, 2 --- t-1)

$V_t = \sum f_i N_i + f_j N_j + f_t N_t$ (j = t+1, t+2, --- n)

i.e. $V'_t = Z + f_t N'_t$

$V_t = Z + f_t N_t$

where $Z = \sum f_i N_i + \sum f_j N'_j$

Loan repayment in year t must be such that

$V_{bt}/V'_{bt} = V_{pt}/V'_{pt}$, when $N_t < N'_t$.

i.e. $(Z_b + f_{bt} N_{bt})/V'_{bt} = (Z_p + f_{pt} N_{pt})/V'_{pt}$

i.e. $\lambda(Z_b + f_{bt} N_{bt}) = Z_p + f_{pt} N_{pt}$

where $\lambda = V'_{pt}/V'_{bt}$.

Since $N_t = N_{bt} + N_{pt}$

then $\lambda(Z_b + f_{bt} N_{bt}) = Z_p + f_{pt}(N_t - N_{bt})$

∴ $N_{bt} = (f_{pt} N_t + Z_p - \lambda f_{bt} N_{bt} + f_{pt} N_{pt})$.

Bibliography

- Clark, R.D., 1970a. 'Some economic aspects of indigenous cattle development in the Eastern Highlands District', paper presented at ANZAAS Conference, Port Moresby.
- 1970b. Budget Example: Ten Breeder Cattle Enterprise, Department of Agriculture, Stock and Fisheries, Port Moresby.
- Cottrell-Dormer, W., 1967. 'South Pacific Commission Agricultural Extension Survey 1967', typed, Department of Agriculture, Stock and Fisheries.
- Crellin, K.G., 1969. 'Land tenure in relation to the provision of credit', Journal of the Papua and New Guinea Society, vol. 3, no.2.
- 1971. 'The use of credit facilities in rural areas', paper presented at the Fifth Waigani Seminar, Port Moresby.
- Department of Agriculture, Stock and Fisheries, 1970. 'The Papua New Guinea livestock development project', unpublished report.
- Dexter, D., 1961. The New Guinea Offensives, Australian War Memorial, Canberra.
- Emmery, Peter, 1970. 'Increasing economic efficiency from plantation tree crops', paper presented at 42nd ANZAAS Congress, Port Moresby.
- Finney, B.R., 1969. 'New Guinea entrepreneurs', New Guinea Research Bulletin, no.27, Australian National University, Canberra.
- Fisk, E.K. (ed.), 1966. New Guinea on the Threshold, A.N.U. Press, Canberra.
- Godyn, D.L. and M.E., 1970. 'Numuyargobo area project report. Korofeigu', typed report, Department of Agriculture, Stock and Fisheries.
- Holzknacht, H.A., 1970. 'Society and agriculture in the upper Markham Valley', paper presented at the ANZAAS symposium on 'Agriculture in New Guinea', mimeo, Port Moresby.
- Howlett, D.R., 1962. 'A decade of change in the Goroka valley, New Guinea: land use and development in the 1950s', Ph.D. thesis, Australian National University.
- International Bank for Reconstruction and Development, 1965. The Economic Development of the Territory of Papua New Guinea, Johns Hopkins Press, Baltimore.
- Jackson, J.J., 1965. 'Cattle, coffee and land among the Wain', in New Guinea Research Bulletin, no. 8, Australian National University, Canberra.
- Johns, G., 1969. 'A lender's problem in Papua and New Guinea - a banker's approach', paper presented at the Third Waigani Seminar, Port Moresby.
- Korte, R., 1974a. 'The demand for stock feed by the human population', Nutrition Branch, Department of Public Health, mimeographed.
- 1974b. 'The importance of food and nutrition for rural development in Eastern Highlands District', Nutrition Branch, Department of Public Health, mimeographed.
- 1974c. 'Proteins versus calories in Papua New Guinea', paper presented at the 10th Annual Symposium, Papua New Guinea Medical Society.

- Langness, L.L., 1963. 'Notes on the Bena Council, Eastern Highlands', Oceania, vol. 33, no. 3, pp. 151-70.
- 1964. 'Some problems in the conceptualization of highlands social structures', American Anthropologist, special publication, vol. 66, no. 4, part 2, pp. 162-82.
- 1968. 'Bena Bena political organization', Anthropological Forum, vol. 2, no. 2, pp. 180-98.
- Lawson, A.R., 1969. 'Summary of Extension Course conducted August 1969', mimeo, Popondetta Agriculture Training Institute.
- Leahy, M., 1930. 'Leahy diary', Australian National University Library, Canberra.
- McArthur, M., 1971. 'Men and spirits in the Kunimaipa Valley' in Anthropology in Oceania, (Hiatt, L.R. and Jayawardena, C., eds), Angus and Robertson, Sydney.
- Nadkarni, M.S., 1970. 'Entrepreneurship in New Guinea - some psychological speculations', seminar paper, New Guinea Research Unit, Port Moresby.
- Office of Programming and Co-ordination, 1971. The Development Programme Reviewed, Port Moresby.
- Read, K.E., 1952. 'Nama cult of the central highlands, New Guinea', Oceania, vol. 23, no. 1, pp. 1-25.
- 1965. The High Valley, Charles Scribner's Sons, New York.
- Rice, V.A., 1943. Breeding and Improvement of Farm Animals, McGraw-Hill Book Company, New York.
- Shand, R.T. and Straatsmans, W., 1969. 'Cash cropping in Boana New Guinea', seminar paper, Australian National University.
- Shand, R.T., 1971. 'Government influence on primary industries: the Papua New Guinea case', in Government Influence and the Location of Economic Activity (Linge, G.J.R. and Rimmer, P.J., eds), Australian National University, Canberra.
- Sillano, J.C., 1972a. 'Market prospects for Papua New Guinea's meat products'. D.A.S.F., Port Moresby.
- 1972b. 'The supply and demand for beef, poultry, and port in Papua New Guinea, 1965-1980', Department of Agriculture, Stock and Fisheries, Port Moresby.
- Territory of Papua and New Guinea, 1968. Programming and Policies for the Economic Development of Papua New Guinea, Port Moresby.
- ToVue, J.C., 1974. 'Agricultural extension in Papua New Guinea - the farmer's viewpoint', Department of Agriculture, Stock and Fisheries Bulletin, no. 4.

Abstract

New Guinea Research Bulletin Four papers on the Papua New
No. 63, 1975 Guinea cattle industry

Cattle raising is one of the fastest growing industries in Papua New Guinea. Indigenous smallholder projects have been a major component of this growth. This Bulletin contains four papers on the industry. The first, by P.K. Philipp, evaluates indigenous participation. Papers by L.L. Langness and F. von Fleckenstein evaluate two smallholder cattle projects in the Eastern Highlands District. The fourth, by M. Evans, uses a simulation model to assess the financial viability of a smallholder cattle project in the Goilala sub-district.

New Guinea Research Bulletins

- Bulletin No. 1 The Erap Mechanical Farming Project by R.G. Crocombe and G.R. Hogbin, April 1963
- Bulletin No. 2 Land, Work and Productivity at Inonda by R.G. Crocombe and G.R. Hogbin, August 1963
- Bulletin No. 3 Social Accounts of the Monetary Sector of the Territory of Papua and New Guinea, 1956/57 to 1960/61 by R.C. White, January 1964
- Bulletin No. 4 Communal Cash Cropping among the Orokaiva by R.G. Crocombe, May 1964
- Bulletin No. 5 A Survey of Indigenous Rubber Producers in the Kerema Bay Area by G.R. Hogbin, October 1964
- Bulletin No. 6 The European Land Settlement Scheme at Popondetta by D.R. Howlett, April 1965
- Bulletin No. 7 The M'buke Co-operative Plantation by R.G. Crocombe, August 1965
- Bulletin No. 8 Cattle, Coffee and Land among the Wain by Graham Jackson, December 1965
- Bulletin No. 9 An Integrated Approach to Nutrition and Society: the case of the Chimbu, ed. E. Hipsley, January 1966
- Bulletin No.10 The Silanga Resettlement Project by Olga van Rijswijk, February 1966
- Bulletin No.11 Land Tenure and Land Use among the MountLamington Orokaiva by Max Rimoldi, April 1966
- Bulletin No.12 Education Through the Eyes of an Indigenous Urban Elite by Karol van der Veur and Penelope Richardson, August 1966
- Bulletin No.13 Orokaiva Papers: Miscellaneous Papers on the Orokaiva of North East Papua, November 1966
- Bulletin No.14 Rabia Camp: a Port Moresby Migrant Settlement by Nancy E. Hitchcock and N.D. Oram, January 1967
- Bulletin No.15 Bulolo: a History of the Development of the Bulolo Region, New Guinea by Allan Healy, February 1967
- Bulletin No.16 Papuan Entrepreneurs: Papers by R.G. Crocombe, W.J. Ooster-Meyer and Joanne Gray, J.V. Langmore, April 1967
- Bulletin No.17 Land Tenure Conversion in the Northern District of Papua by David Morawetz, May 1967
- Bulletin No.18 Social and Economic Relationships in a Port Moresby Canoe Settlement by N.D. Oram, July 1967
- Bulletin No.19 A Benefit Cost Analysis of Resettlement in the Gazelle Peninsula by S. Singh, September 1967
- Bulletin No.20 New Guinea People in Business and Industry: Papers from the First Waigani Seminar, December 1967
- Bulletin No.21 Teachers in the Urban Community by Penelope Richardson and Karol van der Veur, January 1968
- Bulletin No.22 Papers on the Papua-New Guinea House of Assembly by Norman Meller, January 1968
- Bulletin No.23 Mixed-race Society in Port Moresby by B.G. Burton-Bradley, March 1968

- Bulletin No.24 The Organisation of Production and Distribution among the Orokaiva by E.W. Waddell and P.A. Krinks, September 1968
- Bulletin No.25 A Survey of Village Industries in Papua-New Guinea by R. Kent Wilson, November 1968
- Bulletin No.26 The Contribution of Voluntary Aid Organisations to the Development of Papua-New Guinea, 1966-67, by Micheline Dewdney, January 1969
- Bulletin No.27 New Guinean Entrepreneurs by B.R. Finney, February 1969
- Bulletin No.28 Namasu: New Guinea's Largest Indigenous-owned Company by I.J. Fairbairn, March 1969
- Bulletin No.29 Hohola: the Significance of Social Networks in Urban Adaptation of Women by Lynn Oeser, June 1969
- Bulletin No.30 Inter-tribal Relations of the Maenge People of New Britain by M. Panoff, July 1969
- Bulletin No.31 Inter-ethnic Marriage in New Guinea by A.W. Lind, August 1969
- Bulletin No.32 New Guinea Social Science Field Research and Publications, 1962-67 by Susan C. Reeves and May Dudley, October 1969
- Bulletin No.33 The Rigo Road: a Study of the Economic Effects of New Road Construction by Marion W. Ward, January 1970
- Bulletin No.34 People and Planning in Papua and New Guinea: Papers by D.J. van de Kaa, J.M. Stanhope, T.S. Epstein, N.H. Fry, and C.L. Beltz, April 1970
- Bulletin No.35 The Indigenous Role in Business Enterprise: Three Papers from the Third Waigani Seminar, 1969, by A.J. O'Connor, T.S. Epstein and G. Nash, May 1970
- Bulletin No.36 Australia and the United Nations: New Guinea Trusteeship Issues from 1946 to 1966 by W.E. Thomasetti, July 1970
- Bulletin No.37 Port Moresby Urban Development by J.V. Langmore and N.D. Oram, September 1970
- Bulletin No.38 Land Tenure in West Irian: Papers by K.W. Galis, J.V. de Bruyn, J.Power, J.W. Schoorl, and J. Verschueren, December 1970
- Bulletin No.39 The Situm and Gobari Ex-servicemen's Settlements by A. Ploeg, January 1971
- Bulletin No.40 Land Tenure and Economic Development: Problems and Policies in New Guinea and Kenya: Papers by S. Rowton Simpson, R.L. Hide, A.M. Healy, and J.K. Kinyanjui, March 1971
- Bulletin No.41 Would-be Entrepreneurs? A Study of Motivation in New Guinea by Ruth S. Finney, May 1971
- Bulletin No.42 Population Growth and Socio-economic Change: Papers from the Second Demography Seminar, Port Moresby 1970, September 1971
- Bulletin No.43 Langandrowa and M'buke, Corporate Indigenous Plantations by A.M. McGregor, December 1971
- Bulletin No.44 Business and Cargo: Socio-economic Change among the Nasioi of Bougainville by E. Ogan, 1972
- Bulletin No.45 Leadership and Socio-economic Change in Sinasina by Sachiko Hatanaka, 1972
- Bulletin No.46 Melanesians' Choice: Tadhimboko Participation in the Solomon Islands Cash Economy by I.Q. Lasaqa, 1972

- Bulletin No.47 Official and Unofficial Courts: Legal Assumptions and Expectations in a Highlands Community by Marilyn Strathern, 1972
- Bulletin No.48 Freight Forwarding in the Australia-Papua New Guinea Trade by P.J. Rimmer, 1972
- Bulletin No.49 Hoskins Development: the Role of Oil Palm and Timber - Papers by J.P. Longayroux, T. Fleming, A. Ploeg, R.T. Shand and W.F. Straatmans, and W. Jones, 1973
- Bulletin No.50 The Land Titles Commission in Chimbu: an Analysis of Colonial Land Law and Practice, 1933-68, by R. Hide, 1973
- Bulletin No.51 Constitutional Development in Papua New Guinea, 1968-73: the Transfer of Executive Power, by P.J. Bayne and H.K. Colebatch, 1973
- Bulletin No.52 Chimbu Family Relationships in Port Moresby, by J. Whiteman, 1973
- Bulletin No.53 Money, Motivation and Cash Cropping, by T.K. Moulik, 1973
- Bulletin No.54 Transition from Subsistence: Cash Crop Development in Papua New Guinea, by R.T. Shand and W. Straatmans, 1974
- Bulletin No.55 Matriliney and Modernisation: the Nagovisi of South Bougainville, by Jill Nash, 1974
- Bulletin No.56 Foreign Economic Relations of Papua New Guinea, Ross Garnaut (ed.), 1974
- Bulletin No.57 Traditional Marriage and the Impact of Christianity on the Solos of Buka Island, by A.H. Sarei, 1974
- Bulletin No.58 Co-operatives in Papua New Guinea by Sumer Singh, 1974
- Bulletin No.59 Business and Bureaucracy: a study of Papua New Guinean businessmen and the policies of business development in Port Moresby, by C. Leslie Andrews, 1975
- Bulletin No.60 Sound-producing Instruments in Traditional Society: a study of esoteric instruments and their role in male-female relations, by K.A. Gourlay, 1975
- Bulletin No.61 No Money on our Skins: Hagen Migrants in Port Moresby, by Marilyn Strathern, 1975
- Bulletin No.62 Roads and Development in Southwest Bougainville, by Marion W. Ward, 1975
- Bulletin No.63 Four Papers on the Papua New Guinea Cattle Industry, by P.F. Philipp, L.L. Langness, F. von Fleckenstein and M. Evans, 1975

The above bulletins are available at \$2.00 each from the A.N.U. Press, The Australian National University, P.O. Box 4, Canberra, A.C.T. 2600, Australia.

