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The Ombisusu–Tara Village Rubber Project of the Northern District.

David Birmingham & Brian Scoullar.

Dept. of Agriculture, Stock & Fisheries Port Moresby, 1974

EXTENSION BULLETIN No. 7

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O.I. C. Publications Section
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Box 2417,
Konedobu

Editor -- R.F. McKillop
O.I.C. Agricultural Extension and Communication Section .

Cover Design -- Kambau N. Lamang

THE OMBISUSU-TARA VILLAGE RUBBER PROJECT,

ERRATUM

Page 2, Para 4, Line 1, for "Eri" read "Epi".

Page 11, Line 1, delete Brackets "seed".

Page 24, Para 3, Line 4 for Appendix b read Appendix 2.

Page 24, Para 3, Line 10 for (2 = 1.732; p 0.05)
read (Z = 1.732; p 0.05).

Page 24, Para 4, Line 2 for (2 = 2.880; p 0.002)
read (Z = 2.880; p 0.002).

PAPUA NEW GUINEA

OCTOBER, 1974.

THE OMBISUSU-TARA VILLAGE RUBBER PROJECT, OF THE NORTHERN DISTRICT.

BY

David Birmingham and Brian Scoullar
Rural Development Officers.

EXTENSION BULLETIN No. 7

DEPARTMENT OF AGRICULTURE, STOCK AND FISHERIES

PORT MORESBY,

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CONTENTS

ABSTRACT

The history of the Ombisusu-Tara rubber project in the Northern District is traced from the early plantings of cash crops amongst the Orakaiva people, through the introduction of improved processing facilities at Ombisusu, to the development of blocks and the planting of polyclonal rubber stock. The extension approach adopted during the development process is described and also the contribution of a number of key people at points in the process.

We argue that the project is a successful one from all points of view; the individual block owners, the Ombisusu-Tara community and the government. We suggest that the basic reasons for the success of the project were that the Ombisusu-Tara people were a cohesive community whose leaders were acknowledged and respected by that community. D.A.S.F. was able to meet a felt need (improved processing and marketing facilities) at the right time, and, through the posting of an R.D.A. to the projects, to provide leadership and skill in the technical aspects of developing the project. Decision-making was always in the hands of the Ombisusu-Tara people who therefore developed their project at their own pace.

A survey was conducted to determine what factors were influencing the output of individual producers. Production was controlled mainly by the efficiency of utilization of tapped trees and the available labour in the household, which depended on the aspirations of the producer and his managerial ability.

Some implications are drawn for policy decisions within D.A.S.F. concerning smallholder rubber production and extension strategy.

ACKNOWLEDGEMENTS

The authors would like to thank a number of people who helped us carry out this study and write the report.

Mr. John Horne, a former Rural Development Officer at Saiho, helped on the historical background to the story. He supplied source information relevant to the study and offered valuable criticisms of the original draft.

Messrs. Ian Donald, (O.I.C. D.A.S.F. Kokoda) and Kuberi Epi (D.R.D.O., Northern District) assisted with the organizational aspects and helped to determine the direction that the study would take. Mr. Ross Weber (P.A.T.I.) provided us with information from his experience of the Ombi-Tara project.

Messrs. Donald and Eri also made staff available to assist with the survey as did the Popondetta Agricultural Training Institute, for which we are most grateful.

Valuable advice was received during the survey design stage from Mr. George Whitlam (Regional Economist, Papua Region), Mr. Bob McKillop (D.A.S.F. Konedobu) and Mr. Dick Hicks (Psychological Services Section, Public Service Board).

Mr. L. Wilson, Statistician, D.A.S.F. Port Moresby and Mr. G. Whitlam assisted considerably in analysing data.

Finally, and of greatest importance, we thank the people of Ombisusu and Tara villages for allowing us to write up their experience in the hope that it may be valuable to extension officers attempting the difficult task of rural development.

THE OMBISUSU VILLAGE RUBBER PROJECT

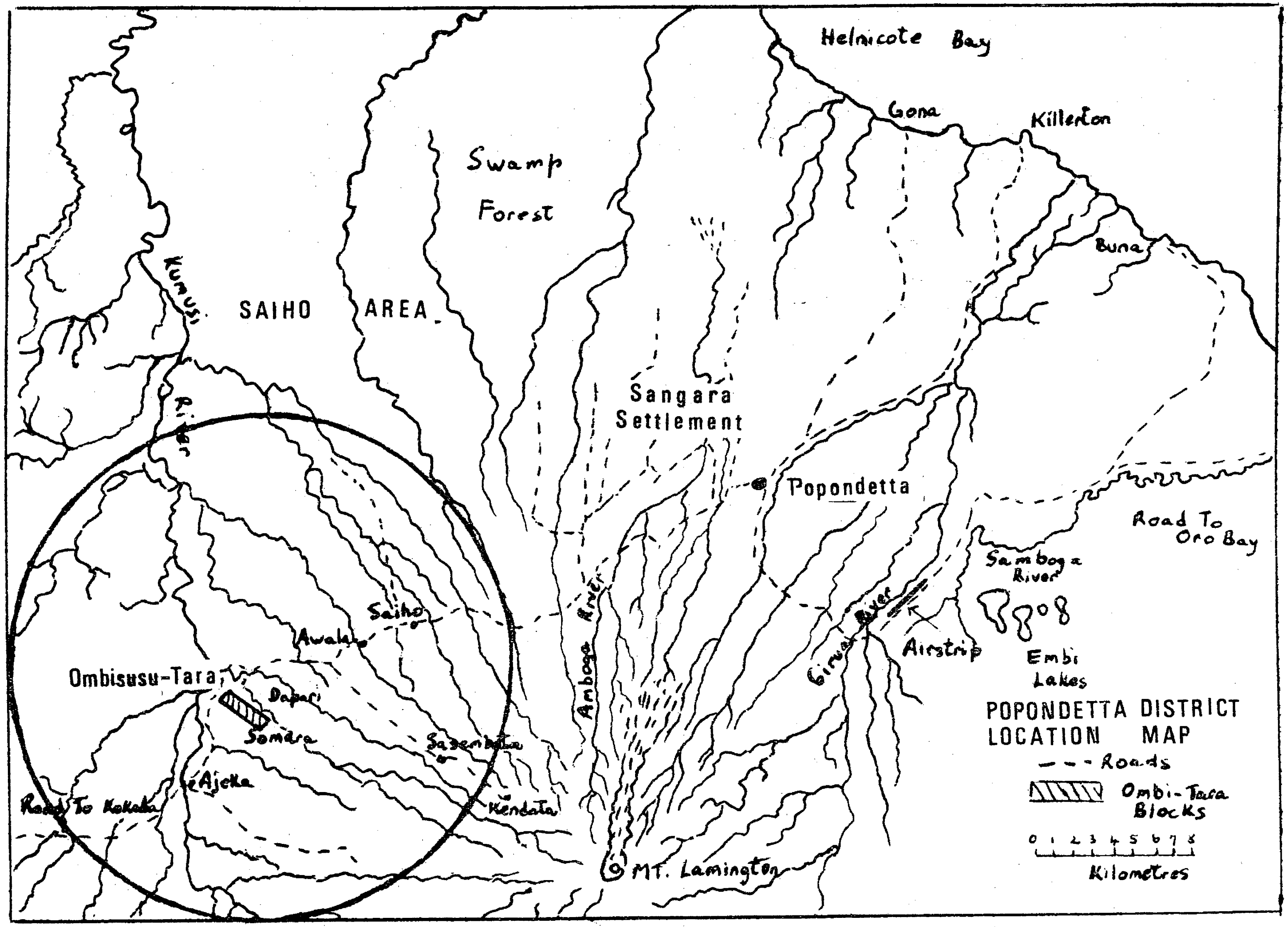
INTRODUCTION

Ombisusu and Tara villages are located in the Kokoda Sub-District of the Northern District of Papua New Guinea. They have had a long association with rubber growing. Since 1963 their rubber plantings have been of "Malayan" rubber which was planted on clearly defined blocks. Their enterprise is now known as the Ombisusu Land Tenure Conversion Scheme.

The Ombisusu-Tara rubber project has now been operating for more than ten years. The project is a modest one which has not received large inputs of resources from the Government. It is not the sort of project that we would read about in the National press or in publicity pamphlets. The project has had its ups and downs, but in 1974 it continues to operate, its operation is entirely in the hands of the village people and its returns serve to meet the needs of these people. In other words, the Ombisusu project is a successful example of a self-help village development programme.

On the following pages the authors tell the story of the Ombisusu project and of the extension methods used by the Government officers who were responsible for the area. They also describe a survey of the project carried out in 1974 which aimed to find out why some farmers have a higher production than others. It is hoped that the experience of the extension officers at Ombisusu and the results of the survey will be of assistance to extension officers working in other areas.

R. McKillop



Map 1
Location

SECTION I

CASE STUDY OF OMBISUSU RUBBER PROJECT

Background History

In the Saiho area of the Northern District villagers produce saleable rubber from their own trees. There is a long, interesting and often troubled background to the present situation.

The actual time that the original rubber trees were planted at Ombisusu-Tara is not known. It can be assumed that the first trees were planted under the Native Regulations (1903) which were first enforced in the Northern District in 1914-15. Often compulsion was used to expand plantings*.

The stands of rubber known as Ombisusu, Sopa, Kembusa and Pekemba were planted from seed supplied from the Government plantation at Kokoda. The seeds were unselected and of low potential yield. The trees were described by the people as "bush rubber". The Government chose rubber as the cash crop for areas away from the coast because the trees grew better than coconuts. However, the people preferred coconuts because of their food value.

It was planned that the village people should tap their own rubber trees, coagulate the latex using lime juice, and produce a saleable smoked sheet. In fact no equipment for processing latex was ever introduced. After planting the trees remained untouched for twenty years.

In 1941 an Expatriate Planter of Awala Plantation successfully tendered for the "rights to tap Orikaiva Rubber" on a Royalty basis. The owners would receive 1 penny to 3 pence per pound of dry rubber processed. The invasion by the Japanese soon put a stop to this work. Following the recapture of the area from the Japanese in 1943, the Planter recommenced tapping. At this time the country was controlled by A.N.G.A.U.** who made rubber production a top priority. This was because Malaya was still under Japanese control.

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* The information for this section was obtained from Papua: Annual Reports, 1914-15, 1917-18, 1918-19, 1919-20, 1920-21 and 1924-25 by Mr. J.R. Horne.

** The Australian New Guinea Administrative Unit.

By 1945 the Planter was tapping about 250 acres of Orikaive rubber. The total production was claimed to be 100,000 lbs. In 1946 a new marketing arrangement was worked out. The people tapped their own rubber and sold it to the Planter who paid them weekly on the amount of dry rubber contained in the latex. The tapping equipment was supplied by the Planter.

The village people expressed dissatisfaction with the prices they received for their latex. Tapping standards deteriorated and growers suffered declining returns. Rubber tapping ceased suddenly with the eruption of Mount Lamington in 1951 and the subsequent disorganisation of the whole area.

In 1954 the Planter again attempted to organise the tapping of village rubber. By this time other avenues of cash income were available and less rubber was produced. The vehicle used for picking-up latex wore out in 1958 and was not replaced. After this the people who were still interested in tapping rubber coagulated their latex in various containers around the village and carried it to the Planter's factory when they had enough.

The villagers gave each man the right to tap the "bush rubber" for one month. Each man would only have a turn at tapping every 12 to 18 months. This system encouraged the men to tap as intensively as possible so they would get a good return for their month. The system was inefficient and damaging to the trees. It returned only about £2 to £3 per man per year. The people thought this return was too small. (For further reading on Orakaiva commercial agriculture see M. Rimoldi*).

In 1961-62 D.A.S.F. began to take a more active interest in the Northern District rubber industry. A rough assessment of village rubber stands was made in 1962. In the following year Mr. D. Birmingham was posted to the area known as SAIHO. He was responsible for the area west of Mount Lamington as far as the Kumusi River (see Map 1).

Smallholder rubber machinery had recently been demonstrated at Sogeri and it became D.A.S.F. policy to introduce this equipment to the Northern District. The factories were to be provided by D.A.S.F. on a loan basis on the understanding that the people would save enough money to buy their own equipment.

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* Rimoldi, M. - 1966. "Land Tenure and Land Use Among the Mount Lamington Orikaiva", New Guinea Research Unit Bulletin, No. 11, p. 86-93.

Mr. Birmingham found the Ombisusu-Tara people were receptive to the idea of a rubber factory. A factory was erected here and the production of ribbed smoked sheet commenced on the 10th May, 1964. The Ombisusu people quickly collected enough money to purchase their own equipment.

The Extension Approach Used at Ombisusu

The Administration had traditionally regarded the Orikaiva people as unresponsive to change and unco-operative. In the Saiho area the land is generally very fertile and produces good food gardens. The people's need for additional cash was only minor. In the past efforts by the Government to increase cash crops had often involved the use of Government resources in the actual planting of cash crops such as cocoa and coffee. Because of this village people often did not see the need to become involved in the labour of maintaining and harvesting these gardens. In some areas a large amount of coffee was allowed to fall on the ground each year.

Due to circumstances in 1963, namely lack of any kind of Administration transport, Mr. Birmingham, Luscombe Dago, Gabriel Mamugoba with a few farmer trainees began an extended patrol programme in the Saiho area, basing operations on the Saiho hospital. An interest was taken in the life of the village people. Gardens were visited, discussions held at night, social and church activities were attended. In this way the people gained confidence in the D.A.S.F. staff. At first they brought repeated requests for D.A.S.F. staff to clean up cash crop gardens but such requests were always refused. Demonstrations were repeatedly given on cultural techniques needed to rejuvinate coffee and cocoa plantings. Extension centres were set up near, but not in a number of villages and a Rural Development Assistant stationed at each. The people showed very little response.

One group of people however were interested in improving their rubber crop. The Ombisusu-Tara people were dissatisfied with the marketing arrangements for their unselected "bush rubber". Apart from a little cocoa and coffee, their only source of income was the tapping of four stands of "bush rubber" growing on their clan land. Coagulated lump rubber had to be carried seven miles to Awala Plantation for sale and the returns were very poor. The Ombi-susu-Tara people told the patrol about their interest in obtaining a better marketing arrangement.

Because of this interest it was decided to introduce the first smallholder rubber processing equipment to Ombisusu. The first factory was set up at Ombisusu in 1964 and an extension centre established with Gabriel Mamugoba in charge. The people expressed an interest in two things. (a) Planting what they called "Malayan Rubber" (i.e. polyclonal seedling rubber) and (b) "Blocks" (i.e. individual title to land like the crown land settlement blocks at Sangara).

The people gave these two needs in the above order of priority but the author who worked with the people at the time feels that they were more interested in the "blocks" than in planting polyclonal rubber. The technique of establishing <u>land tenure conversion schemes</u> had already been tried in the Popondetta area. The idea was introduced because many Government Officers felt that customary land tenure was restricting cash cropping. The schemes involved the survey of part of a clan's land into equal blocks. These blocks were allocated to the men in the clan on an individual basis and the title of this land was converted from customary tenure to individual freehold title. (see Morowetz* for more details). The general requirements for Land Tenure Conversion were -

(a) Enough land to establish blocks and to have some left over for customary use;

(b) The blocks to be laid out in a regular pattern with central road access; and

(c) Agreement among all the people about the project.

The Ombisusu people were interested in "blocks" because they saw them as a means of copying the Europeans with whom they had contact on the Sangara Soldier Settlement Scheme. The apparent affluence of these settlers allowed them to drive around in vehicles and employ labour.

The Ombisusu and Tara people first discussed the idea of a Land Tenure Conversion (L.T.C.) Scheme with D.A.S.F. staff in mid-1963. The people were not pushed to make any decision. In fact discussions continued for twelve months. It was pointed out that such a radical change in customary ways of dealing with land meant that some "big men" lost land while others

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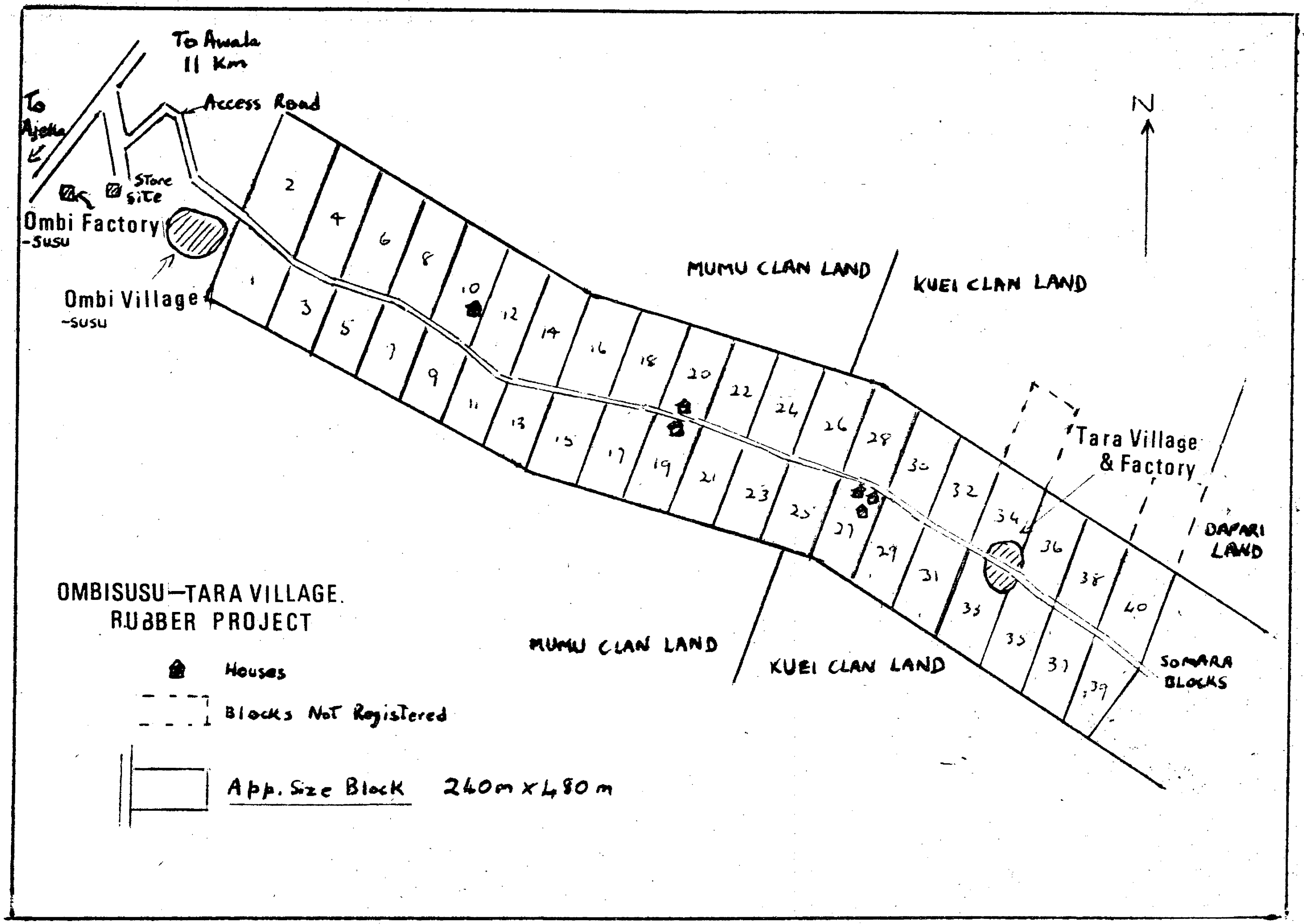
* Morowetz, D., 1967. "Land Tenure Conversion in the Northern District of Papua." <u>New Guinea Research Unit Bulletin</u>, No. 17.

gained. Once the decision to share equally was made it has become permanent and binding - it has stood the test of ten years.

Once the people decided to accept a L.T.C. Scheme D.A.S.F. helped them to mark out their blocks. In July, 1964, D.A.S.F. staff and students and the village people marked out forty, 40-acre blocks by chain and compass survey. The blocks had a 10 chain frontage and a depth of 40 chains, but this was later reduced to 20 chains for registration by the Lands Title Commission (see Map 2).



Map 2
Plan of Blocks

Learning New Skills

In September, 1963, rubber nurseries of polyclonal (seed) (Gough Garden No. 1) were planted by the village people at Ombisusu. The establishment and care of the polyclonal seedling nursery was new to the people. They were not used to any sort of nursery technique but planted from germinated seeds found growing under the old rubber. There was never a shortage of manpower as the seedlings in the nursery were to go to the Ombisusu-Tara people to be planted on their land. A charge was levied on the seedlings (1 cent each) and the money was raised by tapping the bush rubber. Six acres was the aim for each grower. Enthusiasm for the blocks grew as the rubber grew in the nursery.

After the blocks had been marked out the people decided among themselves as to who would take each block. Where trees of economic worth were growing on the block of another man private arrangements were worked out as to what to do in each case. Surprisingly no disagreements were encountered. Morawetz covers this aspect in his paper.

Planting out the polyclonal seedlings started in October 1964. This was a dry period as the expected rains did not come. Planting techniques were not good in spite of adequate training and demonstrations. The mistakes learnt by the people during this planting season were corrected in subsequent years.

Processing rubber using the smallholder equipment supplied by D.A.S.F. was soon learnt by the people. Some of the men were experienced tappers and others learned the skill from them. The standard of tapping improved with practice and the bush seedling rubber provided a good place to practice.

The habit of regular banking of money was started and money paid into a Popondetta bank account for the purchase of rubber processing equipment to replace that on loan from D.A.S.F..

The achievment goals had all been short term. Each step was taken as the necessity arose. The people were involved in planning each activity. The work was carried out by the people under the guidance of D.A.S.F. staff.

Between Planting Out and Production

Rubber prices were as high as 18¢ per lb. return to the grower in 1964-65 but fell in the period 1965-67. There was apparently discontent at the falling returns but planting of the blocks continued. Some of the men made money by working for the army supervised road construction of the Popondetta to Kokoda road. The block development of these men did not fall below the average. Friends and relatives helped each other during this developmental stage. It has been contended in another place that individual land ownership would break down community spirit but this was not the case at Ombisusu-Tara. Probably because there was general agreement within the group and although some have done better than others in terms of trees planted, the whole group has moved together.

At the same time that the Ombisusu-Tara group were involved in their development, other groups in the same area were engaged in similar projects. Some of these groups were Sasembata, Keropata, Mumumi and later Hahi-Hemara. These groups have not generally been successful in their enterprises. This can be attributed to lack of leadership and a willingness of the whole group to work together. At Ombisusu-Tara an ex councillor Charles and a council committee Onda were both influential in keeping the people together and working. Gabriel Mamugoba, the D.A.S.F. representative living at Ombisusu provided technical knowledge. The Ombi people gave Gabriel one of the blocks of land. Although he spoke their language he had no ethnic ties with the Ombisusu people at all.

Once Ombisusu-Tara were showing obvious signs of progress related groups on the same ridge of land copied the example. These were the Somara group and then the Dapari group. These groups joined with the Ombisusu-Tara group to form a <u>Rubber Producers Syndicate</u>.

The syndicate was formed in late 1970 in preparation for the marketing of the polyclonal seedling rubber then coming into tapping size. Membership of the syndicate was by payment of a $12 fee. The syndicate applied for and was granted a Development Bank Loan to purchase equipment needed to start tapping at the beginning of 1971. Factory building materials and equipment was bought by the syndicate for the use of the group and individuals purchased all necessary tapping equipment (buckets, cups, knives etc.) through the syndicate. One extension of the loan was granted when it was found that additional equipment was needed. The loan was repaid in a short period having fulfilled the need.

It should be pointed out that the syndicate is not a co-operative in the

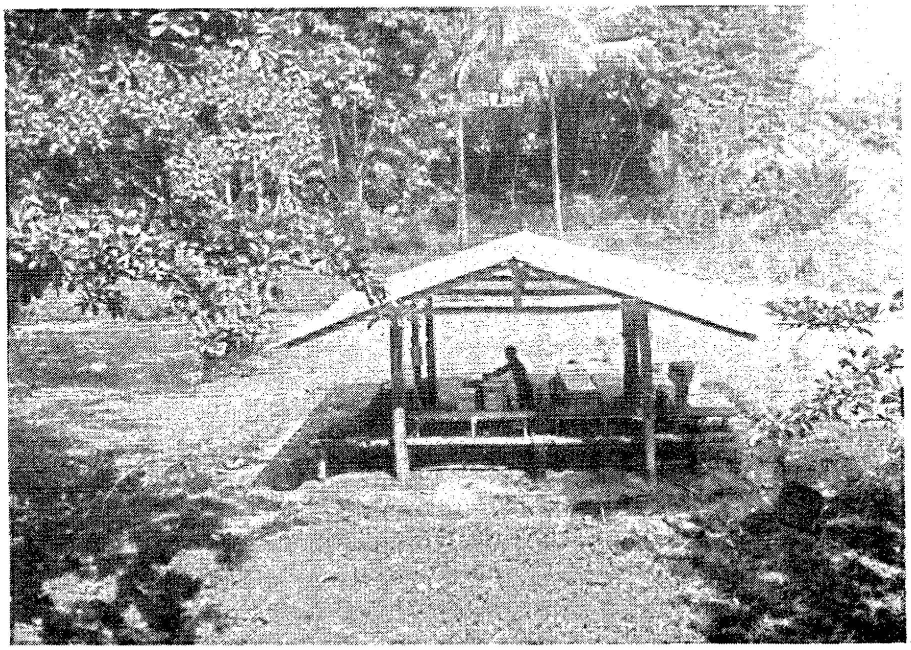


Plate 2. A view of the Ombisusu rubber factory. The man is setting latex in the coagulating factory. The rollers are located in front of the man.

Plate 1. An Ombisusu Villager collects latex from his trees after morning tapping. His rubber trees are now 10 years old.

usual Papua New Guinea style. It provides a service to its members without aiming at profit distribution. The fees paid to join the syndicate came from various sources - tapping the "bush" rubber, working on the roads, selling village produce. The syndicate now markets the rubber of the group, under the direction of Smith, the son of one of the blockholders. This man has risen from the status of an educated villager to a kind of business manager and local extension agent.

Tapping to Marketing:

The tapping begins in the early morning. The tapper and his helper (wife or older child) sets a mark of the number of trees to be tapped depending on the amount of latex that they can carry. The latex is tipped out of the cups into a bucket for transport to the factory (there are two factories, one at Ombi the other at Tara - see Map 2). Collection begins at about 10 a.m. The time taken for collection and transport to the factory depends on such factors as number of trees tapped and distance of travel.

At the factory the latex is first strained and then diluted with clean water (bulking), until it is about 3/4 lb. of dry rubber per gallon. The bulked latex is coagulated in small one gallon pans or mini-tanks that hold the equivalent of 8 x 1 gallon pans. Formic acid is usually used to speed coagulation - this is diluted with water before adding to the pan or tank. There is usually froth formed on the surface of the tank during mixing. This is skimmed off and made into scrap. The pans are covered and left for 4 to 5 hours. The resulting coagulum is then firm enough to roll without it breaking into small pieces. Each sheet of coagulum is manually rolled down using a bottle or similar object so that it is small enough to pass through the rollers. Two rollers are used. First smooth rollers compress the sheet as thin as possible then a ribbed roller gives the rubber sheet its characteristic ribbed look. This increases the surface area and aids drying and smoking.

The factory process is time consuming, but there are social values involved with groups of people working together on the job.

The ribbed sheet is hung over sticks in a smokehouse for 4-5 days. By then the colour turns from creamy white to a deep honey colour. Any remaining wet patches which show up as white areas can be clipped out and redried.

The dried rubber (sheets, clippings and scrap) is weighed by the syndicate and the weights for each producer recorded in a book. The rubber is graded and baled in the syndicate rubber press. The baled rubber is sold to D.A.S.F. The Money paid by D.A.S.F. is distributed to producers according to their recorded production by the syndicate after a small charge is deducted for expenses. Decisions relating to the financial operation of the syndicate is in the hands of a committee. The price paid by D.A.S.F. depends on sales through the Papuan Rubber Pool to Australian manufacturers, based on the Singapore Rubber Exchange price.

A development on this system will be the syndicate marketing their own rubber direct through the Popondetta agent of the Papuan Rubber Pool, using their own brand. The syndicate talks of buying their own vehicle to transport their rubber to Popondetta. Separate from the syndicate, but involving the same people, share capital is being collected to set up a co-operative store at Ombisusu. With careful management this enterprise could succeed - at least it is not an idea forced on the people but it has come from the people themselves.

The key to the success of the syndicate is Smith. He is able to keep reliable records and has a good understanding of business principles. It would appear that the directors of the syndicate keep a careful watch on all Smith's dealings. He is paid $18 per fortnight for his services. Possibly the group could afford to pay more. Expenses of the syndicate (e.g. Smith's wages) are covered by a small levy per kilo on the rubber produced.

Is it Successful?

(a) Individual producer. He is able to make a worthwhile income in his home village by production on ground that previously belonged to the group. (See Economic Analyses).

He has secure tenure of the individual block. There is a certain amount of pride in achievement. He has the potential for a higher standard of living.

(b) Community. Old jealousies within the group do not survive. This contrasts with the often held belief that individual land title would promote division.

The group has pride in their achievement.

Each member of the group has equal potential.

General satisfaction with village life, e.g. Charles could have gone to Rabaul as a taxi driver on a good wage but chose to stay in the village and develop a business there.

The group looks upon the project as their idea.

(c) Government. The Ombisusu-Tara project is a good example of the 8 Point Plan in operation. Decision making to do with the project is at the village level, each person who wanted a block could have one and land is available to provide blocks for children.

At the beginning staff inputs were high, but these were progressively reduced as the people themselves took over the running of the processing and marketing operations, until now the project is self supporting. The project is therefore highly profitable from the country's point of view because government expenditure on it is negligible.

Possible Reasons for Success

Motivation

There is some conjecture as to whether the people wanted blocks first or as the story goes improved rubber seed was offered first. At this stage it is sufficient to say that these were both motivating factors.

Leadership

Gabriel Mamugoba has obvious leadership qualities. His personal drive did much to keep the project going. Within the "local" leadership Charles K and Onda were important. There must have been times when members of the group temporarily lost interest. These leaders kept the group together during the period 1964-70. Once production of the polyclonal seed commenced Smith a new leader emerged with the necessary educational background to handle this new phase of the operation.

Skills

A sufficient number of the men understood what was involved in rubber growing. About a quarter of the block holders had some skill in tapping rubber. The old seedling rubber provided a training ground for others to learn. The operation of the smallholder rubber factory was easily learnt. The planting and establishment of field rubber was not of a high standard but in spite of this the rubber grew well.

Agronomic Factors

The area is ideal for rubber growing The top soil is volcanic in origin and well supplied with humus. Being situated along a ridge no drainage problems were encountered. The incidence of root disease has not been a problem. Pink disease is now very evident but the tree owners are reluctant to expend time and effort in control measures. Until major production losses are experienced it is doubtful if the people will do much to control the spread of pink disease.

Economic Factors

There has been a very large increase in the total annual returns to growers and in the returns for each day worked on rubber.

No figures are available for rubber sold as coagulum, but, since it involved carrying relatively small quantities for seven miles and then walking back again the returns would have been very low indeed.

Estimates have been made on returns from seedling rubber and from polyclonal rubber stock. The assumptions and arithmetic are set out in Appendix 1. The price is assumed to be 40 cents/kg.

TABLE I: Comparison of Returns
For "Bush" Seedling Rubber and Polyclonal Rubber

	Returns/ Man Day	Returns/ Year
Seedling Rubber	$1.00 - $1.50	$20 - $30*
Polyclonal Rubber	$2.00 - $3.00	$398**

* Because there were few trees each man could only tap the seedling rubber for one month each year.

** Calculated from the recorded production over seven months from September 1973 to March 1974. It is the average production of all the producers at Ombisusu-Tara.

The rubber growers at Ombisusu-Tara are now receiving cash returns from their polyclonal rubber which are higher than they could expect to receive if they sought wage employment.

In summary then, the Ombisusu Rubber Project appears to be successful to the individual producers, to the community and to the national Government. Some of the possible reasons for the success of this project and some of the mistakes that were made will be discussed further in SECTION III.

SECTION II

FACTORS INFLUENCING PRODUCTION

As well as looking at the Ombisusu-Tara rubber project as a whole, we also looked at individual producers. The idea was to see if we could find reasons why some people produced a lot of rubber whilst others produced very little. For instance, was it because of age, no education, the number of children he had, or his intelligence or some other factors?

The definition of the factors studied and the way that we measured them are set out in detail in the Appendix for those who wish to study them. Some of the factors were shown to be unimportant with regard to explaining production at Ombisusu-Tara. Others did help to explain production and these will be discussed below.

A. THE METHOD

Firstly, a survey was done on each block to count the number of trees being tapped and also the number of mature trees not being tapped. At the same time we found out from the block owner how many tappers were being used on his block. From records of purchases held by the secretary of the syndicate we recorded the production of rubber by each block owner from 1st September, 1973 to 31st March, 1974, a period of 7 months.

For each block we therefore had the following figures :-

total production
production per tapped tree
production per tapper.

Against these production figures we wanted to compare human factors to see if they would help to explain differences in these production figures. There were 4 main areas that we studied; motivation, biography, capabilities and an understanding of the process of developing the whole rubber business at Ombisusu-Tara (see Muggen, 1969).

1. MOTIVATION

We tried to measure the motivation of individual producers in three different ways :-

(a) Dependency ratio

This was a measure of the committments in a household, relative to the work force available to meet those committments. For instance, a family with many children of school age, and with only the husband and wife permanently working in subsistence gardens and the rubber block would have a very high dependency ratio. On the other hand, a household with many adults and few children would have a low dependency ratio. The ratio was calculated in the following way -

$$\frac{\text{Total number of people in the household}}{\text{Number of available labour units.}}$$

What we mean by "the number of available labour units" is discussed a little later on.

(b) Aspirations

What does a block owner want to achieve for himself and his children? Does he think he can achieve these goals within a reasonable period of time? See also Appendix II.

(c) An Index of Fatalism

This index is explained in Appendix II. At Ombisusu-Tara there was no relationship between the score on this index and production.

2. BIOGRAPHY - the background and experience of each producer.

(a) Age

Simply the age of the block owner as indicated by the year of birth in the village census book.

(b) Education/Work Experience

The way this was measured is explained in Appendix II. It is a measure of how much education and how much experience from working in paid employment each block owner has achieved.

(c) Available Labour Units

This is a measure of how much labour is available for work in each household, with the basic unit of 1 being equivalent to an adult male or adult female. Allowance was made for children attending school. The people in the household were divided up on the following basis :-

Table II

AVAILABLE LABOUR X AGE GROUPS (YEARS)

	0-5	6-10	11-15	16-20	21-45	46-55	56+
Not attending school	0	0.25	0.50	0.75	1	1	0.5
Attending school	0	0.125	0.25	0.375	-	-	-

(d) Consumption Units

This was a measure of the quantity of food (measured as carbohydrates) consumed by different age groups. The following table was calculated on work done in Nigeria (Upton, 1967). The age groups did not quite coincide with those taken at Ombisusu, but a statistical adjustment was made so that a consumption unit index for each household was obtained.

Table III

CONSUMPTION UNITS PER HEAD

AGE GROUPS (YEARS)

	0-7	8-14	15-60	Over 60
Male	0.4	0.8	1.0	0.9
Female	0.4	0.8	0.9	0.7

3. CAPABILITIES

(a) Technical Knowledge

Questions were asked of block owners about the reasons for tapping in a certain way and the consequences of incorrect or poor tapping. Each answer was scored and the total score was taken as a measure of the technical knowledge of the block owner with regard to tapping.

(b) Technical Skill

Twenty trees were taken at random in each block. The tapping panel on each tree was assessed as being either "good", "average" or "bad" tapping mainly by the amount of wounding of the tapping panel. Trees assessed as "good" scored 3 points, "average" 2, and "bad" 1 point, so the highest score possible was 60 and the lowest, 20.

(c) Intelligence

Ord (1968) developed a test for intelligence of non literate people using blocks to make designs that become increasingly more difficult as the test proceeds. The score on the test could range from 0 to 34.

4. MANAGEMENT PROCESS

Block owners were first asked to tell the story of how the rubber business started at Ombisusu-Tara and its development up to the present time. The objective of the question was to turn their thinking towards the resources that had been required to start and develop the project.

After this introduction they were asked to name the resources that had been used to initiate and develop the whole production, processing and marketing of rubber at Ombisusu-Tara. The next step was to ask them to identify the resource which was preventing them from increasing their production; then to suggest ways in which that problem could be overcome and finally they were asked if they had tried any of the solutions they mentioned. Each question was scored out of 3 so the total score possible was 12.

B. THE RESULTS

1. Each Factor Against Production

The production variable which showed greatest variation was total rubber production per block. There was, in almost all blocks, only one tapper, and production per tree depended on many factors, some of which were not measured.

Each of the factors (or independent variables) mentioned in the previous section were compared against production. This was done by listing all block owners from highest producer to lowest producer, and comparing this list with the order in which they came on the other factors. For example, the producer who was ranked 1st in production, was also 1st in the number of trees tapped, 22nd on dependency ratio, 9th on consumption units, 9th on education/work experience and 2nd on managerial process ability.

The results for the whole group are as follows :-

Table IV

FACTORS TESTED AGAINST TOTAL DRY RUBBER PRODUCTION PER BLOCK; FROM 1ST SEPTEMBER 1973 TO 31ST MARCH 1974.

FACTORS	* VALUE	SIGNIFICANCE
Trees tapped	+.667	Significant at 1% level
Consumption units	+.545	Significant at 1% level
Available labour units	+.512	Significant at 1% level
Age	-.008	Not significant
Intelligence	+.033	Not significant
Management process ability	+.230	Not significant
Education/work experience	-.197	Not significant
Technical knowledge	-079	Not significant
Technical skill	+.072	Not significant

* The Spearman coefficient of rank correlation.

The number of trees tapped by a block owner and the amount of labour he has available to him are the two factors which, by themselves, have the greatest influence on production. However, one human factor should not be considered separate from another human factor; each of them will interact with every other one in some complex manner, and it is the result of this interaction which a person can direct towards assisting to solve his problems.

Before the factors can be mixed together, they must be compared against each other to see if two factors are, in effect, measuring the same thing.

Consumption units and available labour units are measuring the same thing: consumption units were excluded from the analysis because one would expect that the nett amount of labour in a household is more relevant to rubber production than is the number of calories of food consumed in a household.

Next we compared all the factors against each other to find out how they effect each other (Inter-correlation). The results of this analysis are given in Appendix III.

Most of the factors are not inter-correlated. However, there are three which are significantly correlated and two others which are very close to being statistically significant:

- As the age of producers increases, so does their dependency ratio. This is a relationship which exists for the whole sample interviewed. Of course, at very old age, the dependency ratio is low, and also at a young age before children are born into a marriage.
- Another significant correlation is between available labour and management process. It seems that as the amount of labour increases in a household (mainly by the increase in the number of children), so does a person's capacity to suggest solutions to overcome limiting resources, and to try out these ideas.
- Technical knowledge about tapping increases with increasing age amongst the producers at Ombisusu-Tara.
- Three variables which have significant or near-significant correlations are age, dependency ratio and intelligence. The list given for intelligence measures a person's general ability to reason and to think in broad, rather than narrow terms. It also tests a person's ability to work with shapes and at seeing patterns. The score received on the list is therefore influenced by a person's background experience in the areas and this experience will increase with age. So, in this

survey, dependency ratio and intelligence both increase with increasing age. It is not surprising, therefore, to find intelligence related to dependency ratio to a degree which is almost significant.

Then factors (with the exception of age* and technical skill*) were combined together (Kendell 1965) into one factor which was called MANAGERIAL ABILITY. The producers were divided into 3 levels of managerial ability, with 12 in each category. We wanted to see if there were any differences between the three groups in the way they used both their trees and the labour available to them.

Then results were as follows:-

(a) Those highest on managerial ability

Table V

	LABOUR	TREES	PRODUCTION	
Labour	1			
Trees	.33	1		R^2= .81
Production	.40	.89	1	

There is a highly significant correlation between the number of trees tapped and production which by itself explains most (approximately 80%) of the variation in production amongst the producers in this management group. The correlations between available labour and trees tapped, and labour and production are much lower, and do not significantly add to the effect of trees tapped in explaining rubber production.

(b) Those next highest on managerial ability

Table VI

	LABOUR	TREES	PRODUCTION	
Labour	1			
Trees	.61	1		R^2= .72
Production	.55	.84	1	

* Age was excluded from the combined factor because of its strong correlation with dependency ratio and technical knowledge and its influence on intelligence. Technical skill was excluded because it was considered to be an outcome of managerial ability, rather than being part of managerial ability.

Again, the number of trees tapped is the only factor which significantly relates to production, but we are explaining less of the variation than we did with those at Management level 1. The correlation between labour and trees, and labour and production is much higher in this category than the first.

(c) Those lowest on managerial ability

Table VII

	LABOUR	TREES	PRODUCTION	
Labour	1			
Trees	.15	1		R^2 = .41
Production	.63	.18	1	

With the producers in the lowest management category we are only explaining a small proportion (41%) of the variation in production by just looking at trees and available labour. There must be other variables involved. However, within that limitation, we find that the effect of labour is significant, but the number of trees tapped does not significantly influence production. It is probably the frequency of tapping which has the major effect on production within the lowest managerial ability group.

The results show that people high in managerial ability efficiently use their labour to tap as many trees as possible, whilst those with low managerial skills depend on a lot of labour, rather than an efficient use of labour and utilization of trees.

This result can be best shown by comparing the top 13 managers with the bottom 13 managers, with the correlations between production X trees tapped and production X available labour.

Table VIII

COMPARISON BETWEEN THE TOP 13 ON MANAGERIAL ABILITY AND THE BOTTOM 13 WITH TAPPED TREES AND AVAILABLE LABOUR AGAINST TOTAL PRODUCTION

	High Managerial Ability	Low Managerial Ability
Production X Trees	.883**	.515 (N.S.)
Production X Available Labour	.417 (N.S.)	.756**

** Significant at the 1% level

N.S. Not significant

What causes the under utilization of trees at low levels of management?

If people have in their minds goals which are not attainable, or if the goals can be achieved with little effort, there is not much point (for these people) in tapping rubber trees intensively.

This hypothesis was tested using the answers to the questions on aspirations. If the producer had attainable aspirations for himself and his children, and if he thought that he could achieve those goals within a certain period of time (see Appendix b), he was given a + score. If his goals were either very low or too high, or if the producer felt that he could not achieve his stated goals within the time specified, he was given a - score. Twenty-two producers received a + score and twelve a - score. If the hypothesis above is correct, we would expect most of the + marks at the top end of the management rankings and most of the - marks at the bottom end. This turned out to be true and the result was significant (2 = 1.732; p 0.05).

However, a much more significant result occurs if the score on aspirations is compared against the ranking on production (2 = 2.880; p 0.002).

C. SUMMARY

The survey of rubber production at Ombisusu-Tara was completed at a time when rubber prices were high. Returns to the grower were 39.6 cents per kilo for R.S.S.1. Ombisusu-Tara was chosen for the survey because, amongst other things, there were no agronomic or marketing problems which would discourage people from producing rubber. There is a problem of pink disease throughout the blocks which is lowering production, but it is distributed evenly through the blocks and it is not so serious as to discourage people from tapping.

The Ombisusu-Tara project was therefore in a good position for human, rather than agronomic, or technical factors to influence production.

The survey showed that people with moderate and attainable aspirations, who have high managerial ability will tap many trees and so achieve high production. On the other hand, those people who have low aspirations, or ones which are not attainable, and who are low on managerial ability will have lower production. This production will be controlled by the amount of labour in the household rather than the number of trees being tapped.

Clearer definition of managerial ability, aspirations and available labour, and careful measurement of their parts will increase our understanding of the human factors which are influencing production.

SECTION III

WHAT ARE THE LESSONS FOR EXTENSION FROM THE OMBISUSU RUBBER PROJECT?

The case study and the survey tell us a number of things about the rubber project. However, they do not tell us why the Ombisusu-Tara people started their project and other groups did not. The extension approach to all groups was the same and the other groups had adequate physical resources (land and labour) to start similar projects. We would need to find out more about these other groups before we could say why they did not respond to the extension effort.

From the experience of Ombisusu-Tara two important things we would need to look at with the other groups are group cohesiveness and group goals. From general experience the other groups in the Saiho area do not appear as cohesive as the Ombisusu-Tara. Jealousy within clan groups is not uncommon. Individuals generally are not allowed to change their standard of living - there must be a movement by the whole group. It should be remembered that the people in this area have gone through traumatic times, especially during the Second World War and the eruption of Mount Lamington. It also appeared that the other groups did not have their goals as clearly defined as the Ombisusu-Tara group. When the extension officers came to Ombisusu the people were concerned about their rubber marketing and they wanted to talk about ways of improving this.

Successful Aspects

There were a number of special features of the Ombisusu-Tara Project which may have contributed to its success. Some of these were :-

- Gabriel was a very good extension officer and he lived in the village with the people. It seems that the people accepted him for they gave him a block of their land.
- There were strong leaders in the group (Charles and Onda). When the need for new business skills arose a new leader emerged who was able to provide these skills.
- The people in the group were in agreement with the basic ideas of the project - individual land tenure and improved rubber. The decision to go ahead with the project was made by the village people without pressure from D.A.S.F..
- The initial contact with the people was in the villages. The extension officer took an interest in community life and listened to the problems as the people saw them.

- Management of the project has always been in the hands of the participants. Initially supervision by Government staff was high, but was progressively reduced as the people became confident enough to manage their own resources.
- The syndicate provides a workable forum for decision making which does not have to rely on outside advisors.

We feel that this last point is very important. The experience of Ombisusu-Tara indicates that any project must be managed from within if it is to be truly independent.

Mistakes

We have argued that the Ombisusu Rubber Project has been a successful one. This is not to say that mistakes have not been made - they have. Some of the more important mistakes, that we are aware of, are listed below :-

(1) High yielding budgrafted material would have been better than polyclonal seedling - there is considerable variation in the yields of individual trees with the polyclonal seed.

(2) The people did not plant the seedlings well and there were losses. More education of the people on planting methods was needed.

(3) The trees were not planted on the contour. This would have made for more efficient tapping and protected the steep slopes from future erosion.

(4) Although aware of the problem of pink disease the people have not carried out any control measures - this will lead to economic loss.

(5) Gabriel was given a block of land by the people - this of course is not D.A.S.F. policy. However, this was the wish of the Ombisusu-Tara people and not Gabriel's will. Perhaps he was able to give better guidance and direction as a fellow block holder than if he had been only an advisor from outside. It should be noted that Gabriel only worked on his block during his own time.

The Future

This evaluation of the Project, and the survey in particular, tell us some important things that need to be taken into consideration by extension workers in the area.

The most important thing we found out about the project is the shortage of labour. The critical effect which the availability of labour has on production points to a need for encouraging labour saving innovations. The same result was found by Whitlam (1974) at Murua. The highest producers are limited not by the number of trees that they can tap, but by their capacity to carry latex to the factory. Charles (the highest producer) taps only until he fills three buckets; two to be carried by himself and one by his wife.

There is need therefore to experiment with trolleys and cannisters with lids (or something equivalent) to overcome this problem which is seriously limiting production.

Full-spiral, rather than half-spiral tapping utilizes labour more efficiently. There are, no doubt, problems associated with its introduction, however, the benefits in terms of more efficient use of labour would be very large.

The number and locality of rubber factories, and the sophistication of the machinery are vital questions influencing the total labour required for rubber production and processing. There is no easy solution as decisions must be made in balancing the need for minimum capital investment, minimum labour inputs and simple processing technology.

We do not know from this study, what human factors we might be able to influence. To know what a person wants to achieve for himself and his children may give some idea as to what his subsequent performance might be. Being able to define limiting resources, suggest solutions and act upon solutions was shown to be an important aspect of a person's managerial ability. It is a measure of skills of solving problems and it therefore suggests that having a <u>problem-solving approach</u> to our extension techniques will be moving in the right direction.

APPENDIX I

CALCULATING CASH RETURN PER MANDAY

The profitability criterior adopted is the Cash Return per Manday. It is implicitly assumed that available family labour is the effective limiting resources :-

$$\text{Cash Return (\$) per Manday} = \frac{\text{Annual Cash Income (\$)}}{\text{Annual Labour Input (Manday)}}$$

$$= \frac{Y.P.}{\frac{D.N}{T}.L + Y.M. + A}$$

where -

Y = yield (kg)/hectare/year

P = average rubber price of output (all grades) ($/kg)

D = number of trees tapped/hectare

N = number of tappings/tree/year

T = average tapping task size (number of trees)

L = average family labour input for tapping and collection activity/task (Mandays)

M = average family labour input for processing activity/lb. (Mandays)

A = average labour input for maintenance/hectare (Mandays)

Assumptions for polyclonal rubber stock based on data relevant to an OMBISUSU superior block at near full production.

It should be noted that no allowance has been made for financial costs and the depreciation of fixed capital items (such as establishment costs, tapping materials, factory and smokehouse buildings and processing equipment). Therefore, the return to labour calculated by the above formula is a gross concept and will be in excess of the actual figure, to the extent of the relative importance of the excluded costs.

Variable	Assumed Value
Y	800 to 1100 kg.
P	$0.40
D	400 trees
N	80 to 100 times/year
T	240 trees
L	0.5 manday (= 4 hours)
M	0.06 manday/kg.
A	5 manday/hectare

Analysis Results:

CASH RETURN PER MANDAY

		YIELD (kg/hectare)	
		800	1100
TAPPING FREQUENCY (per year)	70	$2.67	
	100	$2.35	$2.86

Therefore average return for growers with trees 10-13 years old will be in the vicinity of $2-$3 per manday.

For seedling rubber the yield is taken as 250 kg/ha/year, tapping frequency 80 times/year and all other assumtions are the same as for polyclonal rubber stock.

Analysis results :- $1.15/manday.
Therefore average return for growers from seedling rubber was in the vicinity of $1.00 - $1.50 per manday.

APPENDIX II

DESCRIPTION OF VARIABLES USED IN SURVEY

1. MANAGERIAL PROCESS ABILITY

A farmer with high managerial process ability will have a high score in the following categories :-

- Ability to conceptualize the resources required to establish the rubber industry at Ombisusu-Tara. Score 3.
- Ability to identify which resource is limiting the increase in his production and the attainment of alternative goals. Score 3.
- Ability to suggest at least one solution to overcome this limiting resource. Score 3.
- Evidence that he has implemented this solution. Score 3.

2. LITERACY

The interviewee was scored on his ability to read small sentences, to do with rubber, in Orokaniva, Motu and English.

3. EDUCATION/WORK EXPERIENCE

The effect of contact with a more materially advancec culture would be :-

(a) to increase awareness of the range of physical possessions which can be acquired, which would increase the individual's aspirations, but would be largely independent of the time of contact.

(b) to increase understanding of the operation of the foreign culture, i.e. the technical knowledge base on which its greater level of materialism depends.

(c) through observation and some involvement, understanding of the management of resources (including time) by the foreign culture would be increased. This would be a function of the time of the contact service and the type of employment which the person held.

Measurement of these factors

(a) Awareness would be stimulated by observing store goods and houses at Popondetta. Score 1 or 0.

(b) (i) Post-primary education would be of greater significance than primary level, since it is at the post-primary level that the rational/scientific basis of western culture is taught.

Scoring system used :-

Completed standard 1	Score 1)	
Completed standard 2	Score 2)	+1/year
Completed standard 3	Score 3)	
Completed standard 4	Score 4)	
Completed standard 5	Score 6)	+2/year
Completed standard 6	Score 8)	
Completed form 1	Score 11)	+3/year
Completed form 2	Score 14)	

(ii) Time of contact, i.e. the number of years of contact without regard to the level of skill.

(c) Jobs were classified according to the degree to which they give experience in the management of resources, then multiplied by the number of years employed on that job.

Job Type	Score
Labourer, farmer trainee	0
Boss boy, police, medical orderly	1
Secretary of Rubber Growers Syndicate	3

(d) Urban living (Port Moresby, Lae, Rabaul) as such is likely to have an additional influence on inter-cultural contact.

Therefore one point was added for every year lived in an urban environment.

4. ASPIRATIONS

Respondents were asked what one thing it was that they wanted to improve their standard of living in the village. They were then asked if they believed that they could achieve this goal within the next five years. Similar questions were asked about their aspirations for their children and whether these goals could be achieved within the next 15 years.

The questions were adapted from Pal (1963).

5. "FATALISM"

Maddock (1973) developed a questionnaire which measures the degree to which a sample of Papua New Guineans felt that they had control over their environment, or were controlled by it.

The three areas tested were :-

- When faced with a situation in which it is proposed that an explanation of some natural phenomena be sought, or information gathered about it through the avenue of observation, and investigation, the person will accept observation and investigation as a proper and important method of seeking such explanation or information.

- When posed with situations in which it is proposed that knowledge of the environment can be applied to manipulate the environment for man's benefit, the person will accept that such manipulation is possible and maybe desirable.
- When faced with examples of technology, and asked to accept man's role in such technology, the person will accept that such technologies result from man's efforts with knowledge gained about natural phenomena and not from some "magical" source unrelated to human effort.

The highest score possible was 84 and the lowest 18. The range of scores recorded at Ombisusu-Tara was from 36 and 50 with most scores closer to 50 than 36. The producers at Ombisusu-Tara therefore are willing to investigate their environment and seek rational explanations and solutions to the situation encountered. This result in itself is interesting, but it does not help to explain differences in production because all scores were close together. This measure may be more useful if we extended the sample to include groups who had no undertaken successful agricultural projects.

APPENDIX III

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	Dependency Ratio	Available labour	Management Process	Education/ Work	Age	Intelligence	Technical Skill	Technical Knowledge
Dependency Ratio	1							
Available Labour	+.039	1						
Management Process	+.070	+.325*	1					
Education/Work	-.279	+.017	+.229	1				
Age	+.585**	-.069	-.057	-.048	1			
Intelligence	+.345	+.072	+.019	+.218	+.348	1		
Technical Skill	+.084	-.139	+.057	+.258	-.037	+.305	1	
Technical Knowledge	+.271	-.071	-.077	-.187	+.337*	+.092	-.070	1

* Significant at the 5% level .37 in the sample
** Significant at the 5% level .36 in the sample
*** Significant at the 1% level .36 in the sample

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