LOGGING INDUSTRY RESEARCH ASSOCIATION

NEW ZEALAND

PROJECT REPORT

CABLE LOGGING SEMINAR

- VOLUME I -

PROCEEDINGS

Proceedings of a seminar held in Rotorua by N.Z.Logging Industry Research Assoc.Inc. June, 1978.

P.R.6 1978

N.Z. LOGGING INDUSTRY RESEARCH ASSOCIATION (INC.)

P.O. Box 147 Rotorua New Zealand

N.Z.Logging Industry Research Assoc.Inc.

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- TABLE OF CONTENTS -

INTRODUCTION

The need for cable logging in New Zealand is increasing:

- Many new forests due for logging in the next decade are on steep terrain.
- Environmental pressure to protect soil, water and scenic values is restricting other extraction methods on steeper country.

Many forest industry organisations are being faced with cable logging for the first time, some with no previous knowledge of the technology involved.

In N.Z., current cable logging methods on steep country cost significantly more than extraction by other methods on flatter terrain.

Furthermore there is a requirement for productive thinning on steeper country in some forests and this silvicultural need is both expensive and requires considerable skill.

Given the predicted increase in cable logging, estimates on the requirements in machinery, manpower and training are needed. Also the development of new methods aimed at improving efficiencies and reducing costs.

This Seminar aimed to bring together expertise from current cable logging operations, those involved in management and planning of such operations and the equipment supply sector, to examine the present state of knowledge and discuss the needs for the future.

The proceedings of this seminar, which was attended by 135 people, is now reported on in two volumes:

Volume I:	presents the papers by the keynote speakers, a brief summary of other papers presented and records the subsequent discussions that followed.
Volume II:	contains in full the papers tabled at the seminar.

- SESSION I -

OPENING ADDRESSES: Chairman - P.C.Crequer, LIRA Chairman.

"WHY CABLE LOGGING" - an overall perspective of the requirements and constraints on logging that indicate the future for cable logging in New Zealand.
(G.M.O'NEILL - Director-General, N.Z.Forest Service.)

"N.Z. INDUSTRY'S REQUIREMENTS" - implications of private forest owners development plans on cable logging requirements.
(J.E.HENRY - Director, Forest and Sawmilling Operations, N.Z.Forest Products Limited.)

"A LOOK INTO THE FUTURE" - national requirements and the need for increased technology.
(DR.M.C.PROBINE - Assistant Director-General, Department Scientific and Industrial Research.)

- OPENING ADDRESS -

(Mr. P.C.Crequer, Chairman of LIRA.)

Mr Crequer welcomed all present to the seminar and thanked LIRA staff for organising such a timely conference. He said the seminar was intended for education and learning, and a large amount of information was to be presented much of which would need to be digested at a later stage. Many different disciplines had been drawn together and, to ensure that the necessary exchange of information was effective, all must fully participate in the proceedings by way of questioning and discussion.

Mr Crequer than introduced, in turn, the keynote speakers:

Mr G.M.O'Neill	- Director-General, N.Z.Forest Service.
Mr J.E.Henry	- Director, Forest & Sawmilling Operations, N.Z.Forest Products Limited.
Dr.M.C.Probine	- Assistant Director-General, Department Scientific and Industrial Research.

WHY CABLE LOGGING?

(G.M.O'NEILL - Director-General of Forests, N.Z.Forest Service.)

INTRODUCTION

The question which the title to this paper poses indicates that there is still some doubt as to the need for cable logging systems at all. Certainly the rapid development of log skidders over the last decade and their proven ability to work relatively steep country has tended to push the use of cable systems into the background. In addition, with the rapid expansion of activity in the forestry sector over the same period, the demand for trained and skilled manpower has been much greater than the supply. Because of this there has been a tendency to use the simplest logging systems available, which have, for the most part, been the most economical and required the lowest capital investment in equipment. Also much of the area worked in the exotic forests, from which 90% of our wood production now comes, has been relatively easy topography and consequently suitable for tractor or skidder logging. There has, until very recently, been very little concern by other than the Forest Service and some of the major companies about logging standards. Now, with Catchment Authorities taking a much greater interest in forestry activities, logging guidelines have been established which could limit the choice of logging systems in particular areas. Apart from economic factors which in themselves have a major influence on the choice of logging method, the switch to man-made exotic forests and the lack of skilled manpower have probably been the most important factors in determining the way the logging industry has developed.

WHAT DOES THE FUTURE HOLD?

For the following reasons it is considered that cable logging will have a much wider application in the years ahead.

1. Many of the exotic forests which will come into production in the next decade will be on relatively steep and broken country.
2. On heavy clay soils or soils subject to compaction problems, tractors or skidders may not be acceptable.
3. To meet the logging guidelines agreed on by Catchment Authorities and the Forest Owners' Associations overhead cable systems will be essential in some areas.
4. As the cost of building roads increases, economic factors could favour the introduction of cable logging.
5. There is no alternative method available which appears suitable for extracting logs from steep country in New Zealand.
6. With a logging training scheme now firmly established, the long standing problem of lack of skills should be solved within the next few years.

As I understand this is intended to serve as an introductory paper to this seminar, I will deal briefly with each of the six points I have listed as it is certain that other speakers will cover these aspects in greater detail. I would also point out that there are probably a number of other reasons why cable logging will become of greater importance in future and I presume that one of the purposes of this seminar is to establish these reasons. Having said that, I would like to stress that production forestry, of which logging is a major component, to be successful must be profitable. Also our products must be competitive on world markets as the greater part of any additional production will have to be sold outside New Zealand. It is accepted that substituting cable logging for skidders or tractors may increase costs significantly but provided the best techniques are used efficiently these increases should be kept within reasonable limits. I hope that this seminar will help to resolve some of the problems which arise out of trying to arrive at a satisfactory compromise between economic considerations and acceptable logging standards.

1. Logging Steep Broken Country.

An attempt has been made recently by the Forest Service to rate the degree of difficulty of working all exotic State forests under four parameters of which topography is one. Apart from the sand dune forests only Kaingaroa, Lake Taupo and Rotoaira are listed as having easy topography. The forests in the Coromandel Peninsula, East-Coast-Poverty Bay, Hawkes Bay, Taranaki and parts of Nelson and Marlborough are all, but for a few exceptions, listed as steep. In forests with moderate topography there are substantial areas where cable logging will be necessary. For the most part new planting will be on country that is steep and broken. We therefore face a situation where very large areas of topographically difficult country will have to be worked in future. Clearfelling does not present any really serious difficulties but there has been a long standing problem of production thinning on this type of country. The introduction of light-weight mobile haulers has gone some way to solving the problem but by and large these operations are not economically attractive. It is difficult to see any change is this situation in the immediate future and silvicultural systems for steep country are normally designed to eliminate the need for production thinning. However it is probable that in some circumstances it will be necessary to produce pulpwood or roundwood from intermediate yields so the planner should make provision for these circumstances. For example, at the time of forest establishment future logging of intermediate yields can be assisted by using wider spacing between the lines and by sitting roads which can be used by the loggers. It is desirable that staff with logging experience are involved in the early stages of planning forest layouts to ensure that roading and compartment boundaries harmonise as far as possible with the proposed logging system for the future.

2. Logging on Difficult Soils.

On soils which are subject to compaction or which in wet conditions become unstable or greasy, cable logging may be the only feasible possibility if the areas being worked are to be left in reasonable

condition. It has been demonstrated that skidder logging is possible on this type of country but because of the amount of tracking necessary and the condition of these tracks at the completion of the operation such areas can be difficult and costly to re-establish. On clay soils a continuing problem in the winter months is keeping landings and roads in reasonable condition. Under wet conditions landings to which skidders or crawler tractors are operating soon become a sea of mud which is distributed onto the roading network by logging trucks. This inevitably is costly in terms of road metal, and working conditions on the landings are such that production rates can be adversely affected. In a well organised cable logging operation these problems can be eliminated.

3. Logging in Accordance with Catchment Authority Guidelines.

Catchment authorities are responsible for the protection of soil and water values and consequently are interested in any form of land management which impinges on these values. In the last few years logging, particularly logging in exotic forests, has come under their scrutiny. Some extravagant claims have been made by various people and organisations about the damage that logging does and naturally enough of this sort of comment tends to make headlines. A set of logging guidelines has been drawn up which, as far as I can determine, is operating satisfactorily. It will be interesting to see whether similar guidelines are drawn up for various forms of agriculture. To meet the requirements of the guidelines logging methods may have to be modified or in some cases new logging systems introduced. For example, contour snig tracks on moderately steep country can act as water channels and where they cross gulley heads can trigger off slips. Side casting of material from road cuttings may not be acceptable because of the possibility of the loose material getting into streams. In general it can be assumed on other than easy country cable logging systems are more acceptable to Catchment Authorities than tractors and skidders.

4. Logging and Economics of Cable Logging.

As already stated earlier in this paper under most circumstances skidder logging will be less costly than cable logging. The difficulty of course is to find exactly comparable operations but from cost statements for Forest Service operations it would appear to be 20-30% cheaper to log by skidder. However, even between different cable logging systems there are considerable variations in cost. A comparison of eight different operations in Canada using a range of equipment and different maning scales showed variations of 40%. If it is difficult to get meaningful cost comparisons for different logging systems it is even more difficult to compare the effect on operations which must be carried out before or subsequent to logging. It is well enough known that one of the major costs of forest development is roading. If it is possible to reduce the roading per unit of area established, then a significant cost saving can be made. Cable logging should enable roading densities to be reduced particularly on more broken country. Some work in Canada showed than between 1965 and 1976 the cost of roading increased fourfold whereas highlead logging costs increased only threefold over the same period. It would

therefore seem that the benefit to be gained in reducing road costs will increase with the passage of time. The point I wish to make here is that it should not be accepted automatically that skidder or tractor logging is going to be the most economic system if all factors are taken into account. The cost of forest establishment must be considered particularly in relation to roading and the cost of establishing the next crop following logging must also be taken into account. If all these factors are considered there could well be circumstances where cable logging is the most attractive system in economic terms alone.

5. Alternatives to Cable Logging.

Where difficult country has to be logged there appears to be no reasonable alternative to some type of cable logging system. Considerable publicity has been given to helicopter logging particularly now that there are machines with a capacity to lift more than 2500 kilos. Helicopters are of course being used on some operations in North America but I believe the economic justification is based on the need to keep a capital intensive utilisation plant operating at a certain level and to do this otherwise inaccessible timber has to be worked. It does not seem possible that helicopters will ever become competitive in New Zealand. In addition to the cost factor, and I understand that one of these large helicopters with a double rotor costs in excess of $5 million, these machines can only operate in wind speed below 40-50 kilometres per hour. New Zealand is a windy country and with these limitations there would be a considerable amount of downtime because of the weather. We are therefore going to have to rely on cable systems to work the difficult country.

6. Logging and the Availability of Trained People.

Over a period of many years New Zealand acquired a pool of labour skilled in the use of cable logging systems which were used almost entirely for working indigenous forests up to the late 1940s and early 1950s. With the introduction of the heavy tractor there was a move away from cable logging particularly in the North Island. Regardless of how desirable it might be to move back to cable logging, this will not be possible if the trained personnel with the necessary skills are not available. The introduction of a logging training scheme which has been promoted by the New Zealand Loggers' Association, LIRA, the Forest Service, NZ Forest Products and Tasman should go a long way towards ensuring that we do have the people available to meet any future demand. It is probably worth commenting here that private contractors who are responsible for a large part of exotic wood production will have to acquire expertise in cable logging if they are to be competitive in future.

Most logging will still be carried out with skidders or tractors and improvements on existing equipment can be anticipated but if contractors cannot tender for logging jobs in the difficult areas then their scope will be limited. If we do have the trained people available and if the particular situation points to a preference for cable logging then it is reasonable to assume that such a system would be adopted.

SUMMARY.

Cable logging requires a higher level of skill and in many cases is more expensive than tractor or skidder logging. Therefore, why the need for cable logging? If the exotic forests established on steep broken country, some of which is very unstable, are to be worked in a manner which will not impair soil and water values then some form of cable logging appears to be essential. There is a need to define more precisely the economics of various logging systems not only in relation to the direct costs of logging but also how they relate to the costs of other forest operations.

DISCUSSION:

HAMPTON: The Forest Service is leaning towards cable logging operations. Does this equate to a change in Forest Service policy?

O'NEILL: Not really. The Forest Service has changed the standards of logging required and the condition of cutover, but still demands that the logs are obtained as cheaply as possible.

CREQUER: Is there a danger in planning logging a generation ahead? Will there be changes in machines etc.?

O'NEILL: That is a poor excuse for not acting and it means loggers are just giving the action to foresters.

ROBINSON: In Marlborough there is a need to change the land-use zoning in order to have forestry and to do this a logging plan is required. It may become more common to plan for logging at the time of planting.

N.Z. INDUSTRY'S REQUIREMENTS - IMPLICATIONS OF PRIVATE FOREST OWNERS' DEVELOPMENT PLANS ON CABLE LOGGING REQUIREMENTS.

(J.E.HENRY - Director, Forestry & Sawmilling Operations, N.Z.Forest Products Limited.)

It is interesting to look back at the development of radiata forestry in this country before looking ahead into the future.

Large-scale planting was the main point of the late 1920s and early 1930s, followed by a period of little activity until the early 1950s when large-scale utilisation began to develop.

It is interesting to note that, between the 1930s and 1950s, there was a time when forests were felled to waste merely to obtain the tax relief that this gave, and that a loss of in excess of 20,000 acres of forest in one fire caused little anguish. It was a period of excess wood supply with many forest owners in trouble because forest maintenance costs were mounting and there was insufficient utilisation capacity available to take their wood and to provide a source of income for them.

In the 1950s and 1960s utilisation developed very rapidly until the point was reached where it was obvious that the demand for wood would outstrip the sustained output of the existing forest areas. Two things then happened. Firstly, there started another boom in planting of new forest and, secondly and more importantly from the logger's point of view, more intensive harvesting methods were put into practice.

Forest owners realised that they had to face up to logging the steeper country. This changed the tractor/hauler ratios and thinning of both first and second crops on easy country became more general. To start with these thinning operations were given to existing logging groups to do. These people could not see why they had to mess about with little bits of wood and why they had to be careful of the standing trees as they worked among them. The physical result was a shambles and the economics terrible.

It was not until people could be made to realise that thinning was the only way of obtaining increased quantities of wood, in the short term, that the operation was taken seriously and tractor thinning was accepted as a normal operation. It is interesting to recall the line that the arguments took; firstly, the operation was said to be physically impossible and, when it was demonstrated that this was not the case, the second argument that it was uneconomic was put forward. It was only when people were convinced that there was no other source of extra wood that the users accepted the higher cost of thinnings and

set about using them on a regular basis. In the long run, it is the overall average cost on the wood mix that really concerns the utilisation plant.

This situation prevails at the present time. However, until now thinning has been confined to what is generally known as tractor country. We are now in the position where we have to decide what we are going to do about the steeper country which is now approaching thinning age.

To thin or not to thin steep country, that is the question. It is interesting to see all the squirming and ducking and diving going on. It is a replay, with some minor variations, of the position that occurred when thinning was first mooted as a commercial proposition.

First of all, why thin at all? Why not do a slashing-to-waste and leave it at that until clearfelling? Great solution, especially as it puts any other decision 30 years into the future, by which time those in favour of this action don't expect to be around anyway!

Perhaps, at this point, it would be as well if I digressed for a moment to discuss rotation lengths. Let me nail my colours to the mast and state that I believe that forest managers growing Pinus radiata should have long rotations as their goal, and that I believe advocacy of short pulpwood or fuelwood rotations to be based on a complete misreading of the situation. With radiata, long rotations imply that a significantly greater proportion of the total yield will be thinnings.

Let me hasten to add that, no matter how one tries, there are always circumstances compelling a manager to some other position, but the shorter the rotation a manager aims for, the less room he has for manoeuvre to accommodate these pressures without loss of longer-term benefits.

Also, as a matter of policy and practice, I believe that all areas should have to produce the maximum quantity of wood commensurate with giving trees sufficient room to grow vigorously. In other words I believe in conventional thinning regimes.

So I see the need to develop hauler thinning to enable steep country to be managed properly. We cannot dodge country over 25 degrees slope either on environmental or cost arguments.

The forest manager, having frustrated all attempts to thin-to-waste and other devices to defer thinning as long as possible, then has to get his planners and loggers into a corner and make it clear to them all that steep country is going to be thinned and that no more procrastinating will be tolerated. From that point some sensible progress can be made. There comes a point where theorising must stop and be replaced by practical experience and it is not until one tries in one's own forest that real answers are produced.

The development of tractor and skidder thinnings was quite a painful process and there is no reason to believe that cable thinning will be any less painful.

Generally speaking, hauler country produces better quality trees than tractor country and every effort should be made to increase the length of rotation on these areas rather than on tractor country.

The first objective of thinning must be to keep the stand healthy and growing vigorously. The country cannot afford to have a situation develop such as was the case in the early 1950s where unthinned stands suffered heavy mortality from Sirex. It has been shown quite clearly that, provided stands are thinned on a regular basis, problems such as Sirex can be kept within manageable levels.

The second is to produce more wood. It is this second point that needs further consideration. This wood is produced in the forest in which all growing, tending, and roading costs have been paid so that every extra cubic metre of wood extracted is free of growing costs. It will be expensive wood to harvest because of the terrain, but one must consider the average cost of wood to the plant over a number of years and not this operation in isolation.

The alternative is to plant new forests further from the utilisation centre. Let us consider what this means. Indications are that hauler thinning wood is about $7 per cubic metre dearer than the average cost of wood. So, on this cost difference and at today's trucking costs, this wood is cheaper than any wood for a new forest that is about 80 km further from the mill. If you take into consideration land and added growing costs, and the worsening transport costs, the break-even point is probably nearer 40 km than 80 km. That, too, assumes that there is land available for the extra planting.

To develop thinning operations on steep country there are certain points which must be kept in mind and I will proceed to outline these:

- Markets must be able to absorb the amount of wood to be produced, and there must be a proven willingness to take this wood, or there must be sufficient pressure applied to see that it is used.
- There must be available equipment that is practicable to do the job.
- There must be sufficient area available needing thinning for the job, once it has started, to be carried on on a continuous basis.
- The operations should be started in areas that are well suited to the equipment available, and development work should proceed from the easier to the more difficult areas.
- The job must be undertaken by an open-minded contractor and supervisor. Both must be given every reasonable encouragement to succeed.

These conditions do exist in New Zealand today and it is necessary to get on with the job. It will require fit young men with some special training, but neither the manpower nor the equipment position should be regarded as being insurmountable.

It would be exceedingly easy for anyone to sabotage the development of steep country thinning operations and people should be on their guard against such action. Possible ways are:-

1. Failure to specify a quota and a target unit cost for the wood.
2. Choose the wrong contractor or supervisor.
3. Allow hauler thinning to be a last-on first-off operation if manpower or funds are scarce, or wood supply excessive.
4. Permit over or under-thinning.
5. Permit excessive planning or marking costs, or work study activities, to overwhelm the operation.
6. Worry unduly about bark damage, at least to begin with, and not to permit the removal of some dominant trees in initial operations. operations.
7. Prescribe something else for stands awaiting thinning so as to defer the operation.
8. Worry unduly about the cost before the operation has had time to settle down.
9. Give a low priority for load-out from hauler and thinning operations.
10. Put the contractor in the worst area first.

In conclusion, I would say that of course there is some wood which costs more to bring in than it is worth, and this is likely to include the smallest pieces from the more distant and most steep country. However, we cannot be very sure as to where this margin is now, and even less so for the future. Still less can we make an intelligent judgement if we are ignorant of the cost and production characteristics of an efficient hauler operation. Past experience suggests that, when we get properly to grips with it, costs and production will be much better than many fear. In New Zealand the time to find this out is now.

DISCUSSION:

O'SULLIVAN: Will the forest owners replant the extremely steep country which are almost cliffs as we saw on the field trip?

HENRY: Yes.

MANKTELOW: Two points. First the question of short or long rotations is not clear but we do need flexibility. This is best obtained if a first extraction thinning is done. Second, the training requirements may well be best met by thinning operations. Experienced men can then move to clearfelling with cable operations.

O'REILLY: Who is expected to do the work of thinning on steep country with cable operations?

HENRY: Contractors have benefits and advantages and may be favoured.

BUNN: We cannot foresee all the problems of the future but we

should try to do as much as possible towards future logging at the establishment stage. Short rotations are one option and equate to no thinning but this may not be correct in all circumstances, expecially considering the wood requirements of a large company. Thus we need flexibility and options.

HENRY: With regard to thinnings, everyone can say "Let's not do it", but we can't escape. Someone has to say "Do it now".

BUNN: It must be decided really early on whether or not thinning to waste will take place. You can't just leave it to grow on and then expect to thin it to waste.

REILLY: Is it true that better trees grow on steep country? Surely this only applies to some areas, for example, the pumice plateau. In many cases, such as at Thames, it is just not so.

CREQUER: We must not slavishly accept what experience is in other places. It is necessary to adapt to your own problems.

JOHNSON: Would it be better to build a large number of smaller utilisation plants rather than plant up land which will be very expensive to log?

HENRY: The point is that wherever the utilisation plant is located, it is better to reduce the freight costs and to plant close to the utilisation plant.

F.McINTYRE: There is not much encouragement to the contractor to stay in smallwood operation. These days we are getting pushed into steeper and steeper country with skidders, but don't receive any help to try new methods or techniques.

CREQUER: It is up to those involved. They need to ensure that the contract rate is not beaten down to a point where a bad job is done.

TERLESK: Low volume, low value wood is a big problem. The contractor always finds himself squeezed. They need more positive support.

DONOVAN: Forest managers as well as contractors need to be more aware of, and involved in, the problems. By understanding the difficulties and by better planning by forest managers more support can be given to the contractors.

A LOOK INTO THE FUTURE.

(Dr. M.C.PROBINE - Assistant Director-General, Department Scientific & Industrial Research.)

A paper of Dr. Probine's address was not tabled although a background paper titled "Access to/Use of Technology" is included in Volume II of these proceedings.

A summary of Dr. Probine's address is presented.

The original title of this part of the contribution was to be "A Look at Future Options". However this is not my field, but I have selected five main points that I would like to make to you. They are of a general nature and not specifically related to cable hauling, but I hope that you will find them of interest. I'd like to begin as a member of N.Z.Planning Council, and review the national economic situation briefly.

Recently the Planning Council put out a gloomy review of New Zealand's economic position. We have a deficit in our overseas' receipts and payments account which is now 6½% of gross national product and we should certainly be aiming to reduce this not more than GNP. We have negative economic growth, about -½% per year. We have a falling real income per head, a drop of 14.4% per capita in the years 1973-76. We have unemployment higher than any time since the Depression, and it's still increasing. We have a stream of skilled New Zealanders leaving for overseas, 27,000 in the 1977 calendar year. Continuing high inflation, although there are indications now that that is beginning to drop. We have tensions in the industrial and social scene and we have a slackening momentum in our export drive. External influences have had a quite serious part in causing some of our problems. Terms of trade, if you use 1956 as a base year equal to 100, are now running just above 70, which means that we are getting very much less for our export earnings by way of imports than we used to. One of the dominant features of this adverse balance of payment has been the big rise in import prices, particularly in imported fuel which now uses 15% of our export receipts compared with 5 or 6% a decade ago.

But not all our troubles are due to external causes. Internal influences are there as well. We have stagnant agricultural production for the last 7-10 years. There was some chance of an increase in agricultural production this year, but of course with the drought and the labour troubles, this doesn't seem to be very likely. We have had to dampen down the economy in order to get the balance of payments deficit in hand and to reduce inflation. There has been a very significant rise in Government spending, particularly in Welfare payments, like Social Welfare and National Superannuation. And though we don't have the highest tax in the world, we do have the highest tax take from Income Tax, and this has caused tremendous dis-incentive, particularly of willingness of people to work overtime and so on.

What do we do about it? We have got to earn more and same more overseas exchange and a major objective should be to get that balance of payments deficit down to not more than 2% of GNP. We have to try and get some growth back into the economy. At least 3% growth in GNP per annum if we are going to avoid some of the social strains that we see at the moment. We have to reduce waste in human and physical resources, and we have to keep costs down so that we can compete in the world at large. We must be more efficient, therefore, and most cost competitive in all our operations, yours as well as mine. We must encourage people with energy and drive. We must encourage excellence, innovation and enterprise. One of the major recommendations of the Planning Council, which receives very little discussion, was that we must allow market forces to operate to a greater extent than they do, with less regulation, less control and less intervention by Government and we do need some tax reform.

I would now like to single out aspects which I think are more relevant to your particular type of operation and remember that I listed efficient use of new and existing capital. The use of up-to-date and improved technology, more efficient methods and a drive for innovation, new processes and new products. One of the first questions we have to ask is how do firms get access to new technology, to new methods, and how do they get the know-how to develop new products and new processes? Many firms in New Zealand, including in your industry, are too small to employ their own specialist development or research staff. Big companies can, and they do, but for those smaller organisations that have to be at the forefront of this drive to restore our economic situation, they have to be aware of the organisations that exist to help them. And one of the best ways in the technological field to assist small firms and companies, is for them to go into a group research effort, that is to form a Research Association, as your industry has done. This gives access to information services so that you are brought up-to-date on new methods, new machines, sources of investment, and overseas development trends. You have a method of evaluating new products so that you don't waste your valuable resources and the country's valuable resources on inefficient machines and inefficient methods. It enables a group of small companies and small operators to tap a much wider range of human resources that are there to help.

For example, the Logging Industry Research Association, in a very short time of its existence, has had access to DSIR in a number of areas. Solving corrosion problems, testing, stress analysis, the possibility of using the earth resources technology satellites for land use and forest inventory studies, are possibilities. The Consumer Institute review in chainsaw testing and bulletins have been issued in that area. The RA has given you access to universities. Professor McCallion is from the University of Canterbury and is here working with LIRA and looking at your problems and your methods from a fresh point of view. University people have been used to assess the value of leaving buffer strips or not. The Productivity Centre has been roped in on interfirm comparisons. The Forest Service has been used to provide data on costings and was also involved in the testing of chainsaws and industry involved in evaluations of machinery and systems. So that one of the advantages of group research is that it has given you access to quite a wide range of other organisations that you might not immediately have been aware of, or had easy access to, as small groups.

I spoke earlier about being cost competitive and, as I understand it, cable operations are more costly than skidder operations. They have the advantage that they use less energy and of course they are more suitable for some of the types of country that you may be in now and getting into in the future, but they are more costly and it is very important that New Zealand costs should be kept down, particularly on the export market or on the products that are going for export, compared with Australia where loggers are operating on better country and closer to the end users. It is very important that if we are going to be cost competitive, we use the best technology and the best methods to get these costs down, particularly in the more difficult country as well as we can.

One of the other advantages of an RA is that it gives you access to sources of investment finance, and the Development Finance Corporation has an applied technology programme to assist people to get into research and development, particularly into development on their own and it provides grants, investment finance and so on on very favourable terms; knowledge of these can be obtained through your Research Association. I am not giving a particular plug for LIRA, although it may sound like it. I am really giving a plug for increased efficiency, increased use of new technology, and increased use of better methods.

I would now like to turn my attention briefly to a couple of other planning considerations which I think are important to your industry now, or could be in the future. The two that I thought I might mention in passing were energy and land use.

So far as planning is concerned, I think that your industry is probably in better shape than most other industries in this country. Indeed, the kind of planning that has gone on in the forest industry is an example of what should be done much more widely in this country. It is planning that has been done jointly by industry and by Government, and a good degree of cooperation has developed between the various aspects of the industry; and furthermore the plans have been published for discussion and action. From a general planning point of view I think the industry is in good shape. You are in a much better shape than most New Zealand industries in this respect.

Some new planning actions are going on right now which may alter the future to some extent. And the first is under the heading of "Energy". The forest based industries are very heavy users of energy. They contribute 10% of N.Z.'s factory production, but they consume 20% of all external fuels utilised by all N.Z. industry, excluding transport. In my view, this will not be good enough in the future. Technologies already exist or are being developed for the forest based industries to do much better and to become more nearly sufficient in the use of energy. In your future planning, you will have to pay much greater attention to energy conservation utilisation of waste for energy generation and not be such a tremendous drain on energy resources of this country. Admittedly logging is not a big user of energy, compared to the industry in general. This brings me to consider what the future role of your energy might be. I use the work 'might' advisedly, in the wider energy scene; and I speak of the possibility of using wood as a raw material.

DSIR is to release in the next few weeks a Planning Document on transport fuels. A working party within the Department has been asked to undertake a perspective analysis of the transport fuels area, to see what the national plans are, the international plans are, what indigenous resources we have, what future fuels we could use in the future, what technologies are required to get from those indigenous resources to end use fuels. To produce some general planning goals and on the basis of these, we will select specific projects which are then part of a well focused effort. At present we import 90% of transport fuels and we spend 15% of export earnings to pay for it. As a new oil importing country we are very vulnerable; there is uncertainty in the supply price of oil. If we don't strike oil, we will have to find ways of being more efficient in the use of fuel, and we will have to produce transport fuel from indigenous resources.

This report suggests that a possible timetable for transport fuels could be something like this:-

- By 1980 15% self sufficiency by using condensate, compressed natural gas and liquid petroleum gas.
- By 1985 33% self sufficiency by using the above together with methanol blended in gasoline.
- By 1995 self sufficiency by using methanol fuel, gasoline from natural gas or wood, and wood looks like a good prospect.
- By the year 2005, 95% self sufficiency by adjusting the extent of the proportions of gas, energy farming or wood and coal based steams.

It may well be that, in addition to satisfying existing markets, the forest industry may have to satisfy the need for transport fuels using wood as a raw material for gasoline.

One other aspect of the future concerns that of land use and the environment. Any large-scale increase in forestry can produce large-scale land use changes in some parts of the country. We have the example of the Southern King Country region where it was proposed to use 60,000 hectares of land and put them into forestry, and this has some important planning implications and lessons, I think, for your industry. There was a very responsible approach in my view by the company concerned which undertook an impact audit, or an environmental audit, even through it wasn't compelled to do so. When that was published, concerns arose regarding the use of high quality farm land being lost to forestry, the resulting run down in rural services, decline in small centres and population drifts from the region. A cooperative study was set up to look into this - taking into account national, regional and local aspects and social, economic and environmental objectives. The Government expressed its intention of assuring that the expansion of forestry had as little affect on existing agricultural land as possible and no undue affect on the environment. The situation is that, after three years since the private company voluntarily completed the environmental impact report, we still seem to be some distance away from making firm decisions. As a member of the Planning Council we are very keen on participative planning, but unless we develop procedures so that we can undertake this kind of exercise and make sure that we have wise planning, this will be a very bad thing. And this is an important thing, I think, from the point of view of the forest industry, because land use is going to be a very important consideration in the future. Horticultural production is

increasing very rapidly in this country with land that was previously used for pastoral agriculture being diverted to barley and maize, sub-tropical fruits, vegetables, ornamental trees, all sorts of new crops that we have never grown here before commercially, such as passion-fruit, feijoas, tamarillos, avacados, melons, blueberries, aubergines, artichokes, and so on. That pressure on the high producing agricultural land for horticultural production will tend to force pastoral production back into the hill country and therefore in direct competition with some of the land which has been so suitable for forestry.

I think, therefore, in your industry one of the challenges of the future is to be able to make sure that you are aware of this and that this planning is done wisely. Briefly regarding the environment, I do think it is very important that your case is heard, that people understand your industry better and that they have some sympathy for what you are trying to do.

I would therefore like to sum up briefly by saying as a country we are in a very serious economic situation; it requires increased efficiency and use of resources from everybody; we must compete cost-wise, design-wise, quality-wise in the export market. This means new technology. It means that every branch of industry has got to be in touch with the latest methods, the latest technology, the best equip-ment, the most efficient, and this means that LIRA, in my view, has a very important part to play.

Finally, you will have to consider in the future the fact that there may be quite new uses for your products and that increased competition for land may involve you getting into new land use situations and into other kinds of country, and that seems to me to be relevant to the discussion that will take place during this seminar.

DISCUSSION:

HAMPTON: Land is needed for forestry now. Agriculture has not been doing very much improvement in land use, so surely district scheme plans must give a better hearing to forestry.

PROBINE: It is up to industry to develop an understanding amongst the community. Right now, conservationists have a very intolerant attitude towards forestry and this needs to be combatted by the forestry industry.

CREQUER: What is the status of methanol at the moment?

PROBINE: The project is going well. The gasification route is looking good and 70% of the technology has been proved.

TUSTIN: Where did the DSIR obtain the harvesting costs for steep country from in their fuel planning exercise?

PROBINE: These were obtained from N.Z.F.S. They have already been revised and may be open to criticism. This is why we want discussion and feedback on our proposals.

SPIERS: Does your summary indicate a need to change the way in which fuel is used in forestry?

PROBINE: They still need to use gasoline because it involves the least need to make large reinvestments in our fuel burning equipment. However, the real costs must go up. It is expected to be increased by 70% by 1990.

WILSON: Since in forestry diesel is a major fuel, what use will the new developments be to us?

PROBINE: We are getting interesting information on this question but I do not have the up-to-date answers with me now.

SUMMARY:

(Mr P.C.Crequer.)

Mr O'Neill showed that a topographic study of New Zealand carried out by the Government indicated there would be an increase in logging on steep country. It will be essential to plan at the time of establishment for both the clearfelling and thinning of this country. Some environmental considerations will arise, and perhaps people will be urged to use other methods of logging such as helicopters. However, overseas costs indicate that this would be impossible for New Zealand. When roading problems are taken into consideration, cable hauling systems seem a good alternative.

Mr Henry spoke of a resistance to new or apparently difficult things. He inferred from the data available that thinning steep country was a must and that this must be done with cable systems. He showed that hauler thinnings can be economically sustained if you take the distance from the plant and the plant economies of scale into account.

Dr. Probine painted a disturbing economic view of New Zealand. This indicated a strong need for research and a promotion of the idea that small organisations should should pool their research effort in a research association. Forestry industry planning is said to be good but we must look in our forward planning to the consequences of the energy problem and the competition for land use.

- SESSION II -

REVIEW OF THE PRESENT STATE OF KNOWLEDGE:

Chairman - J.R.Tustin,
Forest Research Institute.

NEW ZEALAND RESEARCH INVESTIGATIONS:-

- "CABLE LOGGING EXTRACTION TRIALS - GOLDEN DOWNS 1964-68."
  (R.H.ROBINSON - Logging Officer, Nelson.)

- "FOREST RESEARCH INSTITUTE'S WORK ON CABLE LOGGING."
  (G.MURPHY - Scientist, Forest Research Institute.)

- "LIRA CABLE LOGGING RESEARCH INVESTIGATIONS."
  (V.F.DONOVAN - Research Officer, LIRA.)

"OVERSEAS INVESTIGATIONS"
(J.J.K.SPIERS - Director, LIRA.)

"FOREST RESOURCES - NATIONAL PLANNING MODEL
IMPLICATIONS. AREA - LOCATION - FUTURE TREE CROP."
(H.H.LEVACK - Senior Forester, N.Z.Forest Service, Wellington.)

CABLE LOGGING EXTRACTION TRIALS - GOLDEN DOWNS, 1964-1968.

(R.H.ROBINSON - Logging Officer, Nelson.)

SUMMARY.

A N.Z.F.S. four-man crew was engaged in hauler thinning trials at Golden Downs forest for approximately four years. During that period a number of small hauler units were used in various applications to try and find economical methods of extracting thinnings from country considered, at that time, too steep for economical extraction with tracked machines.

Most of the initial trials were carried out in Douglas Fir areas as there was a reasonable demand for all produce and it was far easier to carry out trials in this species.

A New Zealand Taylor & Andrews side-by-side double-drum hauler was manufactured to N.Z.F.S. specifications and after some teething problems, this unit proved most effective and was operated for approximately two years at Golden Downs.

Two other haulers were purchased for trials. Both were equipped with VW industrial engines.

An Austrian-made Krasser hauler was far too light in its general construction and the dog clutches were difficult and slow to engage. The unit was very hard to hold steady and,after short trials, was abandoned.

The Morito winch manufactured in Japan proved to be a far superior unit with good controls, line speeds, and of solid construction. The unit was fitted with a capstan drum for endless line operation but this was not used in the trials. The hauler operated for approximately two years.

Trials began in 1966 with downhill thinning, and later moved into a small trial thinnings on a side hill road and then to uphill operations. This paper progresses through the more important trials where there were both negative and a few promising results, but basically to date the low value of material from thinnings precludes the use of haulers in most areas.

One major system was developed to extract post material, and a booklet *"Gravity Extraction of Thinnings from Hill Country Wood Lots"* was published by the N.Z.Forest Service in 1969. Although the title suggests that this method is strictly for the small wood lot owner, it is considered that multiple use of the system could be instituted by major forest owneres where suitable post and pulp markets exist.

THE FOREST RESEARCH INSTITUTE'S WORK ON CABLE LOGGING.

A REVIEW OF ITS MAIN FINDINGS.

(G.MURPHY - Scientist, Forest Research Institute.)

SUMMARY.

Introduction:

The increasing importance of cable logging in the future is already accepted and it is expected that by the turn of the century, approximately half of New Zealand's annual exotic cuts will be logged by over 300 cable logging gangs. The past decade and particularly in the last four years, FRI has carried out eight extensive studies using standard techniques on cable logging operations and has also conducted a survey of cable logging to see where we currently stand. This paper reviews the general findings of these studies.

The 1974 Logging Industry Survey:

Fourteen percent of a total exotic cut of 7.5 million m^3 was cable logged. Of this, 14 highlead gangs averaging 44,500 m^3 per gang logged 60% of the volume, and 11 skyline gangs averaging 38,500 m^3 per gang logged 40% of the volume.

Availability and Utilisation:

As found in overseas research, cable logging operations tend to have high mechanical availability but low utilisation levels. Studies of five different cable logging operations indicated an average of 92% availability but only 45% utilisation. These low utilisation levels are generally related to the amount of time shifting ropes, moving the hauler, skid work and loading interference.

Factors Affecting Productivity and Production:

Extraction distance and haul volume affect the productivity of cable operations. Varying haul volume has little effect on cycle time, and as a result has a great effect on productivity. Increasing the extraction distance increases cycle times, reduces the number of cycles per hour and thus reduces productivity.

The Effect of Tree Size on Productivity and Production:

The effect of tree sizes on productivity is complicated by many factors. It is not fully proven that productivity increases as tree size increases. The size, and versatility, of high capital cost machines and high labour involvement influence the results, but more studies are required to make accurate predictions. Production increase with tree size is also complicated by mechanical availability and the number of productive hours worked per day.

The Importance of Breakage:

Directional felling to reduce breakage during falling and extraction on cable logging operations is not common. Tentative results of studies show that as mean tree volume increases, mean piece size volume as a percentage decreases. To obtain optimum machine capacity per haul, a one tree, one piece situation is desirable.

Method Improvement:

Studies to assist in improving methods include rope shifting for highlead operations, the use of pre-set strops and identifying the best place to carry out log preparation.

Labour Experience:

FRI studies have indicated that the human factor can over-ride all other physical factors. Inexperienced or non-motivated crews are often low-producing crews. Training is essential at all levels if cable logging is to be a successful and acceptable method of logging.

Hauling Phase Most Expensive:

A study of highlead operation showed that 55% of the cost is in the hauling phase. The actual percentages for different methods may change but the relative importance of the hauling phase is unlikely to change. Method changes in other areas of the operation could increase hauling production but would have little effect on the overall unit costs.

Thinning Costs and Production:

Cable thinning on steep country is more costly than clearfelling. The main influence is the smaller tree size found in thinnings.

Conclusions:

FRI's studies to date have been primarily in old crop untended stands. Future studies will be towards gathering pertinent data for application in second generation radiata stands.

LIRA CABLE LOGGING RESEARCH INVESTIGATIONS.

(V.F.DONOVAN - Research Officer, LIRA.)

SUMMARY.

Introduction:

LIRA has given priority to cable logging investigations after extensive discussions with industry, and its Research Advisory Committee indicated that priority should be given in this area.

- It has been recognised that there has been a general loss of skills in the art of cable logging over the past decade in both managerial and operational aspects.
- Many people considering cable logging now or for the future have limited knowledge of equipment, systems, planning and technical detail on which to base decisions.
- LIRA's objectives are, in the first instance, directed at improving the current state of knowledge.

LIRA's Research Objectives:

To guide machine and equipment selection specifically in the use of units suitable for smallwood harvesting and thinning.

To increase the knowledge and present facts on equipment methods and operating detail with the aim of increasing awareness of problems and the necessary skills to overcome them.

To improve techniques suitable for application in thinning and clear-felling for N.Z.conditions.

Research Programme:

A Working Group was established to co-ordinate research with other interested parties and to discuss the direction aims and objectives of their research programme.

LIRA's research to achieve its stated objectives is in three main areas:-

(1) Extension.

This includes this seminar which not only presents up-to-date information but also aims to identify areas requiring further research.

A cable logging handbook aimed at supervisory and operational management level is currently under preparation.

A model hauler is being set up to test the feasibility of, and demonstrate different systems.

(2) Present State of Knowledge.

A detailed survey to gather data on machine characteristics and the conditions udner which they were being operated was conducted in late 1976 and 1977.

Machinery and Work Evaluations have been conducted on smaller sized haulers and these will continue as new equipment becomes operable.

A questionnaire was recently circulated to all forest owners and logging companies to ascertain in more detail the future size and scope of cable logging in N.Z.

(3) New Equipment and Techniques.

Reviews of relevant past research has indicated that breaking-out is one area where a significant proportion of time occurs in the operating cycle. LIRA is to analyse whether different types of carriages can be used to reduce this phase.

Carriages now common to N.Z. have recently become available and studies to evaluate their potential are being initiated by LIRA.

Thinning equipment and techniques using cable logging equipment are currently being examined and reported on.

NORTH AMERICAN AND EUROPEAN RESEARCH ON CABLE HAULING PROBLEMS.

(J.J.K.SPIERS - Director, LIRA.)

SUMMARY.

This paper examined briefly the main lines of research under two broad headings:-

- The studies primarily concerned with productivity, costs, and environmental impact.
- The development or methods and machinery.

Operational Efficiency, Productivity and Costing.

Two important series of studies stand out, these being a series conducted by FERIC and a series known as the Pansy Basin Study by Oregon State University.

Prior to these studies, environmental concern in the Nelson district of British Columbia resulted in Wellburn examining and reporting on alternative methods for steep slope logging. This study was initiated in 1973 following the B.C.Forest Service's decision to restrict tractor use between 50° and 70° slope and prohibit tractor use over 70°. This ruling triggered investigation and research to develop ways and means of economically logging such terrain. The report identified the importance of planning and the main findings were:

1. The difficulty and expense of logging by any method increased as slope increased.
2. Tractor logging was the most economic and most adaptable. Much damage to soil values could be reduced by good planning and supervision.
3. The biggest impediment to the introduction of cable logging in a new area was lack of trained personnel.
4. Short distance simple cable hauling systems worked in conjunction with tractors would initially give the best opportunity for economically acceptable results.
5. Stumpage values would need to be adjusted.

FERIC's comparative evaluation of cable systems (in 1976) identified the following key features:-

- Mechanical availability was 90% or greater.
- Machine utilisation varied widely from 42% to 87%. The effectiveness was influenced by experience, planning and management.
- Break-out time was the largest time element at 25%. Rope changes took 10%-15% of operational time.

The FERIC report concluded that the major technical problems to be solved were:-

- Better systems integration.
- Design of inexpensive machinery.
- Improved planning and management.

The Pansy Basin Studies compared production rates and costs between highlead, shotgun, North bend, running skyline, balloon and helicopter systems under various conditions of timber, terrain, and range of management prescriptions.

A deficiency in FERIC's earlier evaluations and in the Pansy Basin Study was that only the yarding systems were studied and the full implications of roading and other overheads that affect total cost of logging were disregarded.

A more recent FERIC study makes a theoretical cost comparison of highlead versus long reach alternatives and overcomes the earlier deficiencies by examining total cost of systems including roading. In this study they found that although highlead had the cheapest hauling cost, the total cost picture indicated that better overall costs were possible for all of the longer reach alternatives except balloon. Hauling costs represented the highest cost component for each of the five systems studied and the average hauling cost for the long reach skyline systems were all greater than highlead. The report emphasised that long reach systems are inherently more complex and require higher standards of planning, supervision and mechanical servicing to maintain productive levels.

Thinnings operations are a continuing problem with costs always greater than in clearfelling. Studies in Germany based on 19 operations examined techniques, production, costs and degree of damage to residual stems, and compared the breaking-out of logs with the primary hauler to the user of a radio-operated winch. These studies highlighted the following:

- Higher intensity and longer intervals between thinnings gave possibilities for reduced costs.
- Parallel hauling directions reduced line changing and setting-up times.
- Downhill hauling was more difficult.
- Combined selective thinning and strip cutting gave higher production.
- The radio controlled winch for pre-hauling indicated possibilities for improving costs.

Development of Methods and Machinery.

The question must be asked, where should New Zealand go in the future, given concern for increasing physical difficulties and rapidly escalating capital costs? Can we use lighter, less powerful, cheaper haulers? Can we develop the flexibility to cope with all terrain conditions and partial logging problems?

Running skylines with interlock reduce power requirements and give greater operating flexibility. Currently interlocks are expensive,

but the technology exists and the concept is simple. The engineering challenge is to reduce the size and cost of machines.

Endless line systems, as developed by the Norwegians and Japanese, present a light inexpensive machine option with great flexibility. By using capstan drums with drum synchronisation problems are overcome, although rigging and shifting are more complex.

Intermediate support systems, which employ a tight skyline and hangers, give lift for break-out and partial lift along the haul road, with significant advantages on convex terrain. Rigging time can be reduced and light machines used.

Automation by radio control is a simple means of providing a planned programme of sequence of movements and its use could have greater potential in the future.

Summary.

New Zealand is at an immature stage of development in cable logging systems. The potential to improve our technology is immense. These questions must be asked:-

1. Is there a possibility of cable logging competing on favourable economic terms with other systems?
2. Given that cable logging is more expensive and difficult than other methods, under what circumstances should it be used?
3. What improvements in systems, machines, planning and management of cable logging are necessary to make it more efficient and economic?

ESTIMATED CHANGES IN AREA VOLUMES AND CROPS THAT WILL BE HARVESTED BY CABLE LOGGING SYSTEMS.

(H.H.LEVACK - Senior Forester, N.Z.Forest Service, Wellington.)

SUMMARY.

Basic data used in this paper has been drawn from a revision of the National Forestry Planning Model. This has regard for the present conditions of forests in New Zealand and attempts to project the consequences of forest management strategies.

The historical pattern of establishment has a major impact with two major planting booms, lates 1920s to early 1930s, and that of the 1960s and 1970s.

Current new planting of some 45,000 ha per year is assumed to continue until suitable land for afforestation in the regions run out. Tree rotation lengths are assumed to be 30 years for Radiata and 55 years for Douglas fir. Radiata pine makes up 75% of roundwood volume logged and by the year 2010, this ratio is expected to rise to 95%. Regions currently well endowed with exotics will continue to be the major areas although losing somewhat in relative terms. In 30 years from now the total available roundwood will almost quadruple.

The volume to be logged by cable means has not been well defined. However it is estimated by implication from various sources that the present 18% logged by cable means will gradually increase to 44% for the period 2011-2015.

Of significance also is that the relatively rapid drop in the clear-felling age over the next 15 years will mean a drop in piece size from a mean dbh of 63 cm to 43 cm, volumes recovered per hectare are also expected to drop from the current average of about 746m^3 per ha to approximately 622 m^3 per ha.

Improved genetic planting stock and improved silvicultural treatment should mean better formed trees of a more uniform size.

Limited information is available about how much land considered suitable for afforestation is likely to be cable logging country. Data needs to be collected and logging systems maps formed, so that satisfactory estimates of the increases of finance, labour and machinery that the logging industry will need, can be calculated.

SUMMARY.

(J.Tustin.)

The first speaker, Ralph Robinson, dealt with thinning. He has put the practical experience of the experimental logging gang in Nelson on record, for which we should be very grateful. If we take notice of Ralph's paper, we should not need to cover the same ground again in terms of operational trials. His work related primarily to Douglas fir with its characteristics of high volume per hectare for removal, low trimming content, and good marketing. These factors need to be borne in mind in relating his experience to Radiata pine. Ralph, like others, noticed the need for skill and training in his crew. He concluded after four years of experiments, that cable thinning is feasible at a price. He also noted that cost/price relationships are important and as thinnings are not worth much, we can't afford to spend much money getting them out. Ralph is a man who believes in skidders on steep country, so I was surprised he "weighed in" with such a lengthy statement without saying the word "skidder" once. Congratulations, Ralph.

Glen Murphy was the second speaker. He said productivity and costs are closely related to tree size, amount of breakage insofar as it affects piece size, haul volumes, machine utilisation and the team work and experience of the gang. He advocated more attention to these factors and suggested we start with directional felling to maximise average piece size. He also pointed out that the hauling phase is 55% of the loaded on-truck cost, and for this reason hauling should be a major focus for cost reduction.

Our third speaker was Viv Donovan. He gave a good over-view of LIRA's cable logging objectives current and future programme. He stressed the need for an injection of skills at all levels from the logging manager to the bushman. LIRA plan a major and continuing activity in cable logging education and I urge you to support their programme as you are doing today. Viv said there were prospects for improving operational efficiency and highlighted carriages and breaking-out as two important areas for future work. His basic criteria for small skyline yarders included capital cost. I wonder, Viv, how low is low?

Jim Spiers gave a paper with a lot of meat. He pointed out that there is a lot happening overseas and that we need to keep abreast of it and to interpret it for our own situation. The key word is "interpretation" because we have our own peculiar working environments, including higher capital cost and lower labour cost compared with, for example, North America. We do not want to add to the ever increasing heap of rusty machinery abandoned around our countryside. One gem in Jim's paper which appealed to me was "simple systems provide the best opportunities for economy". As a principle to follow, this makes sense to me.

Hamish Levack was our last speaker. He quantified the expansion we should expect in N.Z.cable logging. On his admittedly round figures, our cable logging industry will expand 10-11 times its current size by the year 2011. As this happens, cable logged wood increases from 14% to 44% of the national harvest. What will this change do to our cost structures? Hamish also pointed to the smaller trees and lower volumes per hectare we will be faced with in the future. How will this affect cost structures? His plea for a better data base for planning the cable logging industry at a national level must be heard. It is important to all of us.

- SESSION III -

LET'S LOOK AT SYSTEMS:

Chairman - J.J.K.Spiers,
Director, LIRA.

Presentation - V.F.Donovan,
Research Officer, LIRA.

A group discussion session centred on diagrammatic presentations of all the principle systems options and their variations.

The session aimed to examine operating characteristics and limitations of current N.Z.systems, and to explore the potential for introducing new systems and any factors that might limit their application in New Zealand.

LET'S LOOK AT SYSTEMS.

(CHAIRMAN - J.J.K.SPIERS, Director, LIRA.
SYSTEMS PRESENTATION - V.F.DONOVAN, Research Officer, LIRA.)

SESSION FORMAT: Group Discussion.

Firstly Donovan presented overhead projector diagrams in two parts:-

Part 1: Existing New Zealand systems - briefly outlined the principles, various operating options, and introduced the main questions or problem areas for discussion.

Systems discussed: Highlead, Northbend, Southbend, Slackline, Timbermaster thinning, Golden Downs experimental thinning. *(See Diagrams Vol.2 Appendix I.)*

Part 2: Overseas Systems - (as for Part 1.)

Systems discussed: Gravity return, Running skyline and Slack throwing carriages, Multi-span skylines, Endless rope systems, Austrian block on guy system. *(See Diagrams Vol.2 Appendix I.)*

DISCUSSION GROUP CHAIRMEN:

Glen Murphy
John Galbraith
Mike Colley
Simon Vari
Geoff Wells
Cedric Terlesk

The seminar split into groups each consisting of approximately 16 people (pre-selected to give a balanced coverage). A set of questions were to be answered on the different systems with each group starting on a different question so that all points were covered.

Discussion group chairmen reported back to the reconvened meeting at the end of Part 1 and Part 2.

PART 1: EXISTING SYSTEMS.

GALBRAITH'S GROUP.

QUESTION: Examine limitations to effective application of the system.

1. Highlead: There is an interaction in the lines between power and braking force to achieve lift. Concave slopes and short hauls with a maximum distance of 300 m most suitable.
2. North Bend: Requires clearance but has the ability to lift in the system when the tailrope is tensioned or logs hit an obstruction. Maximum spans usually to 600 m. Has tail-hold limitations.
3. South Bend: Breaking-out speed halved due to extra purchase, but higher breaking-out force. This can cause problems with broken strops and additional tensions on the skyline especially if the operator changes from North Bend and is not familiar with the stresses imposed. Less lateral yarding capabilities because of double purchase and the possibility of rope platting.
4. Slack Line: Limited lateral yarding capabilities. Power is required to lift the skyline and on most haulers the skyline drum is now a working drum i.e. the drum is geared down and slow. Rope crushing problems due to high tensioned line being wound on and off the drum.
5. Timbermaster Thinning Methods: Suitable for smallwood applications but limited lateral yarding due to having to pull slack manually.
6. Golden Downs Thinning System: Limited to 30 m side hauls. Rope twisting a problem.

General Summary: Many systems can be used, therefore operators must be aware of these and flexible in their approach.

MURPHY'S GROUP.

QUESTION: Examine situations where existing systems are used and estimate productivity expected.

Larger companies are more suitably placed to use more complicated systems. Small operators usually have to use what equipment is available. Highlead systems are considered most suitable for new crews as the system is less complicated and rope shifting is quicker. However, they require large landings especially with fixed spars. Rope shifts can range from five minutes for highlead, to 25 minutes for scab skyline.

COLLEY'S GROUP.

QUESTION: Examine setting up time and line shifting.

Setting up time - half to one day for mobile rigs with setting shifts of 4-8 hours. Two days to set up with non-mobile rigs. Line moving times 5-15 minutes with a mobile tail spar. Four hours to re-set a standing skyline or 2½ hours with a slack skyline. Comment that some people wind in the skyline and take it out again, rather than move rope across to the new haul line. In localities such as the Nelson or Coromandel area where there are generally small trees along ridges, more time is involved in setting up due to having to use extra tail hold stumps for anchors. Pre-rigging as used in the U.S. should be looked at more in New Zealand. Road and landing requirements two-stage hauling has not proved successful. Weak points in the system include clearing logs from under ropes, and loading interference of trucks. This is particularly so when piece sizes are between 0.75 m^3 to 1.5 m^3.

VARI'S GROUP.

QUESTION: Examine setting up time and line shifting. How this should best be done with each system. Also desirable roading and landing requirements.

Setting up time for mobile spar - 2 hours, and for a fixed spar - 1½ days with a crew of 3. An extra spar should be available for pre-setting. Landing size should be equal in radius to a tree length. Mobile haulers can be used to reduce landing size. Two-stage hauling can cause union problems. Front-end loaders should be used more than cable loaders. The use of bark on landings could reduce metal usage. Planning is essential at an early stage and although topography determines outright road spacing in most cases, if choices are available when landings are formed, the cost of landings, roading and skidding should be calculated and compared with the cost of skidding or hauling.

WELLS' GROUP.

QUESTION: How does the hauling system set the overhaul logging system of felling, preparation, loading and trucking?

With felling, a herring-bone pattern is best if this is possible, and if machines have sufficient power butt hauling should be used to reduce breakage. Cross-slope felling is necessary if trimming is to be done in the bush. Felling cannot be done in isolation but to assist in the breaking-out phase, and more emphasis should be placed on the skills of the bushman. Trimming depends on tree types, with trimming in the bush not needed on old crop radiata in pumice country. However, in areas such as Coromandel, trimming must be done in the bush. New crop radiata will probably require trimming in the bush. Log preparation in the bush is only an advantage if using a

grapple on short hauling in reasonable country to reduce interference between hauling and log preparation. No real difference between rubber-tyred front-end loaders or cranes because of using cable hauling systems as this is usually dependent on the number of segregations. However it is important to get logs away from under the ropes as soon as possible.

TERLESK'S GROUP.

QUESTION: Examine manpower requirements within various systems.

All systems have a place depending on topography, piece size, finance, size of forest, level of production required, available equipment, roading, and landing costs. Discussion should look at the new generation forests as these trees will have different characteristics and could influence what might be used in the future.

PART 2: FUTURE SYSTEMS.

TERLESK'S GROUP.

1. GRAVITY RETURN: Advantage of low capital cost, faster line speeds and reduced rope shifting time. However, has disadvantage of needing increased lift and suitable topography. Use in New Zealand is limited by topography.

2. RUNNING SKYLINES: Advantages - lighter ropes can be used, therefore reduced power and better log control. Can operate with a slack throwing carriage. Disadvantages include higher costs with the interlock and increased maintenance times. Use in New Zealand dependent on topography.

3. MULTI-SPANS: Advantages - reduced roading and landing densities. Disadvantages - increased set-up time and reduced line speeds. Has potential in N.Z. such as Parkes' operation but mostly for smaller tree logging only.

4. ENDLESS ROPE SYSTEMS: Advantages of lower capital cost, reduced power requirements and small landings. Could be used where low production rates are a requirement. Disadvantages are rigging time, and the limitations of topography.

5. BLOCK ON GUY SYSTEM: Tree length logging in N.Z. requires large landings. Although cut-to-length in bush could reduce this, it would result in higher logging costs. This system could be used where landing size must be restricted.

WELLS' GROUP.

1. GRAVITY RETURN: Has a big advantage for all machine sizes. The best potential in N.Z. is in the smaller machines i.e. under $40,000. Suggested potential use with Idaho Jammer type machines.

2. RUNNING SKYLINES: The cost of an interlock system tends to indicate that one could put in a higher powered engine with extra drums and brakes, and operate on present systems, i.e. in N.Z. low capital cost, low production and generally machines would seem to be more ideal. With alternative carriages it is essential to fit a carriage to specific circumstances as is done in North America. N.Z. needs more general experience in this area.

3. MULTI-SPANS: Suitable for smallwood and thinnings although more research could indicate their use in larger size wood.

4. ENDLESS ROPE SYSTEMS: A serge drum system has been developed in N.Z.

5. BLOCK ON GUY SYSTEM: Advantages in small landings if logs can be cold decked. Swinging logs onto the landing seems best but machines to do this are expensive unless existing logging cranes are modified.

VARI'S GROUP.

Training and adaptability of crews is seen as critical. Detailed planning prior to logging is advocated with the recommended system discussed fully with the logging people.

1. GRAVITY RETURN: Existing N.Z. machines should be adapted for this system ideal for many areas in N.Z. e.g. Marlborough.

2. RUNNING SKYLINES: Generally a costly system especially on ropes with the amount of twisting; seen as limited for N.Z. and should consider other conventional systems first.

3. MULTI-SPANS: Applicable in thinnings on convex slopes. Gives good direction and lift of thinned logs. If correctly planned and only used where needed, it should not hinder production.

4. ENDLESS ROPE SYSTEMS: Considered hard on ropes and long rigging times.

5. BLOCK ON GUY SYSTEM: Only applicable where limits are placed on landing size. Could be added danger to skiddies because of purchase on guy block.

COLLEY'S GROUP.

1. GRAVITY RETURN: Requires suitable topography but fuel savings are substantial. A disadvantage is having to move the skyline more often because of no bridling capabilities.

2. *RUNNING SKYLINES:* Previously discussed.

3. *MULTI-SPANS:* Use where other systems are not practical. Suitable for thinnings with savings on roads and landings.

4. *ENDLESS ROPE SYSTEMS:* Potential use in the low production or low quota operations in N.Z.

Generally N.Z. should consider adaptability or flexibility as an approach in choosing systems.

GALBRAITH'S GROUP.

1. *GRAVITY RETURN:* Two drums are cheaper and power is concentrated on the inhaul only. A quicker set-up time with a single line suitable for small piece size extraction.

2. *RUNNING SKYLINE AND INTERLOCK:* Has the ability to lift with two drums but is generally difficult and complicated in its use. Not much potential seen in N.Z. with slack-pulling carriages.

3. *MULTI-SPANS:* Ideal for thinnings only in N.Z. as they remove topography restrictions and give more lateral pulling ability.

4. *ENDLESS ROPE SYSTEMS:* Group unsure of their ability but they seem complicated.

5. *BLOCK ON GUY SYSTEM:* Potential where working on road or small landing area. Ideal for a short spar.

The group looked at the possible potential of a particular system as follows. A simple 2-drum unit operating on a gravity return system. Development should be in N.Z. with the aim to build a standard unit throughout the country. Although it would not work everywhere, planning such as ridge top roading, could increase its potential. The advantages are the low cost and simplicity. Double drum winches and tower mounted on an old crawler tractor is suggested as a possible alternative. The question was also posed that it may be easier to train dozer drivers than hauler operators.

MURPHY'S GROUP.

Most aspects have already been covered.

BLOCK ON GUY SYSTEM: The group considered this a good alternative as it not only reduces landing size but also reduces hauler interference.

Currently with known systems utilisation levels of only 50-55% are being achieved. More complicated systems will perhaps only lead to more expensive wood.

- SESSION IV -

FILMS AND INFORMAL DISCUSSION:

Chairman - V.F.Donovan, LIRA.

FILM EVENING.

(CHAIRMAN - V.F.DONOVAN, LIRA.)

An informal discussion took place before, during and after the films shown and the following is a report of this discussion.

CHRISTY CARRIAGE FILM - A short 8 mm film which showed the Christy carriage operating in thinnings.

The discussion opened with consideration of the Christy carriage.

O'SULLIVAN: The Christy and Maki carriages are very similar, but I think that the Maki is a better carriage as it allows the strops to be set further apart. It cost $3,200 US, including stoppers. However, the Christy stoppers are said to be better than the Maki stoppers and the two could work together. With the Christy carriage, the distance between strops was limited by the distance from the ball to the rope end.

ROBINSON: I have been quoted $4,500 for the Christy carriage in New Zealand.

DALLY: My company (C.& R. Equipment) could make one in New Zealand for approximately $1,800.

DICKINSON: The slack pulling carriage (West Coast carriage) used at Tairua cost $7,000 and weighed one ton with rope. However we (Cable Price) have since made a smaller version which cost only $1,500.

MADILL EQUIPMENT FILM - A 16 mm film showed 009, 045 and 052 Madill models operating and discussed systems relevant to each machine.

Discussion following the film:-

DICKINSON: With the 052 Tension skidder carriage, pre-stropping was used and Dyform rope was used on the lifting line so that it would run off the middle drum of the carriage more easily.

AERIAL LOGGING SYSTEMS FILM - A 16 mm film purchased by LIRA from the Oregon State University showed skyline, balloon and helicopter logging and discussed a comparative research project known as the Pansy Basin Study.

Discussion after the film:-

O'SULLIVAN: I saw helicopters used in Idaho with an 11,000lb lift, which cost $1,500 per hour. A small helicopter delivered chokers and men to the work site. Twenty seven trucks could be filled in one day. The job was only done for environmental reasons, as it was extremely expensive.

WILSON: A very fast turnround is essential when using helicopters and, for example, chokers are all pre-set. This appears to be a good principle and why can it not be used for skylines?

ROBINSON: Invariably when people are talking about pre-setting, the same people don't work in the bush. Losing chokers which cost $30 each is a problem.

WILSON: This is no reason for not doing it. It works in some cases when they have to pre-choke, therefore we should take notice of it.

MURPHY: Stropping only takes 25% of 50% of the hauler's cycle time, so this is not really all that important.

ESSEX: What are the costs of helicopters in relation to New Zealand?

ROBINSON: Recently British Columbia Helicopters Ltd had given a figure of $60 per cubic metre on truck. In New Zealand we receive up to $20 per cubic metre on truck for Douglas fir. In British Columbia however, they can't afford to use helicopters for Douglas fir and must restrict it to more valuable species.

WILSON: There is too much "can't" and "don't want to" in logging - we tend to use small issues for not changing big factors. We have tried pre-stropping with 7/8" strops but the men prefer to struggle with a 1¼" mainrope instead of pre-stropping.

DOWNEY: The big problem with pre-stropping on steep country is that the men lack mobility and in addition they can't work near the sky-line. It's not that you can't do it, but that it would not be viable.

HOLLIS: Under the spar is the safest place to work, whereas it is very bad to be under the rope in the bush.

DICKINSON: It all depends on the system used and perhaps the Timber-master would be a better bet.

ESSEX: Whatever system is used remember "KISS" which stands for "Keep it simple, Stupid."

INTERMEDIATE SUPPORTS FILM - A 16 mm film showed a contractor using intermediate supports for large tree thinning and discussed the advantages of this system.

Discussion following the film:-

NEILSON*: I have personal experience with the trial area as shown in the film. The University, as instigator, had problems of introducing new equipment in that there was vigorous resistance from industry. It only got going when contractor Dick Renoud,of More Logs Inc., seemed interested. It is important to remember that this sytem is only used where the skyline road has an unfavourable profile. It is becoming more popular, especially if a contractor, compared to the University Professor, says that it's O.K. In the OSU trials on the Igland Alp, it took them three months to get going and to sort out the best rigging system. It is essential to pre-rig and this takes about 45 minutes per jack using tree climbing techniques. The intermediate support does not change the turn time at all. However, it would not be possible to use skyline systems if no intermediate supports were used.

** Denis Neilson recently returned from attending Oregon State University where he was involved in studies using intermediate support systems, and is also familiar with the contractor who was the subject of this film.*

ROBINSON: The Wyssen system that has been previously used in N.Z. had a lot of merit as it was very simple. It has one drum, and a fixed skyline. The rope is set in a groove on a jack to give it lift. It is not fixed in the groove but is held by tension, and pivots about the centrepoint of a pin in order to adjust to the load. Wide sheaves were used on the carriage with the central part being made from strong steel, and the outer flanges of duralumin to give it lightness. An advantage is that there is no need for upper road with this system as all logs are lowered downhill by gravity. The carriage could be stopped at any point. The Wyssen model W90 could handle loads up to 6 tons, and the model W60 loads up to 3 tons. The braking system was a 4 ft diameter band and, in addition, air fans were used.

IDAHO JAMMER DISCUSSION - Pat O'Sullivan gave a brief discussion of these machines from experiences gained during his recent visit to U.S.A.

The Idaho jammer is a very simple piece of apparatus and uses a wooden pole. Users buy a drum-set from Spokane. It is very free running and has a finger-type clutch. Wide flanges on the drum appear to act as a fly wheel. The drum-set is often mounted on a truck in a home workshop. The wooden pole is set at 45 degrees out from the back of the truck, and guyed to the truck and to the bank behind the truck. The machine is often worked parallel to the road so that the processed logs can be pulled on to the road. I saw machines pulling 200 pieces per day. The tong setter got 84 cents a piece, and the cutters got $1 per piece. Tongs were usually used and the rope was knotted above the tongs to stop the rope at the block. The haulback is held while pulling in until it tightens. The drums were driven by the truck motor. Logs could be stacked along high stumps left below the road. The maximum log length would be about 35 ft. Sometimes when the logs are pulled in they are swung and turned end-for-end and neatly stacked along the road. The machine could work out to about 1000 ft on an uphill slope.

ACKNOWLEDGEMENTS:

LIRA thanks the following for supplying and allowing use of their films:-

CHRISTY CARRIAGE:	*LION MACHINERY LIMITED, ROTORUA.*
MADILL EQUIPMENT:	*CABLE-PRICE CORPORATION LIMITED.*
INTERMEDIATE SUPPORT SYSTEMS:	*OREGON STATE UNIVERSITY, OREGON.*

- SESSION V -

EQUIPMENT AND RIGGING:

Chairman - C.Robilliard,
Consultant, P.F.OLSEN & CO. LIMITED.

"STRESSES AND STRAINS IN THE SYSTEM"
(J.L.WILSON - Consultant, J.G.Groome & Associates, Taupo.)

"ROPES AND ROPE FITTINGS"
(P.J.O'SULLIVAN - Logging Contractor, Taupo.)

"CARRIAGES, BLOCKS AND HANGERS"
(R.J.DALLY - General Manager, C. & R. Equipment Limited, Christchurch.)

STRESSES AND STRAINS IN THE SYSTEM.

(J.L.WILSON - Consultant, J.G.Groome & Assoc., Taupo.)

SUMMARY.

The basic commodity used in all logging operations is wire rope, but in cable logging it is even more important than in tractor logging. In cable logging the characteristics of wire rope are critical to the operation.

There are many documents relating to ropes and systems and it is important that you be aware of them, what is in them, and where they can be found.

KEY FACTORS FOR THIS DISCUSSION:

Breaking Load:

The actual load required to break a new rope under test in practice the load could be higher, but normally the rope will break at a weak point at a load less that the stated breaking load.

Rope Type:

This details, in numeric terms, the construction of the rope. The most common type in this industry is 6 x 19. Another important type for easier handling is 6 x 31.

Rope is expensive - downtime is more expensive:

- Initial installation is important to the life of the rope. Run it in to take out stretch and seat all the strands.
- Shock loading imposes a far greater impact than static load. While properties of the wire will enable the rope to stretch and then regain its normal length, shock loading always leads to premature failure.
- Lubrication. Rope may be dirty to handle but the lubricant is important to the life of the rope.

Safe Working Load:

The safe working load is the breaking load divided by a factor of safety. The factor of safety will depend on the type of use that should normally vary between 3 and 6.

Multiple Part Lines:

In a pulley system a mechanical advantage is obtained depending on the number of parts of the line between blocks or pulleys. Unfortunately the more parts, the less efficiency.

When lifting or pulling the same analysis applies. It is important to consider this when choosing the size of rigging.

Skylines:

Difficultmathematical calculations apply when considering skylines or ropes spanning between two points. It is important to know the basic definitions and the problems related to loads in the skylines. It is important to have an appreciation of the effect of log loads on rope tension.

Calculations such as breaking loads, tension and deflection calculations should only concern the operator occasionally unless he is doing his own planning. In most cases these calculations should have been carried out by the company planner.

It should be noted that for every loaded rope there is a reaction force, be it to a deadman, a block, forces on a drum or brakes, or down a tree or spar. Remember this reaction force when you increase the load that little bit more or give the line that almighty jerk.

DISCUSSION:

SPIERS: The rope tension is calculated before the skyline is erected. However, with live skylines, the operator has to consider the tension as well as he can, alter the deflection and thereby alter the tension in the ropes. (This was agreed on by Wilson.)

ESSEX: What do you recommend for rope maintenance?

WILSON: Don't clean the rope before use or drag it through dirt to reduce its stickiness. Lubricate the rope when it gets dry.

MOTION: At KLC we use old waste oil. It is applied on the drum. It reduces friction on the rope and increases rope lift.

ROBILLIARD: Some machines have a lubricator built in on the drum.

O'SULLIVAN: I put waste oil on the mainline and this helps in changing the direction of winding which is particularly hard on the rope. The ropes do not tend to pick up pumice when on the ground. Skylines are not on the ground much and therefore don't get pumice in them and this helps in their life.

ROPES AND ROPE FITTINGS.

(P.J.O'SULLIVAN - Logging Contractor, Taupo.)

SUMMARY.

Cable systems are a series of compromises between the possible and the impossible with a lot of logic and ingenuity.

Wire ropes must be flexible enough to bend around drums, and through sheaves but strong enough to withstand abrasive wear and the loadings imposed by today's modern, high-powered, fast line speed yarders. For mainlines 6 x 19 construction rope is used and although it has a lower salvage potential, it is safer. A 6 x 31 rope would have better resale but is more expensive and suffers more damage. Haul-back lines have good salvage value and usually suffer less damage, therefore 6 x 31 rope is used. Strawline used in New Zealand is commonly 3/8" diameter whereas the Pacific North West use 7/16" and have more labour in their rigging crews. Coiling strawline lengths of 300 ft on a suitable carrier is ideal and joins are made with couplings, hooks or grommets, depending on topography.

Blocks should have sheave diameters in excess of 20 times the rope diameter, but where these must be manhandled a smaller lighter block is compromised. In New Zealand 14" diameter sheave blocks are common. All removable parts on blocks should be kept to a minimum to prevent parts lost. Block strops must be long enough so that the block is hung in both eyes of the strop and the strop can pass around the stump twice.

For butt-rigging the most expensive will be the best investment. It must be of high tensile strength to stand the loadings and hard enough to withstand abrasion.

New Zealand made shackles would seem to be too soft and distort easily. Also the coarse thread of the pins results in the pin becoming loose very easily.

Butt hooks are a personal preference but the link-lock type is very satisfactory.

Strops are another compromise area. Large diameter strops last but often become kinky and hard to handle. Alternatively small diameter strops usually break before becoming kinky. The double-knobbed type choker is preferred to increase the reach of strops. Long strops allow good reach but reduce lift.

Line changing studies have shown that 15% of available machine time was lost in these delays. Alternative methods were tried, including the use of a small chainsaw-powered capstan winch. The use of an extra man to pre-set blocks and strawline has reduced some rope shifts from 40 minutes down to under 5 minutes.

DISCUSSION:

O'SULLIVAN: Why can't N.Z. manufacturers make lighter blocks? In U.S. 14" blocks weigh about 50 lbs.

DALLY: Lightweight blocks are talked about by salesmen, but not actually made by the manufacturers. The smallest I have seen in a 14" diameter was the Ropemaster 513. It weighs 63 lbs for 3/4" to 7/8" rope, and 73 lbs for 7/8" to 1" rope. Thus 50 lbs is a bit too low to expect.

DICKINSON: Where do you put swivels in your rigging?

O'SULLIVAN: I use plenty in the butt-rigging regardless of the rope lay.

SMITH: We use 100% terylene slings which are much lighter. Also Australians don't like to carry 90 lb blocks out into the bush.

HAMBLETON: What can you say about rope anchors?

O'SULLIVAN: We pull out about five per year with a running skyline and very few of these are guy stumps. If we set up the machine properly, it is necessary to pull out three stumps before the spar falls and after the first one you can't work anyway, so the machine must stop.

LOUGHLIN: If machines have been seen in the U.S. pulling 200-300 pieces per day, the equipment must be O.K. for New Zealand.

O'SULLIVAN: The problem is that in New Zealand the choice will never be as wide as it is there and it will be more difficult to fit the right machine to the circumstances.

GILLOOLY: Why do we not get rope twisting now?

O'SULLIVAN: Using the Westminster on skyline system hauling logs on a downhill pull, you get terrific twisting tension in a half inch haulback rope, and you can end up with very big kinks. We still get this twisting but with a heavier rope for the load size it is reduced. This is a good reason for using a heavier strawline as well.

MOTION: The reason we are stingy with our strawline is because we get too much breakage. We let the man in the lead wander too much as he takes out the strawline. You would get less breakage if you kept it straight.

FITZGERALD: What can you say about a chain versus a rope strop?

O'SULLIVAN: The idea has been around for years. We have tried it but it is difficult to push the chains under logs.

HOLLIS: We use a combination of chains and rope strops. We use ½" to 5/8" hammer locks and lock shackles. We never lose then and we never break them.

CARRIAGES, BLOCKS AND HANGERS.

(R.J.DALLY - General Manager, C.& R. Equipment Ltd, Christchurch.)

SUMMARY.

Cable yarding systems utilising carriages are not new to the New Zealand logging scene but the degree of sophistication now becoming available throws a different light on their increased capabilities.

Types of carriages available break down into four categories:

1. BASIC CARRIAGES. Single, double and three-sheave carriages for northbend, southbend, or slack skylines are simple of construction and generally inexpensive.

Gravity or shotgun systems not common to New Zealand can use a basic two-sheave carriage with the chokers attached directly to it. The mainline is used as a slack skyline with the carriage returned by gravity and the haulback used for inhaul.

Another simple system where a two-sheave carriage can be used in the running skyline or Grabinski. The haulback rope is threaded through the carriage, through the tail-block and back to the carriage, thus serving as a skyline and outhaul line. The mainline connects direct to the carriage and is the inhaul line.

2. LOCKING CARRIAGES. There are two basic systems - completely mechanical e.g. the Christy and Maki carriages, or hydraulic-mechanical e.g. Danebo carriage.

The mechanical system consists of a skyline stop which is positioned on the skyline adjacent to the area to be logged. The carriage runs under gravity down the skyline with the mainline locked to the carriage. The carriage hits the stop and effectively locks itself whilst automatically releasing the mainline. The chokers are set and the mainline is inhauled until a ball stop on the mainline engages. The skyline stop is released and the turn of logs is taken to the landing.

The hydraulic-mechanical type carriage is gravity returned, but the choker setter manually pumps up the hydraulic skyline clamp and is then able to feed the mainline laterally out to the logs. The mainline is inhauled until the ball stop engages with the carriage stop and the skyline clamp is automatically released.

3. SLACK PULLING CARRIAGES. Generally in two broad areas of design:

(a) A single sheave drop-line type, but these are usually limited to 100-125 ft of drop line for lateral skidding. The carriage is relatively simple as it is basically a series of sheaves which change rope directions. This carriage type is used with a running skyline system.

(b) The mechanical multi-drum slack pulling type carriage which is also used on a running skyline system. The mainline and slack pulling line wind on and off separate drums on a three drum axle in the carriage. The drop line is on a separate drum on the same axle and normally holds up to 300 ft of rope for lateral skidding.

4. REMOTE CONTROL CARRIAGES. The remote control carriages such as the European Koller and Hinteregger and the American Young and Danebo, may be relatively simple or quite complex combinations of the principles of locking and slack pulling carriages.

One of the most simple examples of radio control on a carriage is the shotgun system with a radio activated hydraulic skyline clamp.

CONCLUSIONS. Cable logging systems will increase in New Zealand in the future and combined with these will be the greater use of carriages. The cost of the more sophisticated carriages does not appear in keeping with the technology involved but appears to include a sizeable sum of development costs. We either pay these costs or develop our own carriages. We have the engineering skills but unfortunately it is not often coupled with sufficient practical logging experience.

DISCUSSION:

JOHNSON: On the question of high development costs for logging equipment, what is the problem in New Zealand? Do you we have to buy patent rights, pay for development costs, or just copy items and take the risk?

DALLY: Generally overseas producers couldn't patent their systems because there are many similar systems in operation. Usually they simply write patent pending on it and leave it at that. Thus there is no real trouble in just copying it.

SPIERS: What ideas could you "pinch" from this Conference?

DALLY: The Christy carriage is one of the best seen. Though Pat O'Sullivan says the Maki is better he would find there are different stories in other places and when talking to other people.

SPIERS: If you were able to manufacture a particular kind of carriage in New Zealand but then found that the operators didn't want the one you manufactured, but wanted to import a different one, would you raise an objection to an import licence?

DALLY: Yes, I would.

ROBINSON: Why don't New Zealand manufacturers make a multi-block carriage such as those in Europe which have four blocks and are much lighter for the size of rope?

DALLY: We have never been asked.

REILLY: What happens in gravity return systems to a fast-moving drum? Does the rope tend to over-run and end up in a bird's nest?

DALLY: No, this does not happen because the operator applies the brakes before the carriage reaches the end.

BRYAN: What happens if a skyline breaks? Is the carriage ruined?

DALLY: It depends on the height which the carriage falls. Slack pulling carriages could be very high and it will do a lot of damage. However the Christy carriage would, in general, be O.K.

NEILSON: I saw an $85,000 carriage drop and it was written off. Therefore not many of this kind are sold.

SUMMARY.

(C.Robilliard.)

Len Wilson spoke of the importance of wire rope in the logging industry and stressed that we need to understand more about the stresses and strains which we set up in wire rope. We should use the available material such as wire rope manufacturers' handbooks to get this information. Often the only way in which we find out if a strain is excessive is after the whole system has crashed into the gully.

Pat O'Sullivan also stressed the use of available literature to find out information about overseas equipment. He stressed the importance of salvaging rope and perhaps re-using it. He gave us his experiences with various items such as butt rigging, shackles, butt hooks, strops and blocks.

Bob Dally said that there were very few people in New Zealand with a good knowledge of the overseas carriages available. However there could be a place for some of them in New Zealand but we need to be very careful of importing highly sophisticated equipment as it is very easily rendered unusable.

- SESSION VI -

THE MACHINES - WHAT DO WE NEED FOR THE FUTURE?

Chairman - R.D.Gordon,
Research Engineer, LIRA.

SESSION FORMAT:

- Introduction of Panel Members.
- Outline of current N.Z. and overseas machine types.
- Indications of Seminar so far on machine requirements.
- Panel presentation on desirable machine specifications.
- Summary of Session findings.

THE MACHINES - WHAT DO WE NEED FOR THE FUTURE?

(CHAIRMAN - R.D.Gordon, Research Engineer, LIRA.)

INTRODUCTION OF PANEL MEMBERS.

The Chairman introduced the panel stating that its members give a good spread of expertise in design, supply, manufacture and maintenance with experience from large to small haulers. Also that they represented all the past major N.Z. hauler supply companies.

Panel members were:

COLIN DICKINSON - CABLE PRICE CORPORATION (setting up of Westminsters, supply of Madill, design of Wilhaul.)

CHRIS WADE - LOTUS ENTERPRISES (recent manufacture of Timbermaster haulers.)

PAT HAMBLETON - DISPATCH ENGINEERING (design and manufacture of Dispatch haulers.)

MILTON BRUCE - JOHN BURNS ENGINEERING (supply of Skagit equipment.)

BOB YARDLEY - WILSON BROS. (manufacture of Wilsons haulers, design and manufacture of Wilhaul.)

Session summation: *LEN WILSON - J.G.GROOME & ASSOCIATES, TAUPO.*

OUTLINE OF CURRENT N.Z. AND OVERSEAS MACHINE TYPES.

A background paper listing brief specifications was tabled and 23 slides were shown illustrating a range of machine types both within New Zealand and overseas.

INDICATIONS OF SEMINAR SO FAR ON MACHINE REQUIREMENTS.

The initial plan was to use any directions from earlier sessions which might typify machine requirements, such as required systems, terrain and crop types, productivity requirements or restraints, cost limitations or special purpose machines or elements. However, only a few sketchy guidelines stood out, these generally being as follows:-

(1) The future requirement for handling large trees such as old crop radiata:- High production rates are required with high cost machines. Unproductive time needs to be minimised, thus consider alternative systems, but it is important to be flexible. Quick shifting is important and therefore we require simpler systems and mobility. No specific systems stood out therefore the panel would cover general machine aspects.

(2) Requirements for smaller trees such as new crop radiata:- Production and cost are related to tree size therefore lower cost machines needed. There is potential to use gravity and running skyline systems depending on topography. New techniques should

be tried here and it is an area to build up our deficiency of skilled personnel.

(3) Radiata thinnings:- Low cost machines and systems are required. Multi-span applications seem to have potential.

PANEL PRESENTATION ON DESIRABLE MACHINE SPECIFICATIONS.

The Chairman put set questions to the panel and accepted some questions from the floor on the following aspects:-

Mobility - Engine and Power - Transmission - Drum Set - Spar - Basic Rigging - Control - Service and Maintenance.

MOBILITY OPTIONS:

CHAIRMAN: Options are rubber tyres, tracks, or skids and either self-propelled or towed. What are the cost differences?

DICKINSON: In the 300 h.p. class trailer to truck-mounted approximately 12% more expensive. Track to rubber-tyred mounted approximately another 12%. Rubber is more expensive and track most economical. Points to consider include mobility (i.e. trailer more difficult and requires suitable vehicle to shift), loader, ground conditions and repositioning.

WADE: On smaller haulers for thinnings, where capital cost investment of this size operation does not justify the expenditure of self-laying tracks or even second-hand commercial trucks, skid-mounted machines are more desirable.

CHAIRMAN: Are there advantages or problems to consider regarding stability with mobility versus skids?

HAMBLETON: Must bear in mind effective angle of guys, but no other stability problems.

CHAIRMAN: Should the engine operator's cab, or controls for travel, be separate from those for hauling operations?

BRUCE: Depends on carrier. For instance, SJ4 or SJ7 with power divided for travel and swing needs only one set of controls. However, SJ4RT mounted on automotive type 6 x 6 carrier required different engine in the upper works. The cost of duplicating controls could be substantial and problems could sometimes occur with combined controls in certain situations. Controls should be confined to the job being done to avoid duplication or accidents.

GALBRAITH: What is the percentage or cost saving using a second-hand truck?

WADE: Depends whether truck engine is to drive the winches in which case re-powering might be required. However as a prime mover the cost would be approximately $10,000.

ROBINSON: I consider there is a need for a basic hauler to suit most of New Zealand's conditions. The mounting of a double drum winch on a crawler would apply for both clearfelling and thinning.

WILSON: If Madill owners were offered a machine on skids at a 12% saving, would they be happy?

O'SULLIVAN: No!

GRAYBURN: No!

ENGINE - POWER NEEDS.

CHAIRMAN: What are the basic aspects we need power for in hauler design?

YARDLEY: Main power usage is in overcoming tailrope tensions. Power is required to haul the log in and this is determined by the speed with which you want the log pulled in. To maintain a lift of 1 ton, 200 h.p. is required with wastage of 100 h.p.

CHAIRMAN: Basic power requirements are for line pull and desired line speeds. Also extra power for braking. Why do we need extra power over and above this, and what is the cost of it?

HAMBLETON: Production depends on power and from there you must ratio it down to give line pull to break the log out. Speed will follow on. The cost is extremely difficult to estimate.

CHAIRMAN: Have engines, apart from diesel, a future in cable logging?

DICKINSON: I doubt whether an alternative fuel to diesel will be available although a reintroduction of steam with total utilisation of forest residues for fuel is possible within our life time.

BYRON: Has the panel considered hydrostatic transmissions for small to medium power units?

WADE: Yes, but cost and other practical considerations must be taken into account, i.e. what we are prepared to spend for what effect. As this means of transmission is being used in other applications and vehicles there is no reason why it cannot be used for haulers.

TRANSMISSION OPTIONS.

CHAIRMAN: What options exist for getting power from engines to drums and what advantages, problems and cost differences are there?

HAMBLETON: To get from 2000 r.p.m. to 100 r.p.m. at drums normally requires chain drive and gears with a torque convertor somewhere inbetween. The TC ratio can be supplemented with change speed gears such as Gearmatic. The TC is important as it takes out the shock between engine and winches and gives better life to shafts, gears and clutches. A safety factor on clutches can be reduced from 4 to 1¼ when a TC is in the circuit. The cost difference for a TC would be $10,000 and a large clutch would be much less.

WADE: Regarding small haulers, they could be completely hydrostatic as it saves on shafts, sprockets, belt drives, and safety relief valves can be set into these machines. A drawback is the sophisticated pumps and motors. However the advantages outweigh the disadvantages.

WILSON: What is the cost in design and development of the engine and transmission, as part of the total cost of a machine?

DICKINSON: A 283 h.p. GM with 3-speed Gearmatic would have an installed cost of about $9,000 whereas a big V12GM with 3-stage TC and no transmission would cost about $3,000 more. However there is no substitute for horsepower when considering line speed and pull.

WADE: In thinnings machines, capital cost is dictated by what the end user gets out of his product. A 300 h.p. range Detroit diesel motor and 3-speed TC is about 25% the cost of the hauler without spar.

PIVAC: What is the efficiency of hydrostatics?

WADE: Currently, variable displacement pumps are 85% to 90% efficient.

O'SULLIVAN: Are there any developments in electric drives?

SPIERS: No developments were seen in this area overseas.

DICKINSON: We looked at this with Le Tourneau but bush servicing and repairs would be a problem.

DRUM SET NEEDS.

CHAIRMAN: How many drums are needed for the different hauler categories, and for what purposes?

BRUCE: Simpler systems are best for thinnings. Highlead and North Bend need main, haulback and straw. Bigger units may need a skyline drum.

CHAIRMAN: Braking options include normal energy dissipating, such as band or disc, and re-generative type such as planetary or hydraulic interlock. Which system is recommended and why?

DICKINSON: Band type brakes are cheapest and most versatile but a single brake is inefficient. Large centrifugal fan air-brakes are cheap but won't hold at low speed and require a holding brake. Multi water-cooled brakes are efficient but expensive. If brakes are used a lot, the running cost of other types could equal the cost of outlay for multi water-cooled. Hydraulics eliminate the need for brakes and clutches.

CHAIRMAN: What about interlock systems on haulers?

DICKINSON: Hydraulics are the ultimate but cost is the problem. Complete hydrostatic doesn't cost more but hydraulics built in to a mechanical machine would be expensive.

CHAIRMAN: Can existing haulers be fitted with extra drums and what would be a likely cost?

YARDLEY: Most existing haulers can be fitted with additional drums although the frame may have to be extended. Sometimes it is possible to raise an extra drum at the back of existing drums. Cost would be between $15,000 and $20,000.

DICKINSON: Regarding the cost of removing a drum, this would reduce total fixed daily costs very little and the versatility of retaining that drum would outweigh the reduction in costs.

CHAIRMAN: Is there any future for capstan drums in New Zealand?

DICKINSON: Yes. Possible in small thinnings, but rigging technology and technical knowledge would rule them out in most cases.

MANAGH: Has anyone on the panel looked at interlocks?

YARDLEY & WADE: Yes. In the small horsepower range.

GALBRAITH: Is the Pee Wee yarder worth the money and can it be made more economically?

DICKINSON: The concept was excellent, but the cost too high to be practical.

SPAR OPTIONS.

CHAIRMAN: With the major hauler categories and systems, what spar heights are needed and what construction is recommended?

BRUCE: Ninety feet seems to be the optimum but cost is the factor. Wooden spars take longer to set. Lattice spars have merit as inserts could be added for extra height, but the costs are more than wooden spars.

KIRKLAND: A N.Z.F.S. lattice spar built on contract cost $6,000 although today's cost would more likely be $9,000.

WADE: An enclosed steel spar was used on the Timbermaster because of the time factor in welding.

BASIC RIGGING NEEDS.

CHAIRMAN: For different systems, what determines the number of guys required?

WILSON: Loads and setting tensions.

CHAIRMAN: What is the cost of adding extra guys and the cost diff difference between manual and powered guy winches?

WADE: Cost per unit is approximately $200 and controls approximately $400 for a bank of eight.

YARDLEY: The angle of hauling off the top of the spar with a 4-guy system is limited compared to a 6-guy system. The load induced in the tower is relative to the angle of pull off the tower and the angle of the guys.

O'SULLIVAN: Safety standards affect the number of guys required. You need to make sure that there is enough left if one or two stumps pull out.

CONTROL OPTIONS.

CHAIRMAN: Where and why should mechanical, hydraulic or other types of controls be used?

WADE: Controls need to be sensitive in the hand of the operator. Operators prefer levers to buttons.

DICKINSON: Air-activated controls can be a safeguard, especially on bigger machines where pre-set tensions are required.

CHAIRMAN: Do we need an operator on the machine?

BRUCE: Not always. With remote control the number of men on the landing can be reduced. No cab is needed thus costs are cut. Radio control has an advantage where labour turnover is high. A disadvantage is servicing this equipment.

HAMBLETON: With remote control, the operator has trouble with feel, especially on the haulback brake.

FITZGERALD: What about remote control with ground lead?

YARDLEY: Yes, it can be done but damage is easy. It needs good protection.

SPIERS: Overseas work being done on automation takes the errors out of the system, especially where there is a sequence of movements.

GILLOOLY: Air is best for control systems. It is lying about everywhere, you can hear it when you lose it and it doesn't make a mess when you spill it. Remote control doesn't tell you when you have lifted a stump behind the hauler.

SERVICING AND MAINTENANCE.

CHAIRMAN: What components cause the most trouble, and need the most mothering in haulers?

HAMBLETON: Brakes used to cause most problems, but this has been

overcome with disc brakes.

O'SULLIVAN: Highest costing problem is now the power unit.

DICKINSON: Problems rated in order are brakes, transmission and engine.

CHAIRMAN: Are cable logging machines a difficult maintenance area?

DICKINSON: Haulers seem to require a special breed, but for no apparent reason as they are all made up of common components.

FITZGERALD: Maintenance seems lower on haulers than tractors. Is it because of better reliability or can downtime be scheduled more easily?

MOTION: Maintenance costs of the Hayes hauler at Maramarua was $1.00 per day.

JOHNSON: When utilisation equals 80% to 90% in haulers as in skidders and tractors, then maintenance will be expensive also.

HAMPTON: The maintenance cost of our hauler was $700 per month, versus a skidder at $2,000-$3,000 per month. It would have to go a long way before it equalled skidder maintenance costs.

HAMPTON: What is the write-off period when talking of operating costs of haulers?

DICKINSON: Fifteen years for a 300 h.p. unit, 10 years for a 150 h.p. unit.

WADE: Bearings have a lifetime of about 20,000 hours (approx. 10 years).

HAMBLETON: Ten to fifteen years first life then complete overhaul and ten years second life.

YARDLEY: Bearings could last for 30,40 or even 50 thousand hours.

WILSON: Should not the panel be referring to hours and life between major overhauls. Also with the requirement in size for New Zealand, what did the panel think of local manufacture versus overseas imports?

WADE: New Zealand manufacturers have to rely on overseas markets for New Zealand developments because of the limited N.Z. market. Guidelines for design of machines for this country are needed.

HAMBLETON: Our company has never had to go overseas for markets and the user pays for development.

DICKINSON: Development mistakes should be stood by the developer and development should be done before sale. The industry cannot decide on how many threads are required on a shackle, so how can it decide on how many drums are required on a hauler?

SESSION VI - SUMMARY.

(L.Wilson.)

I was unable to get conclusive ideas but have noted the following:-

- It was agreed that mobility was required particularly in large haulers, but in the smaller types it may not be needed.

- Regarding engine and power options, the engine plus torque convertor seemed the way.

- Hydraulic (hydrostatic) systems for small haulers should be looked at provided costs are in line.

- No definite ideas were forthcoming regarding transmissions, options and drum sets.

- There is a possible need to explore value for money regarding self-raising spars.

- On controls, sensitive controls are required and air seemed the best type.

- The panel suggested that the engine created most maintenance problems, although I do not feel that this is the case when considering downtime.

- On imported versus locally produced machines no answer was given. Perhaps we should look at second-hand machines imported from overseas, and overhauled or adapted. These may be the best and cheapest.

- SESSION VII -

CABLE LOGGING EXTRACTION IN THE LOGGING SYSTEM:

Chairman - J.E.Galbraith,
N.Z.Forest Products Limited.

"CABLE SYSTEM PLANNING"
(D.NIELSON - Logging Supervisor, Kaingaroa Logging Company.)

"FINANCIAL REQUIREMENTS AND COST LEVEL EFFECTS OF CABLE LOGGING SYSTEMS"
(K.WALKER - Forest Research Institute.)

"MANPOWER AND TRAINING"
(D.G.BRYAN - Training Officer, N.Z.Forest Service.)

CABLE SYSTEM PLANNING.

(D.NIELSON - Logging Supervisor, Kaingaroa Logging Company.)

SUMMARY.

Introduction:

The planning for engineering of any logging system is the interface between the production requirements, machine capacity, economics, multiple land use and environmental concerns. Logging planners must ensure that an area can be harvested to meet resource objectives.

Cable equipment is used in difficult areas and because of reduced flexibility, skilled planning is essential for efficiency.

The following points must be considered in the planning sequence:-

Machine Selection - Optimum Yarding Distance:
The selection of a piece of equipment to harvest any area is dependent upon what is available, its physical limitations and its most effective use. The logging planner often has little influence over these in the short term and in practice the actual yarding distance is often fixed by topographical features. However, optimum yarding distance calculations for a machine can prove a useful guide.

To achieve the minimum logging cost, the planner must determine the yarding distance such that the fixed plus variable costs of yarding are at a minimum.

Power Requirements:
Another guide to determining the correct machine to use in any area is the potential inhaul speed possible with the available horsepower.

System:
The planner should be familiar with the various cable logging systems available. Highlead is the most common, is simple to rig and operate and can use a two-drum machine. Generally uphill hauling should be planned if possible as it provides greater log control, increased production, reduces water run-off hazards and reduces the strains placed on the system.

Gravity return systems can be used with a highlead machine and this system can increase production and reduce fuel consumption. However to ensure the system will operate more efficiently than highlead, the planner should ensure that chord slopes are greater than 20%(11°).

Load Carrying Capacity:
The determination of load capacity within any system can be done by computers. A currently more available method to achieve the same answers is the chain and board method. This procedure gives a

graphical determination of allowable load deflection and a mathematical determination of payload capacity.

Landings:
In areas where construction costs are high, planners should be familiar with the minimum requirements, such as size required, location of guy anchor stumps and the effects of various anchoring and guying configurations have on the stability of the system.

Roads and Road Network:
Roads should be planned to ensure that the modern steel tower mobile machines can, in fact, negotiate corners. Road construction and log transportation costs must also be calculated.

DISCUSSION:

COLLEY: In techniques for planning, to what extent are they actually used and, when used, how is the message obtained in the planning exercise got to the field?

NIELSON: In the North West, operators on Federal land have Forest Service engineers doing the planning for them. They must do profiles etc. to get the plan through but, in some cases, you still get foul-ups. The problem is the lead time from initiation to actual logging which may be up to eight years.

WILSON: What about in New Zealand? Is any planning done?

CHAIRMAN: Certainly not enough is done. The cost of logging a setting is $40,000, plus or minus $10,000, so a few dollars spent in planning could well be worth while and I refer you to the mistakes seen during the field trip.

NIELSON: A big increase in interest in planning has been shown by field people in the United States. This has been brought about by the pressure of increasing costs of logging.

ROBILLIARD: Ninety per cent of planning information never gets to the operators.

NIELSON: This is true and a common example is that of not leaving guy stumps near proposed landings.

ROBILLIARD: A problem is that there is very slow retrieval of cost data to show where mistakes have occurred. We need to be more up-to-date.

UNKNOWN: What planning is done at the establishment phase?

NIELSON: Some rough planning has been done for the Tarawera Forest but in 25 years we will be logging from existing roads and the original planner will have gone or become the General Manager. This problem

requires more effort.

DOWNEY: KLC has seen a range of planners from the best to the worst in New Zealand, but the supervisors in the field are used by the planners as the chopping block. When the planner changes ideas and methods change. This is bad for the morale of the operator and makes the supervisor's job difficult so we must decide what we want and stick to it.

FINANCIAL REQUIREMENTS AND COST LEVEL EFFECTS OF CABLE LOGGING SYSTEMS.

(K.WALKER - Forest Research Institute.)

SUMMARY.

Introduction.

In business the story begins and ends in finance. Without it nothing happens. Therefore it is the financial requirements that becomes important in the overall planning function.

Financial requirements fall into three categories:
(1) Current period finance.
(2) Intermediate finance.
(3) Longer term finance.

Ultimately all finance must come from earned revenue, but initially much of it will have to be borrowed and then paid back with interest.

System Cost Structure:

Financial strategy will depend on the structure of the system costs and the period of principal recovery on borrowed monies.

For two systems, one tractor, and the other cable, a typical example of the cost structure is:

	Tractor	Cable
Labour	34%	25%
Operating Expenses	29%	40%
Capital Recovery	37%	35%

This represents quite a distinct change in the financial requirements. Operating costs in the cable system are greater than the tractor system and because of the uncertainty in the regularity of financial requirements in this sector, a higher reserve would need to be maintained.

Initial capital costs of the cable system are approximately 100% greater than the tractor system and in tractor operations this would require a 70% increase in the rate of production. In cable logging systems, the increase may not be so severe because the extended working life of machines lessens the impact of capital recovery.

The overall effect of change from tractor to cable indicates an increase in system costs will be in the region of 30% to 40%.

FRI research to date and stated overseas experience indicates about a 30% reduction in the rate of production in cable logging when compared with production of tractor logging in a similar piece size situation.

Hence a further increase in the unit cost can be expected. As a result an increase of 100% in the unit cost of cable production over tractor production should cause little surprise.

Financial Problems:

In the initial stages, the cash required to cover charges related to operating costs and loan capital repayments is difficult to find from earned revenue and this leads to increased borrowing.

One cause is the short period allowed for loan capital repayment when related to longer term capital recovery, particularly when the capital recovery allowance is part of any contract price formula.

Because of the expected longer lift of cable systems, the impact of the discrepancy between the rate of cash requirements and cash recovery will tend to be greater than in the shorter life cycle of tractor systems.

The industry needs to seek and obtain better financial terms that recognise a realistic rate of capital recovery. Finance to cover increased machinery costs and the expected increase in industry activity is also a problem.

Technical advances and inflation have doubled machine costs from prices paid 8-10 years ago. This places strains on available finance, increases the competition for finance and forces up the interest rates.

If increased activity is largely to be carried out by cable loggers, then they will have to bear the brunt of the problem and its cost.

Initial capital cost of logging systems ranges from $100,000 to $500,000. This level of capital makes it nearly impossible for a potential sole owner to make significant personal investment.

With the need to find the growing additional finance comes the need for a greater degree of managerial proficiency.

It is up to the logging industry to ensure that it supplies adequate information to accountants and financial advisors if they are to get the greatest benefit from their services.

A greater degree of coordincation and cooperation between disciplines is needed if the industry is to improve both its productivity and profitability.

DISCUSSION:

O'REILLY: It may be that cable logging is not actually more expensive than skidder logging, it's just that we use cables on more difficult country.

WALKER: This may be true but the trouble is we don't yet know enough. It could be a function of terrain, or of the skill affecting overall efficiency. As yet we do not know how much slack can be taken up in improving this efficiency.

O'REILLY: What about using cables on flat country?

NIELSON: This has been tried in the U.S. with intermediate supports. There was very little difference in production compared with hill country cable logging, but the production costs were still greater than using skidders.

LOUGHLIN: You said that cable haulers were written off over ten years. What happens if this is done faster? Do you end up with more profit at the end?

WALKER: You should not confuse cash in the bank with profit. You can juggle profits easily in the book. The problem usually is that high early payments can get a contractor into trouble.

McKENZIE: Where will the money for logging machinery come from?

WALKER: I don't know. New Zealand small businesses are approximately 90% self-financed. Of this 65% put in more than 50% of the capital themselves. In addition many logging contractors obtain their money from non-preferred sources such as finance houses rather than Banks. Thus the situation with regard to financing operations is not good.

SPIERS: I was surprised to learn from you that not only capital, but operating expenses are high cable systems. Can we get any improvements in the operating expenses?

WALKER: Capital costs are still a problem. Logging has a very high investment per man employed. The total investment in the industry is around $9 million which may seem a lot but is, in fact, a very small amount by national standards. Glen Murphy has shown that there may be a 1200% increase called for and this will strain the resources for finance greatly.

MATO: If a contractor gives good production, then the employer screws his price down, they try cutting his quota at the new price. We need to look more at the market and try to reduce demand fluctuations at the contractor level.

WALKER: It is very difficult for a contractor to determine what his risk factor should be. A leading accountant I know obtained it by putting his finger in the air, and there is no available set of formulae, thus personal experience is used and a wide margin allowed for contingencies unknown.

MANPOWER AND TRAINING.

(D.G.BRYAN - Training Officer, N.Z. Forest Service.)

SUMMARY.

Manpower Requirements.

The number of employees required for each system must be determined. This varies depending on a number of factors but as a rule it is directly proportionate to production. Operations producing 150-200 cubic metres per day, 8-10 men; 75-150 cubic metres, 5-8 men; up to 75 cubic metres per day, 3-5 men.

Labour Force Required in the Industry.

Based on 1974 FRI survey data with projections to the year 2015, an estimated 5% increase of employees per year will result, to service cable logging operations.

Need for Cable Logging.

Increases in cable logging within exotic forests over the next 20 years assume recently planted areas are unsuitable for other forms of extraction. Alternative methods must be investigated and the indiscriminate use of cable systems avoided where not required.

Skill Required.

The basic functions of a logging operation must be considered to ascertain the additional skills required in cable logging.

Felling skills between tractor logging and cable are similar, except the latter must have the ability and inclination to work on steep country.

Breaking-out is similar for tractor and hauler although the latter requires the additional skills of being able to shift haul lines.

Skid work skills are similar.

Machine operations, tractor or skidder operators' decisions and skills directly reflect in the volumes produced per day. Hauler operators require skills in setting up their machines and must be aware of the strains placed on it and on the rigging, otherwise they have very little influence on how the lines are positioned. Additional skills required have little influence in increasing productivity.

Breaking-out skills are thus the most critical in determining the output from a cable operation.

Training.

Two levels are involved. Management and employee training.

Management training must make these people aware of the limitations of systems, planning details, etc. Seminars such as this will help, but the only organisation currently carrying out such training is the N.Z.Forest Service at Rotorua.

Employee training. In the past this has been mostly on the job training but with increases in numbers of trained persons needed, a different approach will be required. A formal training combined with practical training in the field will be the most suitable.

Development of training. Proposals to set up a logging industry training board are well in hand and this should provide great benefits for cable logging systems training.

DISCUSSION:

MURPHY: The number of employees you have given may be incorrect because more wood will be produced by cable systems as a proportion of the total in the future, as shown in the Levack paper. Thus there may be 4,500 not 1,400 men employed in cable logging in the future.

BRYAN: Both figures are subjective. Mine is just one way of arriving at a figure.

McKENZIE: Do your figures assume that no intermediate thinning operations will take place?

BRYAN: Yes.

GRAYBURN: I would challenge the statement that the breaker-out is the most important man in the gang. The machine operator may be under greater strain and have more responsibility and pressure and has therefore been under-rated.

BRYAN: The breaker-out controls productivity and is therefore the most important man.

HONEY: Will wood be pulled out by pencil and paper or will you use some practical training?

BRYAN: Training must first be done by discussing the problems involved in the classrooms and secondly, by working in the field.

CHAIRMAN: What are the problems with training?

McDOWELL: You can't put a tractor driver in the seat of a hauler. He is a very important man.

HOLLIS: Everyone must be able to do all jobs and get a good appreciation of the whole operation. This is what happens with my gang.

UNKNOWN: There is a team effort required between the hauler, the breaker-out and the hauler operator.

BYRON: We need the forest industry training board, not just the logging industry training board. In other words training should be widened. Where will all these new men who are required come from? Many in-roads have been made on traditional sources, (e.g. the pill). Potential loggers are at school now and we should get at them and sell logging to them. We need more public relations and perhaps some vocational training. Another problem is that often we pick the best worker to be the supervisor and it may not be the best thing to do. We should have more training for both workers and for supervisors.

BRYAN: Right now we have 40,000 out of work. There are plenty available. Making workers into supervisors is one way of rewarding them by giving them status.

VARI: All crew members are equal but a few are a little but more equal than others. Even the new starter is sent to groove a stump and he must do it properly. The machine operator is very important. Perhaps sales people should be talking to the machine operator, not to the engineer in the plant workshop.

O'SULLIVAN: Responsibility on a breaker-out is that he is a very important link back to the feller. The problem is that a man with responsibility has to do the hardest work and it is hard to combine the two.

ROBILLIARD: I don't think the breaker-out is responsible for rope layout. Often the crew boss does this.

JOHNSON: Aircraft pilots are trained on the ground. Perhaps we should try simulation for haulers. Dave has indicated that the required skills exist now but is that all that is needed? Is training required to improve productivity and can it?

BRYAN: We can do it and some must be given in the classroom. In other words you can't pick up 300 people off the street, put them all over New Zealand in cable logging jobs and then try to pull them into training. Large companies or contractors would have to be willing to release men for training courses.

O'REILLY: There may be a slow growth in numbers employed as you have shown, but there is a big turn around and therefore many new men are on the job. Often you find that the boss is old but the workers are young. We need to find out how to attract and keep men in the industry.

GORDON: How do North West U.S. training systems compare with their needs?

NIELSON: They have similar problems to those we face and similar gang structures.

CHAIRMAN: In other fields, such as in Eastern Canada, operators are trained by the machine manufacturers, e.g. the Koehring.

SUMMARY.

(J.E.Galbraith.)

Dennis Nielson's paper covered a lot on planning but only in brief detail, and we can see now that there are techniques available to do planning for cable logging scientifically before the job starts.

Ken Walker gave us a new light on costing. He showed how cost differences between cable and tractor operations arise. He stressed the importance of planning for future financing of forestry operations.

Dave Bryan gave a very provocative paper on training requirements for the future, and it is obvious that not all agree with his interpretation of future needs.

- SESSION VIII -

LESSONS TO BE LEARNT FROM THE CABLE LOGGING SEMINAR.

(J.J.K.SPIERS - Director, LIRA.)

CLOSING REMARKS.

(P.J.FITZGERALD - Logging Superintendent, N.Z.Forest Service, WELLINGTON.)

LESSONS TO BE LEARNT FROM THE CABLE LOGGING SEMINAR.

(J.J.K.SPIERS - Director, LIRA.)

This seminar has covered everything from shackle pins to sky cranes without the participants getting sprags in their hands. The aim of the seminar was to present all of the relevant information and I believe this has been done. There was a high quality in presentation, particularly by speakers little known in the industry. The verbal presentations and the question and answer sessions are only part of the learning process. The participants now need to go home and study the data presented to them.

One of LIRA's objectives in presenting such a seminar to serve the industry interests was to go a step further and identify leads for further research and development. There appeared to be three areas where action could be taken:-

1. To Extend Knowledge:

   - by developing a short course on planning and rigging for cable operations, for those involved in the practical aspects of these operations. This could probably best be done with the cooperation of the Forest Training Centre, possibly in 1979.
   - by turning out a handbook on cable logging operations with the information of all that might be involved in these operations in industry.
   - by publishing a proceedings of the present seminar conference which would contain all the tabled information currently of use to the industry.

2. To Develop Better Methods:

   A second function of LIRA was to promote the development of new methods and this Seminar indicated that industry was receptive to development in two areas, particularly in the medium to small size cable logging machine operations. These were:-

   (a) The testing and extension of the possibilities for various gravity return systems, and

   (b) More extensive use of intermediate supports and guidelines on the rigging and application of such systems.

   To achieve development in these areas it was necessary for LIRA to get alongside the operators, feed them with information, help set up the systems, assist them with work in the planning stages, and arrange to carry out the evaluation and study that was necessary for extension of the knowledge into industry generally.

3. To Assist in Making Improved Equipment Available:

   In summarising the potential for equipment development in New

Zealand it appeared that there was the opportunity for building a simple self-locking carriage that would enable breaking-out to some distance each side of a skyline, particularly in thinnings or partial logging. Such development was certainly within the technology of the current industry.

The short session available on machines did not enable parameters for machine specification to be defined. It would appear that it might be of benefit to set up a working group to attempt to define requirements for machinery in some categories of cable hauling, particularly thinnings and small wood. A working group of machinery and operational people could make a positive contribution toward this end. This does not mean design by a committee, rather a means of outlining better guidelines for selection or development.

DISCUSSION:

WALKER: A problem in machinery development is the question of who stands the cost of field trials. In New Zealand this is often the first buyer. We need to closely look at who finances it.

SPIERS: Perhaps we need co-operative financing.

JOHNSON: The knowledge of what we will log in the future is required. The development cost is dependent on the quantity logged. We must get this data.

SPIERS: We are always arriving at a stalemate because we don't have enough knowledge. We must improve the data base. We will try to get it and to feed what we learn back to industry.

LOUGHLIN: We must know what we will be doing, how much will be logged and what size and species it will be and then evaluate what kind, and how many machines we need.

SPIERS: We have part of this now in the papers presented.

O'REILLY: Our first need is to find out where we are now. The 1974 census is old and needs up-dating.

SPIERS: Viv Donovan has done this for cable operations. The problem is that a census is a massive exercise and cannot be done often.

GILLOOLY: The capital cost of cable logging machinery is very big, but there is still old resurrected gear working well, for example, the Hayes hauler in Tapanui. These machines have ability to do the thinnings and, depending on clutches and brakes, could do shotgun systems. We should get into them to reduce our capital requirements. We need to give these people who buy these machines more help, for example, in terms of what masts to use, and how to fit a skyline drum.

SPIERS: Yes, this is a function of LIRA and we have looked at this in our survey, but there are not many old machines left.

GILLOOLY: Yes. We have got nearly all of them.

O'SULLIVAN: New Zealand is rather small compared with overseas, so the market here is very small for the largish number of manufacturers wanting to build haulers and the sales potential. The end result must be a very small run of machines. How can the industry rationalise this aspect?

SPIERS: It is not my wish to attempt to design a machine. We must attempt to get people together to pool knowledge so if they are to build something or import it we can tell them what the industry requires.

PIVAC: Could LIRA put pressure on forest owners who sell wood by tender and dictate that it be pulled by cable to ensure that the volumes available are adequate to do this economically?

SPIERS: It is important. Costs are higher and on difficult terrain the contractors' skills and efforts should be adequately rewarded.

CLOSING REMARKS.

(P.J.FITZGERALD - Logging Superintendent, N.Z.Forest Service, WELLINGTON.)

CLOSING ADDRESS AND SEMINAR SUMMATION.

Gentlemen, Pat Crequer, the Chairman of LIRA, was to have made these closing remarks to you but is not well and apologises for his absence. He asked me to substitute for him, but as most of you would agree, there is no real substitute for Pat Crequer.

However, on his behalf I will say a few words about this Seminar and LIRA. I will not try to sum up the mass of information we have received as your Chairmen have all done excellent work in that regard and I congratulate the Chairmen and those who gave papers. The subject has been well aired, some problems have been discussed at length and some pearls of wisdom and experience have been put on view.

I have three items to put to you:

Firstly, in regard to cable logging. LIRA organised this meeting at which it was assumed 40-50 people with interest in cable operations would attend. It is a real measure of importance of the subject and of the standing of LIRA that about three times that number are here today. The items I would like you now to consider are what you think should be the next steps LIRA should take in regard to cable logging. Some of the options - (please indicate by show of hands if you think LIRA should):

(a) Perhaps with F.T.C. arrange short courses or workshops on cable operations. *(Reply - majority affirmative.)*

(b) Should LIRA set up a working group to write up a specification for a New Zealand machine and should LIRA pursue the prospect of New Zealand design and manufacture of a simple two-drum machine. *(Reply - majority affirmative.)*

(c) Are there other aspects LIRA should follow up, for example - hardware, systems, handbook? *(Reply - majority affirmative especially for Handbook.)*

Secondly, I would like to mention to you a fact of life. Dr.Probine stated that he represented a major shareholder in LIRA - the Government. You represent the other shareholders and your organisations are paying the LIRA bill. Your presence here demonstrates that the industry has a real need for LIRA and the interest shown and knowledge gained in the past few days demonstrate that LIRA is achieving its objectives; operators may have been stimulated to try new ideas and systems or improve their present operations; machinery people will have picked up guidance on types of equipment needed and favoured; planners and manager have a better understanding of cable applications where, how and when to use them.

If you have gained in one or more of these ways, then this Seminar has been a success.

And now the fact of life I mentioned - LIRA can achieve these objectives all for the benefit of the industry only so long as you - the membership - continue to subscribe as members, or become members, use the facilities of the library, continue to cooperate in the field investigations LIRA carries out and above all, use the results. Think about what you have seen and learned. You are the industry and this is your research arm. Use it to your advantage - it is skilled, vigorous and willing. It has demonstrated clearly that it can assist you to improve your job. It needs your encouragement to continue this momentum and this work.

A few pertinent snippets - keep it simple; give it a go before you condemn it; eliminate downtime; it's not the problems during working, it's the costs of crews, equipment, etc. - not working - that is important.

Finally, I would now ask you to join me in thanking the staff of LIRA for setting up this Seminar and for making it work so successfully; the Chairmen and speakers for a remarkable set of papers. Much of the data will be of great value to the industry in addition to this Seminar.

We would congratulate Jim Spiers on a job well done and on having a keen and dedicated staff, all of whom have contributed to our further knowledge of this complex subject.

Jim, thank you and your staff for a most informative and enjoyable Seminar.

APPENDIX I.

SEMINAR PAPERS PRESENTED OR TABLED

DAY 2 SESSION I. OPENING ADDRESSES.

Volume 2 Paper Ref. No.

(1) WHY CABLE LOGGING?
(G.M.O'Neill - *Director General of Forests, N.Z.Forest Service.)*

(2) N.Z.INDUSTRY'S REQUIREMENTS.
(J.E.Henry - *Director, Forest & Sawmilling Operations, N.Z.Forest Products Limited*

(3) BACKGROUND PAPER - ACCESS TO/USE OF TECHNOLOGY.
(Dr.M.C.Probine - *Assistant Director General, D.S.I.R., Wellington.)*

SESSION II. REVIEW OF THE PRESENT STATE OF KNOWLEDGE.

(4) CABLE LOGGING EXTRACTION TRIALS - GOLDEN DOWNS 1964-1968.
(R.H.Robinson - *Forest Ranger, Nelson Conservancy.)*

(5) FOREST RESEARCH INSTITUTE'S WORK ON CABLE LOGGING
(G.Murphy - *Scientist, Forest Research Institute)*

(6) LIRA CABLE LOGGING RESEARCH INVESTIGATIONS.
(V.F.Donovan - *Research Officer, N.Z.Logging Industry Research Association.)*

(6a) APPENDIX I - CABLE LOGGING SURVEY.

(7) NORTH AMERICAN AND EUROPEAN RESEARCH ON CABLE HAULING PROBLEMS.
(J.J.K.Spiers - *Director, N.Z.Logging Industry Research Association.)*

(7a) BACKGROUND PAPER - RUNNING SKYLINES AND INTER-LOCK YARDERS.

(8) ESTIMATED CHANGES IN AREAS, VOLUMES AND CROPS THAT WILL BE HARVESTED BY CABLE LOGGING SYSTEMS.
(H.H.Levack - *Forester, N.Z.Forest Service, Wellington.)*

SESSION III. LET'S LOOK AT SYSTEMS.

(9) APPENDIX I - DIAGRAMS.

DAY 3

SESSION V. EQUIPMENT AND RIGGING.

Volume 2 Paper Ref. No.

(10) STRESSES AND STRAINS IN THE SYSTEM.
(J.L.Wilson - *Consultant, J.G.Groome & Associates, Taupo.)*

(11) ROPES AND ROPE FITTINGS.
(P.J.O'Sullivan - *Logging Contractor, Taupo.)*

(12) CARRIAGES, BLOCKS AND HANGERS.
(R.J.Dally - *General Manager, C.& R.Equipment Limited, Christchurch.)*

SESSION VI. THE MACHINES.

(13) BACKGROUND PAPER - MACHINE SPECIFICATIONS.
(R.D.Gordon - *Research Engineer, N.Z.Logging Industry Research Association.)*

SESSION VII. CABLE LOGGING EXTRACTION IN THE LOGGING SYSTEM

(14) CABLE SYSTEM PLANNING.
(D.Neilson - *Logging Supervisor, Kaingaroa Logging Company.)*

(15) FINANCIAL REQUIREMENTS AND COST LEVEL EFFECTS OF CABLE LOGGING SYSTEMS.
(K.Walker - *Technical Officer, Forest Research Institute.)*

(16) MANPOWER AND TRAINING.
(D.G.Bryan -*Training Officer, N.Z.Forest Service, Rotorua.)*

APPENDIX II.

CABLE LOGGING SEMINAR - FIELD TRIP

STOP 1 - WAIOTAPU SUB DIVISION KAINGAROA FOREST.

MALREX LOGGING - ECOLOGGER AND GRAVITY RETURN SYSTEM.

Contractor, Malcolm Whale, has been primarily on skidder operations to date. Contract level is 76,000 tonnes of larch per year. He has recently purchased an Ecologger to do the logging of the steep terrain.

Initially the Ecologger was worked in easy tractor areas to break in the crew who had no previous experience of cable logging. Following a month or so in this activity, they then worked a steep downhill setting. On this setting a scab skyline was used and production was 100 tonnes per day, averaging up to four logs per turn with a six man crew.

Currently they are working uphill using a gravity return, (shotgun system) with a Christy self-locking carriage. At the time of the visit they had only started and had less than one hour's experience. The felling pattern was not entirely desirable for the system and the chord slope of the skyline was insufficient to get a fast gravity return of the carriage.

For such a system a minimum 20% chord slope is required, plus clearance to the back of the haul to enable the carriage and strops to run freely back to the carriage stop. Good back and guy stumps are required as increased tension can be put on the skyline by this method.

The Christy carriage is activated simply by a ball clamp on the skyline. The carriage separately clamps the main rope enabling the main rope and strops to be pulled to the side.

The hauler needs to be situated on the landing so that there is clearance and slope for the carriage to run back freely. In the situation seen, a step landing was being used to enable a skidder to pull out logs from in front of the hauler.

The Ecologger is a machine of mid-range in power and expense. It is mounted on a Clark Ranger 667 GS skidder and powered by a Cummins 139 h.p. engine. The 13 m tower is hydraulically raised and the cost of this unit was $118,000.

STOP 2 - DUMP 686/12, N.Z.F.P'S KINLEITH FOREST.

PLANNING FOR SKYLINE AND MADILL RUNNING SKYLINE SYSTEM.

The importance of planning for skyline operations was discussed during the first part of this stop. Approximately $40,000 is spent logging a skyline dump, therefore thorough and correct planning can result in substantial cost savings.

Dump 686/12 was planned for a Westminster Skyline operation. General description: Area 22.2 ha; Average haul- 200 m; Maximum haul - 550 m; Average stem volume - 4.4 m^3.

Hauling began working in an anti-clockwise direction with production averaging approximately 150 m^3 per day. However, about three quarters of the way through the total area, production dropped to approximately 50 m^3 per day due to the lack of deflection around a rock outcrop near the back of the stand. Because of this, the decision was made to locate an additional road dump (costing $6,000) to finish the area with highlead hauler.

Part 2 of this stop viewed a track-mounted 90-foot Madill tower operating a running (scab) skyline. The machine was completing the area not pulled with the Westminster skyline. However, the time delay meant that the felled trees had deteriorated to a stage that they were only suitable for pulpwood. The Madill was averaging 150 m^3 per day.

STOP 3 - DUMP 643/14.

SKYLINE OPERATION USING WESTMINSTER HAULER.

N.Z.F.P. Gang 23 were operating a Northbend skyline system across a large steep-sided ravine.

General description: Area 11.3 ha; Average haul - 118 m; Maximum haul - 350 m; Average stem volume - 3.5 m^3.

The Westminster hauler was purchased in 1964, is powered by a 275 h.p. Cummins diesel engine and has a Twin disc Gearmatic transmission. A 70-foot rimu spar was being used. Tree length logs were being cut to sawlog and pulpwood segregations with stacking and loading being done with a 30RB crane. Gang production had averaged 180 m^3 per day although this included some wood logged from adjacant areas by tractor.

STOP 4 - DUMP 386/36.

TIMBERMASTER SKYLINE HAULER.

A Timbermaster skyline Model 4070 owned and operated by N.Z.F.P. contractor, Ian Parkes, was seen on extraction thinning of 17 year old Radiata pulpwood. The stand was being reduced from 650 stems per hectare to 350 stems per hectare. Production for this operation had averaged 40 m^3 per day.

Convex slopes had, in some cases, required the use of an Intermediate Support to give added deflection and clearance. This system had worked well and, although it adds slightly to the rigging time, it does not otherwise hinder hauler production.

STOP 5 - PREVIOUS CABLE LOGGING.

A brief stop was made to view Ngatuku Hill near Atiamuri to discuss the difficulties presented with convex slopes and added roading required when logging by conventional cable systems.

ACKNOWLEDGEMENT:

LIRA acknowledges the assistance and cooperation of N.Z.Forest Products Limited and contractors, Ian Parkes and Malcolm Whale, for allowing us to visit their operations.

APPENDIX III.

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