will influence where (and how) the wood is consumed. Domestic markets may be completely bypassed with wood produced for export markets only, or used as an outlet for undesired by-products (such as out-of-grade timber), or as a platform from which export markets are developed.

Evaluation of the acceptability of the wood produced is the second stage. During initial development probably only a technical assessment of wood properties is required. Later, as experience in target markets accumulates, other, often subjective considerations are likely to emerge as understanding of consumer preferences matures. It is likely manufacturers and distributors will be best positioned to take advantage of these preferences for marketing purposes.

The third stage is to compare New Zealand-grown wood with that from competing suppliers in the same target markets. This will highlight any intrinsic advantages or disadvantages. In this respect potential competitors may be even more important than current competitors.

The fourth stage, establishing comparative advantage, is the nub of wood production for specific uses. Nationally, comparative advantage determines whether a country is a net exporter or importer of wood. At the firm level, there must be advantages in producing, processing, manufacturing, or marketing wood for the target markets; these then can be built up, exploited, and protected. There are numerous possibilities, including availability of highly favourable growing conditions, superior growth rate and yield, superior technical knowledge and managerial ability, an established infrastructure supporting wood production, early anticipation of market opportunities, ability to assure supply continuity, and recognition and exploitation of scale economies.

The fifth stage is technical in nature: how should the type of wood required for the target uses be produced? Besides the physical aspects of wood production (e.g., site selection, pruning and thinning treatments), social and political factors are important, influencing, for example, individual and organisation decisions concerning resource establishment. Another part of this fifth stage is co-ordination of production and processing with marketing activities, particularly in the absence of well-established markets.

SUMMARY

The ESPSP provided a convenient starting point for use-based diversification. However, relying on species' wood properties and abilities to grow on New Zealand sites has resulted in species and product considerations dominating special purpose wood production at the expense of a use-driven perspective. Producing wood for specific, rather than special purpose, uses requires complementing the previous supply "push" of the ESPSP with a demand "pull" component in searching for profitable market opportunities.

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FRI/Industry Research Co-operatives – A framework for successful collaboration

S.D. CARSON

SUMMARY

FRI/Industry Research Co-operatives, formed in response to user-pay requirements, have been very successful in achieving and implementing research results and in encouraging a team approach among industry organisations and FRI. A Co-operative is formed in order to achieve a set of technical objectives. Organisations join and researchers participate as appropriate to these technical objectives. Co-operative research is directed by a Technical Committee, managed by a Programme Manager, and carried out by researchers and industry personnel working together. A Co-operative Research Advisory Board, a Research Co-operative Manager, and an FRI Divisional Director oversee and co-ordinate Co-operative activities. Some research projects are more appropriate for the co-operative approach than others. Advantages of Co-operative research to industry organisations are: shared research costs, research goals that are focused on industry needs, faster and more complete technology transfer, and access to all of FRI's expertise when required. Industry involvement in the research process also encourages industry definition of research goals and provides opportunity for achievement of non-research goals. Co-operative research provides FRI with revenue **for research** which tends to be long-term, to require less marketing, and to encourage independent thinking and innovation. Publication of results is encouraged to maintain high scientific standards, while the commercial advantage to industry is maintained through review of publications and delay in the release of results for an appropriate period of time. Success of FRI/Industry Research Co-operative research is absolutely dependent on FRI maintaining its reputation as a centre of excellence in forestry research.

INTRODUCTION

Because Government departments now have to earn a proportion of their funding, the Forest Research Institute (FRI) has developed a series of co-operative research programmes (FRI/Industry Research Co-operatives) jointly conceived, funded, and implemented by the FRI and industry organisations interested in forestry research. The structure of these Co-operatives was modelled after the numerous university-based co-operative research ventures in the USA, some of which have successfully carried out applied research for over 35 years. FRI and other Co-operative members believe that this development has enhanced the linkages between FRI and research user groups and has improved the direction and implementation of forestry research programmes. The objective of this article is to emphasise that high-quality, cost-efficient research

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can be obtained by industry organisations through the co-operative structure.

Co-operative research is defined as:

"A unified research effort into a subject of common interest to a number of separate groups in which the groups are jointly involved in both funding and participating in the research process from planning through to implementation."

FRI/Industry Research Co-operatives represent a partnership of forest industries, consultants, government and local bodies, professional organisations, forestry suppliers, and the FRI for the purpose of addressing both short- and long-term forest research interests for a common advantage. The co-operative approach is a team approach. The real strength of the co-operative structure is that every participant has input into research plans, data interpretation, and implementation.

Twenty-six member groups (Table 1) contribute funds, and to a lesser extent manpower, expertise, and other resources to carry out joint research within the Co-operative framework. The total 1988/89 budget for all the research Co-operatives was just over $1,250,000 with about $630,000 in cash contributions from non-FRI member organisations. The rest has come from FRI's Government funds.

Suitable co-operative projects must be of sufficient size and duration to warrant the intensive scrutiny of research plans and results provided by the co-operative approach. Goals of the research have at least some applied objectives and are achievable within a set time with implementation of research results expected when the research is complete. Long-term research can be especially suitable when supported by a steady stream of usable interim results in addition to the long-term goals.

TABLE 1: FRI/Industry Research Co-operative member organisations

Forestry Companies:

Baigent Forest Industries Ltd
BP Forests NZ Ltd
Carter Holt Harvey Forests Ltd
Caxton Paper Mills Ltd
NZ Timberlands Ltd
NZFP Forests Ltd
Northern Pulp Ltd
Shell Forestry NZ Ltd
Taitokerau Forests Ltd
Tasman Forestry Ltd

Consultants:

Chandler Fraser Keating
Groome Poyry Ltd
P.F. Olsen and Co Ltd

Local Bodies:

Auckland Regional Authority
Dunedin City Council (Forestry Dept)
Hauraki Catchment Board
Marlborough Catchment Board
Selwyn Plantation Board
Wellington Regional Council
NZ Catchment Authorities Association Inc.

Overseas Organisations:

Forestry Commission, Tasmania
RCA Management Ltd, Australia
Tree Genes International Ltd, Australia

Other:

NZ Furniture Manufacturers Federation (Inc)
NZ Farm Forestry Association
Petrochemical Corporation of NZ Ltd

The co-operative approach is highly desirable in several circumstances – for example, when people with the skills necessary to carry out the project are employed by different organisations, or when projects require input from different disciplines or perspectives, or when sharing data would reduce costs for each participant. The co-operative approach might be especially suitable when the development of very large, expensive data sets is required to make progress, or when a national approach would be the most appropriate, and no one group could provide it.

STRUCTURE OF FRI/INDUSTRY RESEARCH CO-OPERATIVES

Each FRI/Industry Research Co-operative is organised around a set of technical objectives. The programme of work is aimed at achieving these objectives. To staff the co-operatives, researchers are drawn from all parts of the Institute and the industry organisations, as appropriate to the individual research programme. Participants commit to membership with statements of intent to participate (Co-operative Agreements), which are in force for periods of one to four years, and in which they agree to participate in an open exchange of information relating to co-operative projects. Six co-operatives are active at the moment (Table 2). Another co-operative, the Evaluation of Pruned Stands, was completed after achieving its objective, which was to develop a method of valuing pruned radiata stands.

TABLE 2: FRI/Industry Research Co-operatives

Eucalypt Breeding Co-operative
- Improves Eucalypt species through tree breeding

Management of Eucalypts Co-operative
- Investigates growth and yield of *Eucalyptus* species

Management of Improved Radiata Breeds Co-operative
- Defines the optimum use of rooted cuttings
- Develops management strategies which optimise genetic gain
- Investigates clonal forestry

National Forest Fertilising Co-operative
- Quantifies effect of nutritional problems on growth
- Identifies methods of avoiding nutritional problems

New Zealand Radiata Pine Breeding Co-operative
- Improves radiata pine through tree breeding

Stand Growth Modelling Co-operative
- Produces growth models to predict future yields
- Develops strategies for future growth modelling
- Provides a basis for sharing data and develops standards for data collection

The working parts of a Co-operative programme are its research team, Programme Manager, and Technical Committee. Efforts of all of the FRI/Research Co-operatives are co-ordinated by a Research Co-operative Manager, and an FRI Divisional Director facilitates the business of the Co-operative and oversees its technical programme. A Co-operative Research Advisory Board (CRAB) advises the Ministry of Forestry (MOF) and NZ Forest Owners Association Inc. (FOA) to promote the efficient running of the co-operatives and to foster support for co-operative research at the political, forestry sector, and technical levels. The Board has provided a forum for discussion of administrative and policy issues, is working to influence government policy on research funding, and has greatly contributed to the success and smooth operation of the co-operative research effort.

Technically skilled people in member organisations direct the technical programme and obtain research results through participation on a Technical Committee. The Programme

Manager, who is chosen for his technical expertise and ability to communicate technical information, designs an annual programme of work in close consultation with the Technical Committee. Once the programme of work is approved by the Technical Committee, it is carried out under the supervision of the Programme Manager. With the assistance of Co-operative staff Technical Committee members act as the primary agents for technology transfer to their organisations.

ADVANTAGES TO FOREST INDUSTRY ORGANISATIONS

Cost efficiency

With a common species and largely common markets there are many opportunities in the New Zealand forestry sector to define common goals, making co-operative research an efficient way to obtain essential research results. Sharing costs for achieving mutually desirable research goals means that the input required by any one group is less. Research costs are reduced by sharing costs through in-kind contributions of manpower and/or data sets.

In addition, the structure of FRI/Industry Research Co-operatives is especially cost efficient because of its flexibility. Flexibility leads to increased value for money in two ways. First, each forest industry organisation has the choice of membership in a co-operative based on the relevance of specific technical goals and objectives to that organisation.

Secondly, participation of researchers is flexible. Projects which tackle the complex research issues that confront the forestry sector usually evolve and change from year to year and can require intermittent input from people with different types of expertise. Because FRI has a wide and comprehensive range of experts in all aspects of forestry, co-operative programmes can involve these experts when required for specific purposes without having to support all of their professional activities, as would be the case in a research association. Experts from member organisations can also participate when desirable.

Rapid and effective technology transfer

Through the co-operative process, industry practitioners gain access not only to new information, but also to the people who have created it and understand it. This has encouraged faster and more comprehensive application of research findings than was previously the case.

Co-operative research has many aspects which favour rapid and effective technology transfer. The transfer of research results to potential users is almost instantaneous through the co-operative communication channels without the usual delays associated with formal research publications. The involvement of the co-operatives during the research and development process will normally ensure that the user has a good feel for the quality of the research output and that the output is in a usable form. This often involves a heavy commitment to time and effort by industry staff, but helps ensure rapid implementation. Further, co-operative staff have an incentive to get fast application of results, as they are aware that their continued membership will ultimately be dependent upon their technology transfer record.

Sharp focus on industry needs

The co-operative structure encourages industry-driven research. With the open exchange of information relating to co-operative projects among member organisations and the involvement of the users of research results from inception to implementation, sectoral research needs can be more sharply identified and duplication of effort can be minimised. Practitioners, too, through their involvement in Technical Committees tend to more fully understand and appreciate the work of the researcher, making it easier to direct the research toward their needs.

Most of the proposals for Co-operative Work Programmes to date have been suggested by researchers and the programmes have been structured initially by researcher perception. It is true that researchers have often foreseen problems before the industry has. In the past industry appears sometimes to have had difficulty in assessing its research needs, and the present uncertainties facing the major forest owners have made the assessment of research needs much more difficult than usual.

The New Zealand forest industry has become more proactive in the co-operatives through the Technical Committees. The job of a forest manager primarily involves specific targets and short time frames. It is often easier for managers to define research needs if the context is wider than their own direct responsibilities. Technical Committees are having an ever-increasing influence on the direction that the co-operative research programmes have taken.

Opportunity for Achievement of Non-research Goals

The FRI/Industry Research Co-operative structure can also provide a vehicle for co-operation among members for purposes other than achieving research goals. Technical Committee members have exercised national leadership in areas related to co-operative objectives in several instances. For example, the Stand Growth Modelling Co-operative has begun rationalising growth/volume data collection on a national level, which is expected both to provide a more representative data base and to reduce costs of data collection for each member organisation. A second example is that the New Zealand forest industry has, through the Radiata Pine Breeding Co-operative, established guidelines to limit the export of highly improved radiata pine seed.

Even without specific non-research goals, the co-operative structure provides enhanced opportunities for communication among personnel employed by different member organisations. Many opportunities for informal communication are provided by organisation of and attendance at Technical Committee meetings, field trips and technical days. This often leads to increased co-operation in mutually beneficial non-research areas.

ADVANTAGES FOR THE RESEARCH INSTITUTE

Maximises time researchers do research

Co-operative funding tends to be long term and more predictable than contract research. Frequent and consistent contact with clients means that researchers have advance knowledge of client intentions. Less marketing is required because co-operative participants agree at the outset that there is a need for an ongoing research programme, often of several years' duration. In effect the "marketing" is essentially built into the co-operative structure.

Encourages research independence

Effective research organisations must have as basic principles the preservation and transmission of existing knowledge and the pursuit and dissemination of new knowledge. It is widely recognised that a large degree of technical freedom is essential to innovative and productive inquiry.

A key to maintaining technical freedom, the cornerstone of quality research, is to avoid total funding of researchers for an extended period by one special interest group. Cost sharing by the many industry members of FRI/Industry Research Co-operatives encourages researcher independence and scientific objectivity. The input of government funds and the flexible structure of the co-operatives in terms of researcher participa-

tion encourages a greater recognition of the "public good". Joint funding, planning, and implementation of co-operative projects promotes a more applied view from researchers and a more long-term view by practitioners which is likely to benefit industry in the long term.

Enhances research effectiveness

The quality of research can benefit immensely from increased opportunity for researchers to talk with practitioners in industry. The critical review of research plans and results provided by the Technical Committee can often speed up the process of technical advancement. It can also encourage quicker adoption of more promising research directions and more timely abandonment of less promising ones than might usually be the case.

BALANCE OF CONFIDENTIALITY AND SCIENTIFIC DISCLOSURE

As the New Zealand Government contributes a decreasing portion of the research dollar and industry contributions increase, it becomes more difficult to reconcile the free dissemination of research ideas and results with the industrial imperative to be competitive. The New Zealand industry is aware that restricting all information arising from co-operative work programmes would have a detrimental effect on the scientific standards of co-operative research.

It is possible for industry to draw benefits from its investments in research without compromising the open communications that are at the heart of good science. Research co-operatives, in particular forestry research co-operatives, have expanded and flourished in the USA for the past few decades. Staff servicing these co-operatives are all or almost all employed by universities, where research results, even if industry funded, are by law public knowledge. Staff participate freely in the scientific research community, and yet industry co-operative members continue to feel that they are getting value for money.

The Co-operative Technical Committees are encouraging FRI staff to publish co-operative findings to achieve recognition and standing for the research effort. Because co-operative members frequently have proprietary interests to protect, they have the right to review proposed publications and to request that any proprietary information be removed. Commercial value of both knowledge and products which may arise from the research programmes can be protected for the period that it is useful to do so. Commercial value can be judged on a project basis and appropriate restrictions applied where warranted while still ensuring scientific communication. Researchers and industry representatives can continue to work together to ensure that co-operatives promote both high-quality science and commercial advantages.

FRI/INDUSTRY RESEARCH CO-OPERATIVES IN THE FUTURE

FRI would like to see the co-operative concept applied more widely. Used in conjuction with other funding mechanisms, the co-operative structure is a good way of obtaining the funding necessary for maintaining FRI as a centre of excellence, because of its encouragement of high-quality research. Constructing relationships that work, and that truly benefit both the research institution and industry, is immensely difficult and requires effort. The returns, however, are well worth the effort.

The government contribution to the FRI/Industry Research Co-operatives has been targeted in the past to be 25% of the cost of the total work programme. Recent changes in government policy have made continued government contribution of funds to co-operatives uncertain. The Co-operatives Research Advisory Board believes that Government policy toward research funding should be to encourage good working relationships between research, industry, and local body organisations like the FRI/Industry Research Co-operatives. Strict separation of research projects into "appropriable" and "non-appropriable" categories discourages truly collaborative effort. The 25% contribution from the Ministry of Forestry allows for a government shareholding in the technology, and for some unidentified small client groups too dispersed to levy but who are accessible through consultancy. A government contribution to the Co-operatives is warranted because of the long-term, often strategic, nature of the research programmes. Care should be taken to ensure that a balance between Government and Industry funding continues in order to maintain and encourage researcher independence.

The theme of this paper has been to emphasise that high-quality, cost-efficient research can be obtained by industry organisations through the Co-operative structure. However, this is absolutely dependent on the maintenance of FRI as a centre of high-quality research. FRI and the New Zealand forestry sector must work together to maintain this excellence in forestry research with its breadth and depth of expertise, its collaboration with the international scientific community, and its tradition of independent thought.

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CONSULTANT RECOGNITION

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