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Workshop

COOPERATIVE STRATEGIES

for

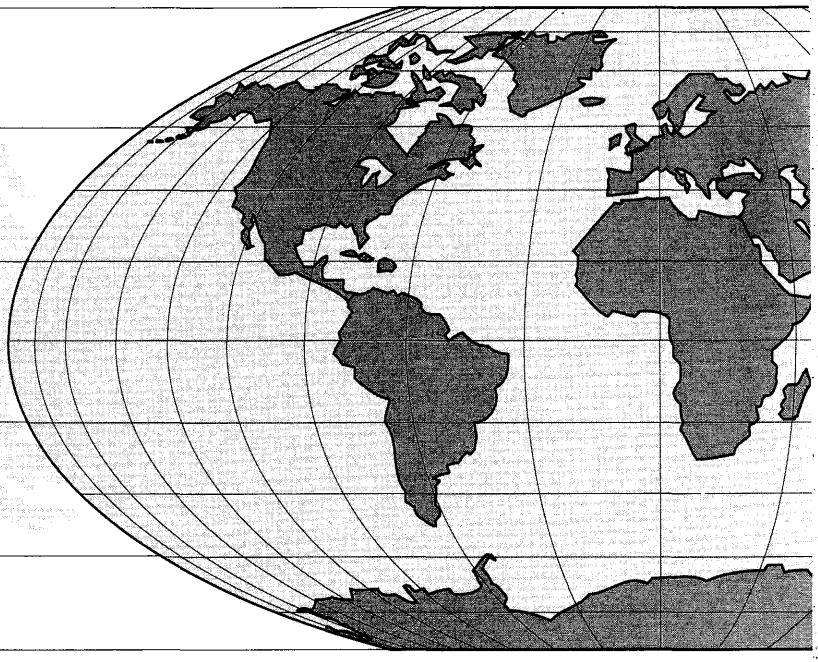
FOREST SCIENCE MANAGEMENT

and LEADERSHIP *in an*

INCREASINGLY COMPLEX

and

GLOBALIZED WORLD



Focus on Best Practices and Organizational Benchmarking

Natural Resources
Canada
Canadian Forest
Service

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Abstract

The purpose of this workshop was to develop organizational networks to help achieve best practices in management and leadership of forest research and foster continuous learning toward that goal through organizational benchmarking. The papers and notes herein document the presentations and discussions of the workshop.

Keywords: benchmarking, forest research, international forestry, leadership

Sponsors

* Ministry of Natural Resources Canada
* Ministry of Natural Resources Quebec
* Forintek Canada Corp.
* USDA Forest Service

Workshop Coordinators

* Dr. David DeYoe, General Manager, Ontario Forest Research Institute
* Dr. Denver P. Burns, Station Director, Rocky Mountain Research Station, USDA Forest Service
* Mr. Jean-Claude Mercier, Vice President, Forintek Canada Corp.

Compilers' Note

None of the papers presented from the conference were subjected to technical review; the views expressed and the mode of expression are those of the presenters. The USDA Forest Service shall not be responsible for statements and opinions advanced in this publication. Authors are responsible for the quality of their papers.

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Cooperative Strategies for Forest Science Management and Leadership in an Increasingly Complex and Globalized World: Proceedings of a Workshop

International Union of Forest Research Organizations: Group 6.06.00 Workshop

August 23-26, 1998 **Quebec City, Quebec, Canada**

Contents

Preface

The idea for this workshop began in 1996 when the folks in Quebec, faced with some unappealing fiscal realities that promised to devastate their provincial forest research capacity, held a meeting that convened representatives from research organizations around the world to share their experiences under similar circumstances. The meeting gathered senior research executives from England, Australia, New Zealand, Canada, the United States, and Sweden. The experiences and the messages were surprisingly similar and confirmed a disconcerting fact: that times are changing for R&D in forestry and if we are not willing to change to meet the challenges, we're toast! Further, it was clear that many would view this as a threat, not an opportunity, since the adjustments required to survive and thrive could appear quite radical for those grounded in tradition. Nonetheless, the meeting attendees took to heart the presentations and ensuing messages, and actions were proposed and taken.

One of those actions stemmed from the need and desire to learn more about how to capitalize on the opportunities and to become a positive and relevant force in the R&D community while improving alignment of science activities to corporate priorities and client needs. At the end of the conference the speakers and the hosts gathered to discuss next steps. It was at this point that the commitment to hold an IUFRO 6.06.00 conference was made. The principals were Jean-Claude Mercier of Forintek, Denver Burns of the USDA Forest Service, and David DeYoe of the Ontario Forest Research Institute. These people, with valuable input and advice from program and organization committee members, designed a workshop-style conference to provide participants with ideas and approaches that would be of value in helping them address relevant issues and opportunities.

The idea was to gather a much broader collection of research managers from around the world to address the issues and opportunities inherent within the choices required to change the way we need to do business. The intent was to provide participants with experience-based information and approaches to help those at various stages of a change process improve their margin of success. To that end, a series of presentations accompanied by breakout discussions was planned. The focus of the presentations and the discussions was to be on the identification of best practices for each of what was considered key topic areas in management and leadership, and to establish a framework for managers to evaluate progress through organizational benchmarking.

The workshop was scheduled for Quebec City in August 1998. The objective was to have participants walk away with some new insights, ideas, and processes that will be of value in helping them proactively "assault" their realities and move forward in a progressive and positive manner. We recognize that this is a big challenge. We also recognize that if we don't take the challenge, the obstacles will only get bigger and more complex. The papers published herein capture or highlight the presentations given. I hope this material will help the reader balance possibilities and realities.

Dr. David DeYoe, General Manager
Ontario Forest Research Institute

Workshop Purpose

- To develop organizational networks to help achieve best practices in management and leadership of forest research and foster continuous learning toward that goal through organizational benchmarking.

Objectives

- To facilitate the development of best practice standards for management and leadership of forest research, both within and across organizations.
- To establish a process for benchmarking current or planned practices against a collection of standards that are effective, relevant, flexible, and viable.

Desired Outcomes

- To inform research managers of management and leadership strategies that work.
- To provide managers with an expanded network of colleagues with whom they can confer on what works, what doesn't, and why.
- To ensure participants walk away with at least one revelation or practice that will help them resolve an issue of concern.

Benchmarking: A Strategic Overview of a Key Management Tool

Chris LeClair[1]

Benchmarking is a continuous, systematic process for evaluating the products, services, and work processes of organizations in an effort to identify best practices for possible adoption in support of the objectives of enhanced activity service delivery and organizational effectiveness.

Benefits of Benchmarking

- Input to strategic plan
- Product/service comparisons
- Work process comparisons
- Goal setting

Types of Benchmarking

- Internal benchmarking
- Competitive benchmarking
- Functional benchmarking

Key Phrases of Benchmarking Process

- Determine what to benchmark
- Form a benchmark team
- Identify benchmark partners
- Collect and analyze benchmarking information
- Prepare benchmarking report
- Take action

Determine What to Benchmark

- Organizations must identify those aspects of their operations that they believe warrant benchmarking. What is important?
- Organizations must identify organizational features and processes that lend themselves to comparison. Can they be translated into comparison metrics?
- What are the organizational factors (for example, staffing, revenue sources, planning process)?
- Is the benchmarking strategy- or activity-related?

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Form a Benchmark Team

- Effective benchmarking requires strong staff support from a participating organization.
- The staff that should be involved is a product of what is being benchmarked.
- Regardless of what function is being benchmarked, senior management must play an active role if benchmarking is to have any meaning.

Identifying Benchmark Partners

- Identifying benchmark partners is a balancing act.
- You need to identify organizations that represent potential best practices in the area(s) that are being benchmarked.
- Sometimes, it is not possible to identify the fact that an organization demonstrates a best practice until after it has participated in the benchmarking process.
- You must also find organizations that are ready and willing to share information.

Collect and Analyze Benchmarking Information

- Data gathering must only take place after careful planning that clearly identifies what areas are going to be benchmarked and how.
- Strategic benchmarking reveals much more than simply a comparison. It should go beyond defining differences between organizational performance and shed light on the sources of these differences.
- Benchmarking data can be obtained from a number of sources: interviews, background materials, the Internet, survey data, and so on.

Prepare Benchmarking Report

- Benchmarking should result in the kind of report that enables a benchmark partner to take action.
- Benchmarking should contain both comparative analysis and recommendations that build upon the findings to help participants embrace best practices.
- A good benchmarking report offers a call to action and does not dwell on poor performance; rather, it highlights the opportunities that exist.

Take Action

- The timing of a benchmark project should be linked to an organization's strategic planning process. It should be a key input into the planning process.
- Benchmarking partners should be asked to develop a response plan to the benchmarking report, complete with timelines and deliverables.
- Relevant best practices in the benchmarking report should be cited as goals that the benchmark partner cites in strategic/operational planning.

Benchmarking Methodology

- The process of benchmarking is based on the ability to make informed, meaningful comparisons about key activities, strategies, work processes, organizational attributes, and so on.
- This requires a process of measurement—the measurement of organizational elements that often do not readily lend themselves to being measured.
- The development of the appropriate metrics is the key to the benchmarking process.

Comparison Metrics

- This refers to measurable activities and/or traits developed from the benchmark areas.
- The process of measurement focuses upon elements of a strategy or structural attribute while addressing salient issues within the organization.
- The challenge is to not lose sight of what is fundamental to an organization and its key functional areas.
- Efforts to define comparison metrics are often drawn from input received from interviews, meetings, and experience.

Opportunities for Benchmarking Forest Research Organizations

- Do enough similarities exist among forest research organizations for benchmarking to make sense (size, structure, activity/service focus, and so on)?
- Is it possible to identify best practice organizations?
- Will organizations devote the necessary staff/financial resources required to undertake a benchmarking program?
- Will organizations agree to share the kind of information needed to make the benchmarking project worthwhile?

Launching a Benchmarking Project

- Define potential benchmarking categories.
- Identify benchmark partners and secure commitment to proceed.
- Secure required benchmarking expertise through staff secondment/consulting contract.
- Draft benchmarking work plan outlining duties, project timeframe, deliverables, and costs.
- Commence project.

Opening Remarks of Session Moderator

Dr. Perry J. Brown[1]

It is a pleasure to be in Quebec City to learn about this very important topic of managing research. We have an interesting panel to share ideas about managing science. They will talk about:

- Research Priorities
- Goals and Objectives
- Managing Human Resources
- Evaluating Research

To kick this off, I will make a few remarks and then we will go to our panel.

Great change in our world is driving scientists and science managers to search for best management practices. You know the story—some forces of changes are good, some bad, and all a great challenge:

- Questions about the relevance of science and what scientists do
- Reductions in base budgets (disrupting personnel and programs)
- Greater use of competitive grants
- Faith in privatization with the belief that short-term efficiency should rule
- A short-term focus of politicians and industrial managers, thus ignoring the benefits of research and development
- Globalization of forestry in trade, climate change, habitats for humans and animals, environmental impacts, and species distributions
- More organizations involved in forest decisions and needing scientific information
- Increasing demands on forests for both commodities and services
- Increasing recognition of the positive relations between forests and people
- Calls on scientists to provide information for policy development
- Use of science to defer policy action
- Use of science and scientists to deflect and diffuse political criticism
- Scientists who advocate policy and management solutions to social problems under the guise of science

I am sure many of you could add to this list. Given the context that it provides, a context of considerable change, how might we cope with change in natural resource research and development? As a research manager I do not have any magical solutions or any absolutely proven best management practices.

While there are some things that we need to do to cope with change—and I mean cope in the sense of managing and leading the change—overall I would

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say that managing research and science takes the following in our leaders and managers:

- Vision—a view of a desired future involving questions such as, "Who are we?" and "What can we become?"
- Optimism—seeing the challenges and opportunities in change
- Commitment to excellence—helping the organization and its personnel be as good as they can be
- Passion for people—seeing and developing their strengths, being sensitive to uncertainty and turmoil, listening to them, genuinely liking people, encouraging and supporting them
- Boundary spanning—being able to cross the boundaries of disciplines and organizations

So, what are some of the elements of coping with change as we move toward the 21st century?

- Focus on expected benefits—we must be able to effectively answer when someone asks, "So what?"
  - As appropriate, the answer can be about benefits to science, management, education, society, or individuals.
  - The kinds of benefits can be ecological, social, psychological, political, or economic.
  - The bottom line is that we must be able to articulate how our research will help achieve something good.
- Deal with both simple and complex problems—
  - Demonstrate relevance to multiple observers; we must solve some clear and straightforward problems to demonstrate output and relevance and we must tackle complex and difficult problems that represent many of the challenges managers face.
  - Develop project groups to tackle complex issues.
  - Develop non-discipline, non-functional funding and personnel groups.
  - Mix scientists in location—facilitate their encountering each other; build encounter spaces for them.
  - Develop and sanction non-classical media reporting such as video and web-based media.
  - Reward those who work with managers and other relevant publics.
- Listen to managers, politicians, special interests, and other publics
  - Listen and convert what is heard into researchable questions
  - Test your understanding of what is heard by articulating the expected benefits of the research—are the benefits those that are desired?
  - Engage scientists in discussions of context for natural resource issues and problems—do they know what managers, politicians, special interests, and other publics want?

- Diversify sources of income
  - Assess your expertise relative to new sponsors.
  - Do things that people need—provide benefit.
  - Build partnerships to gain synergistic effects of pooling talents, knowledge, ideas, problems, and resources.
- Encourage and support technical and scientific development of scientists
  - Provide skill development for new technology—personal computer technology has been a recent example of this need.
  - Provide courses, readings, and so on, for concept and knowledge development.
  - Develop discussion groups with managers, CEO's, politicians, and others to foster context development.

These are some of the "whats" that can be done. Our panelists will give you more of these and suggest some of the "hows" of doing them. There are big challenges in management of research and development, but I believe the challenges can be met. My own program, the Montana Forest and Conservation Experiment Station, is changing dramatically. We have new areas of science, new disciplines, new partnerships, and new ways of doing business and I believe we are getting better at both science and responsiveness to the society in which we live.

So, let's hear what others have to say and turn to our panel.

Establishing and Agreeing on Research Priorities

Ian de la Roche, Ph.D.[1]

The organizers asked me to share with you my experiences in developing and implementing a process for establishing and agreeing on research priorities in a multi-stakeholder research institute such as Forintek.

The mechanism we have in place has been well received by Forintek's membership and certain aspects have been adopted by other research organizations. While we are pleased with developments to date and the strong commitment of employees, priority setting has been, and will continue to be, an evolutionary and iterative process with opportunity for future improvement. Also, our approach may not be appropriate for other organizations because of differences in mission, governance, and client base. For these reasons I have decided to take an anecdotal rather than a prescriptive approach in this presentation.

Forintek Canada Corp. is a private, non-profit research institute—Canada's national wood products research institute. Established in 1979, it is an industry-government partnership. This year our National Research Program is valued at Cdn $10.5 million and our contract portfolio is expected to be Cdn $8.8 million. Our staff of 185 is located in laboratories in Vancouver, British Columbia, and Sainte-Foy, Quebec. As well, we have a fire research group in Ottawa, Ontario, and a regional office in Edmonton, Alberta. Also in Edmonton is the Alberta Research Council, a key member of Forintek's Composites Research Consortium.

New partnerships are under development with the Saskatchewan Research Council and the University of New Brunswick's Wood Science and Technology Centre.

Forintek's National Research Program is the "raison d'Ltre" of the partnership and is funded entirely from membership assessments based on the principle of shared costs, shared risks, and shared benefits. The partnership presently comprises 155 wood products companies from across Canada, five provincial governments, and the Government of Canada.

As Canada's national wood products research institute, we carry out research in the following areas: resource quality characterization; advanced manufacturing of lumber and composites; drying and protection; and building systems, which includes research on markets and codes and standards. We are involved in each step of the value chain—from the resource through to the marketplace. Our Sainte-Foy and Vancouver laboratories are good examples of wood use in industrial and commercial construction, using engineered wood systems.

When I joined Forintek in 1992, the framework for establishing priorities in the National Research Program was already in place through various advisory committees representing government and industry members. Meetings were infrequent and there was considerable cynicism among the membership about the effectiveness of the process. This had led to the recent resignation of a major company and several more were considering the same action.

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Obviously, quick action was required. The root of the problem was around the following four concerns:

- consultative but not responsive;
- lack of urgency in getting out results;
- confusion about vision and direction; and
- lack of client focus and accountability.

I have seen similar concerns expressed by other research advisory boards I have served on in government and university. Forintek undertook quick and deliberate actions to address these issues:

- dedicated manager for the process;
- integration in strategic and operational plans;
- performance measures tied to employee performance and compensation;
- focus on timeliness, relevance, and quality;
- member feedback and follow-up; and
- clear vision and direction developed by members and staff.

To put teeth in Forintek's planning framework and to ensure clear division of responsibilities, we engaged the involvement of our members, starting with the Board of Directors. The Board formally set up the National Research Program Committee (NRPC) and made it responsible for setting the strategic direction of the research program, establishing overall priorities and allocating resources amongst the five program areas.

The five Technical Advisory Committees (TACs), which coincide with the five program areas, were made responsible for project prioritization and selection, as well as monitoring progress and technology transfer of results. The NRPC and TACs have broad-based representation from the membership. There are approximately 260 members involved in the process.

Each project must be approved by the TAC. The project leader is required to present his proposal and briefly address "what" is being done, "when" it will be transferred, and "what" will be the impact on the members. Each approved project is assigned one or more liaisons to assist the scientist during the course of the research and to facilitate the application of the results. Progress is reviewed quarterly.

Establishing and agreeing on research priorities is the first and most important step of research management that includes execution, monitoring, technology transfer, adoption, and evaluation. At Forintek, we have adopted a "co-producer" approach to deal with this. It involves our government and industry members and Forintek scientists in each of these activities. This involvement by members engenders a level of ownership that is essential to maintaining credibility of the process and for the continuing support of the membership.

The specifics of priority setting for an organization accountable to membership with very diverse needs and priorities—federal and provincial governments, large fully integrated companies, and small operations—are shown in figure 1.

Using a strategic planning approach, we were successful in getting consensus on the major challenges driving change in wood products and agreement that science and technology could play a very useful role in turning these challenges into competitive advantage for Canadian producers. Our challenge was to get agreement on where we should be spending scarce research dollars.

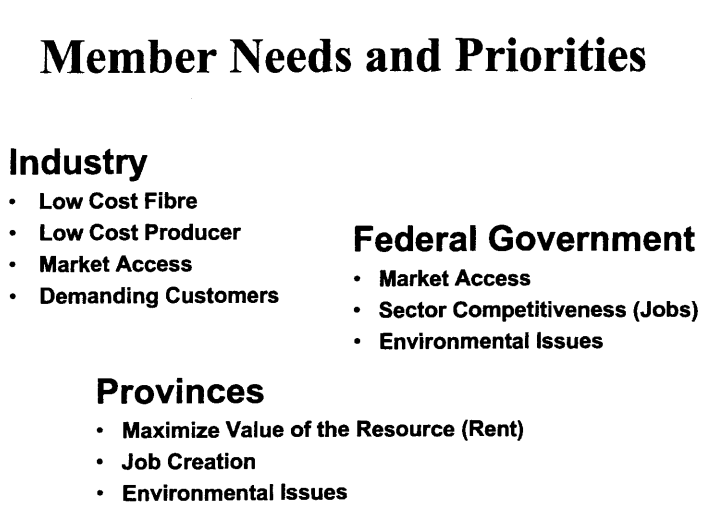

Figure 1—Priority setting.

The process turned out to be an exercise in compromise and consensus. Provinces placed high priority on hardwood research; the federal government on environmental comparability of building materials and performance of light-frame structures; and the small and large manufacturers had different priorities in composite and lumber manufacturing. Some cases where agreement could not be reached were eventually handled outside the National Research Program under contract. For each priority area, the TACs agree to program goals to help focus research ideas for each of the five areas. A portfolio of projects is developed to specifically address each goal. Approximately 90 projects are carried out in any given year.

In the past, the research program had been generally biased toward shorter-term problem solving, with a focus on cost minimization and market access. Recognizing the short-term bias, we decided to go through a second planning process—a "top down," "big picture," and global approach to reassess needs and priorities. The Board, NRPC, and senior management met to consider the principal drivers, trends, and predictions that would impact on all sectors over the next 10 to 15 years and examine how some trend-setting companies were meeting these challenges.

We concluded that the electronics and information revolutions would continue to be the most significant influences in the global economy. These revolutions are changing the rules for doing business. We examined companies that had demonstrated the capacity to successfully adapt to the new rules (for example, WalMart, Canon, 3-M, Toyota).

We identified four business strategies that were relevant to the forest products sector and they became the drivers of our new research strategy (figure 2). The new research strategy focuses on our members' customers, not only on our members; on building products, systems, and structures; and on all the product attributes and qualities of solid wood products which are demanded in the market place (such as a holistic approach). As a result, our focus shifted from "maximizing" to optimizing" wood usage. The new program foci are:

- Optimize use of wood to meet end-user expectations.
- Enhance attributes to products and systems.
- Improve manufacturing processes to maintain cost competitiveness.
- Add value at the resource.

Significant emphasis is placed on adding value at each step in the value chain, and on the effective use of technology and knowledge of the market,

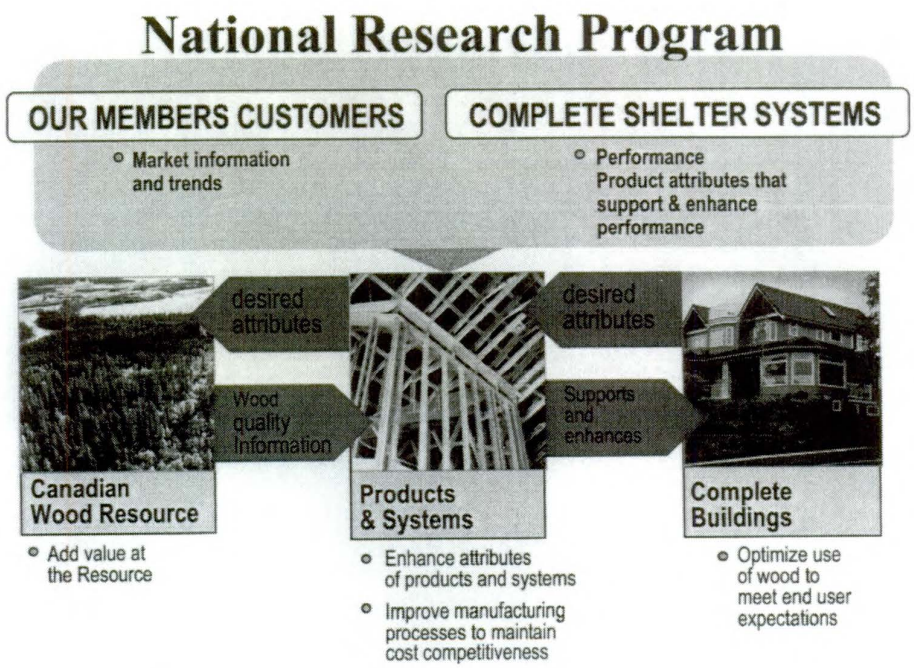

Figure 2—Forintek's new strategic directions.

resource and manufacturing processes. The focus is now on the longer-term needs of the sector.

Over the last two years, we have realigned research program goals to fit the new direction; for example, Building Systems is guided by the first two program foci above. We now have a more appropriate balance between the short- and the longer-term needs of the industry. In addition, the new direction has enabled us to embark on a new value-added initiative and a new market attribute program. To identify needs and establish our research priorities we utilized two different planning processes. Members and staff were intimately involved in both, which is consistent with the co-producer approach used at Forintek.

To maintain credibility with members and ensure their continued involvement in the planning process, the organization has placed considerable emphasis on client focus and accountability for the timely delivery of cost-effective, relevant, and high quality research results. Corporate accountability for all aspects of the National Research Program, including priority setting, is captured under the client focus, financial sustainability and excellence goals of the Strategic Plan and annual Operating Plan. Employee accountability is built into the job descriptions, and performance and compensation systems. The job descriptions and the annual objectives of each employee are built around the same three goals.

In conclusion, the National Research Program is guided by a framework and series of processes that are captured in the Strategic Direction, the Strategic and Operating Plans, our human resource management systems, and the annual program of work which spells out the "what," "how," and "when" for each project.

Generally, we have been satisfied with the results we have achieved in this challenging aspect of research management and with the positive reactions we have received from our very diverse client base. We recognize that our process could be further improved, but I hope I have given you some ideas that could prove useful to your organization.

Setting and Measuring Team Goals and Objectives for Improved Management of Forestry Research

Dr. Scott J. Josiah[1]

As our world becomes more complex and diverse, many forestry research organizations are responding by adopting more interdisciplinary and collaborative research programs. Our rapidly increasing knowledge of the ecological, social, and economic factors affecting forestry and natural resource management makes it simply untenable to expect that complex problems can be solved through the expertise and contribution of a single discipline, or with the resources of a single organization. The recent shift to holistic land management approaches such as Ecosystem Based Management acknowledges these complexities, and attempts to integrate management approaches on a landscape scale. The rise of Adaptive Collaborative Management also recognizes the uncertain, interactive and adaptive nature of decisions in natural resource management, and emphasizes continuous reassessment and adaptation to changing conditions. Coinciding with this shift in natural resource management philosophy, and thus a change in approaches to forestry research, are the demands of funders for more interdisciplinary investigations and approaches.

Setting and measuring goals and objectives can be challenging enough for researchers working in a single discipline on a narrowly defined, single discipline project. But many research questions today are more broad and integrated, requiring a team of specialists from different disciplines. Getting diverse groups of researchers to come together and make the hard decisions on how research should be jointly designed and implemented are not easy tasks. Clearly, defining and measuring research goals and objectives under these more complex conditions can be a daunting challenge. This paper clarifies how goals and objectives can be better defined, implemented, and monitored when using interdisciplinary, collaborative teams.

Goals and Objectives: A Review

"If you don't know where you are going, any path will take you there."

—Sioux proverb

It is important to note from the outset that goals and objectives are different. Goals are broad statements of the intended outcomes of the research organization as a whole (strategic goals) or each research program (program goals). They set the strategic direction for the organization and are the desired impacts on society of the outputs of research. Examples of goals may be to increase the national self-sufficiency in wood products, or to increase the basic understanding of tropical forest ecosystems.

Objectives are statements of specific results that the research organization seeks to accomplish in a relatively short period. They are the tangible outputs

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of research. Objectives should be "SMART" - Specific, Measurable, Achievable, Results-oriented, and Timebound (Harrington-Macklin 1996). Examples of research objectives would be:

- over the next 3 years, develop small-scale, affordable portable sawmilling technology appropriate to local conditions; or
- develop, over 2 years, a high efficiency wood stove that reduces fuelwood consumption by 50%.

Determining and clearly stating objectives is a powerful way to clarify the steps needed to reach goals. Objectives need not overly dictate or restrict a team's activities, a criticism often directed at the formal "Management by Objectives" approach.

> *"Objectives are not fate; they are direction. They are not commands; they are commitments. They do not determine the future; they are means to mobilize the resources & energies of the business for the making of the future."*
>
> —Peter Drucker, 1977

For effective interdisciplinary team-based research, the organization's strategic, program, and project goals and objectives must complement each other, with strong links between each level of planning. As Alvin Toffler wrote in 1988, "You've got to think of the 'big things' while you're doing the small things, so that all the small things go in the right direction." Goals and objectives must be dynamic--able to respond to changing conditions and priorities, achievable, and worth doing. Clearly, "if a research project is not worth doing at all, it is not worth doing well"(Lindermann, 1969).

Who Sets and Prioritizes Goals and Objectives?

On clear and effective goal setting:

> *"On a country hike, two city kids met a grizzly bear. One kid sat down to put on a pair of sneakers and made ready to run. The other kid said, scoffing, 'I've read all there is to read about grizzly bears, and no man can outrun a grizzly.' The first kid looked up and said, 'I don't care about outrunning the bear, I just want to outrun you!'"*
>
> —Anonymous.

Research organizations and teams use a number of approaches to setting and prioritizing goals and objectives. Goals and objectives can be solely determined by upper management (a top-down approach), although acceptance and support by research staff may or may not be forthcoming. Or, they can be determined by the researchers themselves (a kind of limited bottom-up approach, at least within the organization), with the risk that the research is not in line with the organization's strategic goals. A third option, with research questions being identified by the eventual users of the research, would be truly bottom-up in nature, but could result in ad-hoc research without an overall long-term focus.

In practice, effective research organizations involve top management, scientists, and stakeholders in an iterative, collaborative process to set overall strategic goals, develop focused research programs, and identify specific research projects that meet stakeholders needs as well as fulfill the organizations strate-

gic goals. This top-down, bottom-up approach requires lots of communication and a commitment to the process. But the extra work is worth it, resulting in improved congruence between program and strategic goals, research that is better oriented toward real needs, and greater opportunities for potential users of the research results to provide input. Under such conditions, researcher "buy-in" is enhanced, and stakeholders feel ownership in the process and of the research results. Indeed, in an interdisciplinary, collaborative ponderosa pine research project, "a major reason for the smooth functioning of the team is that the scientists 'own' the concepts and participate voluntarily" (Oliver and Powers, 1998).

It is not unusual for some members of a particular team to have been assigned to the effort by their organization. Under these circumstances, it is imperative that everyone involved has the authority to represent their organization in goal setting, and to ensure their achievement. Otherwise, the individual's effectiveness will be limited, hampering the entire team effort.

A Framework for Successful Goal and Objective Setting

Research teams with successful, effective goal and objective setting often exhibit the following eight characteristics:

Accountability

Team members must be accountable for their and the team's performance to their superiors and to their stakeholders.

Responsibility

They must be responsible for the day-to-day activities and resources being utilized by the project or effort.

Authority

They need to have the authority to delegate control of funds and resources to scientists and research staff, to determine and delegate activities that others may be doing, or to act themselves. In highly interdisciplinary and interorganizational research projects or programs, central coordination by a facilitator not strongly affiliated with any one discipline can be an effective way to manage the effort (Oliver and Powers, 1998). This assures that at least one member of the team has the authority to adhere to timetables, take care of reporting and administrative functions, foster communications, and keep the team on track. Indeed, a central coordinator can be an effective means to maintain team discipline and focus. As Benjamin Disraeli said nearly 130 years ago, "the secret of success is constancy to purpose," or in this case, goals and objectives.

Communication

Clear communications between members is clearly essential, given the breadth of disciplines and subsequent diversity of opinions on how things should be run. Teams need to spend considerable time early on to develop a commonly shared language and understanding of what is expected, an appreciation of the linkages between strategic, program and project goals, and consensus on

the team's goals and objectives. Frequent reiteration of the team's goals and objectives at meetings, in written communications, reports, and publications can help maintain and enduring consensus. This also provides multiple opportunities for the team to re-evaluate the relevance and "fit" of the current set of goals and objectives to current conditions. And, since there will always be conflicts among members on a diverse team, mechanisms for managing conflicts will need to be determined and agreed upon early on by the group.

Participation and consensus building

For teams to work effectively throughout their lifetime, a participatory approach right from the start can best build and maintain consensus and ensure research relevance. This allows for, and indeed should encourage, input from as broad a group of stakeholders as possible. In acquiring this input, a policy of inclusion rather than exclusion (even with project opponents) is desirable and worth the extra effort. It increases the chance that the project will have committed scientists willing to compromise to ensure project success, reduces "out-of-the-blue," last minute objections from excluded stakeholders that could derail the effort, and is more likely to effectively integrate environmental, economic and social understanding and concerns.

Access to resources

Effective teams also need adequate and timely access to resources to perform the research. Delays and inadequate resources will quickly reduce team morale and effectiveness.

Adequate incentives

From either the individual or team perspective, adequate incentives are essential, as well as the elimination or reduction in the number of disincentives. For example, will a tenure-seeking academic team member receive adequate recognition from his or her employer for implementing a particular project when they are only one of many authors on the final papers? Indeed, according to Hersey and Blanchard (1972), "The productivity of a work group seems to depend on how the group members see their own goals in relation to the goals of the organization."

Monitoring

Effective monitoring systems are needed to establish performance milestones both for individual team members, and for the team as a whole. Effective monitoring systems for team-based research show a strategic dynamism, with built in mechanisms for feedback and adjustment. Such teams have frequent formal and informal team meetings to allocate funds, coordinate fieldwork and activities, and to assess performance in terms of outputs as well as impacts.

Problems of Setting and Managing Team Goals and Objectives

Teams that lack these eight characteristics typically exhibit a number of problems that ultimately result in increasingly unrealistic and/or unrealized goals and objectives. Because of inadequate feedback loops, they may become static efforts that are unresponsive to stakeholder needs, leading to disgruntled

stakeholders and loss of support and funding. Organizations or teams will show greater stress, with growing interpersonal conflicts, and greater unpredictability and manageability.

Some common problems interdisciplinary research teams tend to face include:

- Confusion between goals and objectives, either because they have been incompletely developed and "processed" by the group, or are not clearly stated—meaning different things to different people, or are not measurable—resulting in poorly defined activities and inadequate feedback on performance.
- Rushing the process, with incompletely developed or shared "common" goals. Goal and objective setting with teams takes a lot of time and effort to come to consensus, particularly on teams with diverse members. Without making this early investment, subsequent performance will likely suffer significantly.
- Excessive and unreasonable attention to the process of setting and achieving goals, to the point where the process becomes burdensome, bureaucratic, and hinders innovation. As Gardner wrote in 1964, "...Little by little, preoccupation with method, technique, & procedure gains a subtle dominance over the whole process of goal seeking. How it is done becomes more important than whether it is done. Means triumph over ends. Form triumphs over spirit. Method is enthroned. Men become prisoners of their procedure, & organizations designed to achieve some goal become obstacles in the path to that goal."
- Some team members may "free ride," not carrying their fair share of the work required. This may be a function of an individual's personality, the failure of their organization to provide them with the clear authority, responsibility or resources to act, or their lack of complete agreement with the group as to the goals and objectives of the effort and the ways to achieve them.
- Poor or inequitable delegation of responsibility, authority, and distribution of resources, leading to delays, declining morale, and competition instead of collaboration among team members for resources.
- Team members may occasionally find that their participation in the project conflicts with their other job responsibilities. A common question to their supervisor in such cases may be "Do you want me to do this, or my job?"
- Rifts between team members from different backgrounds (e.g., scientists/farmers) that speak different languages (in a figurative sense) and with different personal reasons for participating can hamper team effectiveness.
- Inadequate reward systems for interdisciplinary activities regarding promotion, recognition, etc., can become commonplace.

Summary

Setting and measuring individual and team goals and objectives is an essential part of the research management process. While they do not draw a distinction as this paper has between goals and objectives, Weinberg and Schulman

(1974) succinctly captured the nature and importance of goals and objectives to research management:

> *"No experiment ...should be undertaken without clear, explicit & reasonable goals – unless the experiment is designed to measure the effect of unclear, implicit, or unreasonable goals."*

Well-defined goals and objectives help to guide the research management process and clarify its direction. They are essential to the success of collaborative, interdisciplinary approaches increasingly used in forestry research. Effective interdisciplinary, collaborative teams have members that are able to come to consensus on a project's goals and objectives, ensure they are congruent with those of their larger organization, and receive the management support, resources and incentives to effectively work together to achieve these common aims.

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Managing the Human Resource: The Challenge of Change

Dr. Gary Latham[1,2]

How do we, as leaders, get people to embrace change rather than resist it? Getting people to embrace change is what psychologists call having a "superordinate goal." In plain English, a superordinate goal is an attainable vision. When psychologists talk about vision, they mean something that is not more than one to three sentences. It is not a silly mission statement that no one reads and nobody remembers. With vision, we are referring in psychology to the power of language. It is a few words to galvanize people and incite them to action. It gives people a cause that they can believe in. Some examples are Churchill, Kennedy, and Iaccoca.

The downside of talking about vision is that you are playing with fire when you play with people's emotions. And great vision statements are often nothing more than words, so they become a source of cynicism and frustration. An employee may say, "I can't believe at my age and my experience that I was so naïve to fall for this, because subsequent to the articulation of the vision statement, it's the same old thing."

Goal Setting

What differentiates effective from ineffective leaders? It is, in fact, goal setting. The purpose of goals is to simply move the vision from concept to action steps. Specific difficult goals lead to higher performance than abstract goals or no goals at all. Recall Scott Josiah's presentation earlier; SMART goals win over 90 percent of the time. Why? Because most of us live in a world where everything is urgent and high priority. But when you set a specific goal that is difficult yet attainable, you beat the sense of urgency. Commitment to higher goals results in higher performance. The most interesting aspect of goal-setting theory is that monetary rewards, public recognition, and employee participation in decision making have no effect on behavior unless the person believes and participates in commitment to high goals.

During World War II, a German psychologist conducted an experiment to see the effect of meaningless work on behavior at a prison camp. He commanded each prisoner to fill a wheelbarrow with dirt, wheel it over to a dirt pile, and dump the dirt out. Then the prisoner had to refill the wheelbarrow, push the dirt back to where he originally shoveled it, and dump it out. After 65-70 days of this, guess what the prisoners did? Did they ask for a raise? No—they went mad and threw themselves on electric wire or simply threw down their shovels and raced off knowing that German guards would shoot them down. They went nuts. On the other hand, why do many people here today ruin their weekends with trying to hit a white ball into a little tiny dirty hole? Why are you doing that? All you have to do is pick it up and drop it in, pick it up and drop it in, and so on. You are doing that because it is a challenge. Goals

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[2]This paper summarizes a transcript of Dr. Latham's presentation.

give meaning to otherwise meaningless tasks and they provide a sense of accomplishment. Goals keep you from going mad.

Goals reduce stress. Goals need to be few in number, as in 3 to 7, not 37. The danger of 37 goals is that your eyes glaze over and there is no focus. And worse, you're apt to get into cherry picking, which is picking only the easy ones. Goals also need a time frame to them. Does anybody remember John F. Kennedy saying, "We will be the highest quality, lowest cost space explorers of the world"? No—he said in 1962 that within that decade we would put a man on the moon and return him safely to Earth. It had a time frame to it.

Goals need to be tied directly to the strategy of senior management. Employees have to perceive that what they are doing is tangibly helping them. If you can understand consequences, you can understand behavior. Look at consequences from the eyes of manufacturing, from the eyes of marketing, from the eyes of senior management. And you need to talk the language of the people with whom you are relating.

Integrity and Accessibility

Something else that differentiates effective from ineffective leaders when it comes to getting people to embrace change is integrity. It's serving as a model to the people around us whether it is co-workers, bosses, or people reporting to us. We are walking examples of desirable behaviors. We need to be sensitive to the signals we send. I'm talking about signals that are inadvertent, unintended, and unconscious. For example, what signal did I hope I was sending to you today by not using overheads during my presentation? Maybe you picked up the signal that I was unprepared, but the signal I'm sending is that I want this presentation to be interactive with all of you.

Another factor that helps people embrace change is accessibility. Let people know that the little things they do are noticed and appreciated, not the big things. If you scrub on the big things, don't worry—someone will fill the blame for you. I am talking about the little stuff. You need to notice and appreciate the little things that people are doing in relation to vision and goals. Also, simply be a good listener and encourage disagreement.

Attention

Why is it that a spouse walks out after 20-25 years of marriage? A hint: It has nothing to do with sex, money, religion, or in-laws. Those are all the big issues for the first seven years. Why does he or she walk? It is lack of attention. By the way, the third party—you would be amazed—is even uglier than you and me. So why would he or she leave you for someone uglier? Lack of attention. You have no problem getting upset when someone turns in a report late. But when was the last time you complimented someone for reporting on time?

Attention begins with being specific. When you see someone doing something you appreciate, comment on it. Here's a sexist question for you. In general, who is better at giving praise than receiving it? Males or females? By far most of you raised your hands in favor of females. Why? It is not genes, blood type, nothing to do with babies—it's a learned behavior. At the age of 18 months or so, little girls learn that it is respected and appropriate to make comments such as "Look at your hair, you're so pretty!" If I were to walk up to Dave this

morning and say, "Dave, I really like your hair these days," he wouldn't speak to me for hours. Well, Dave's hair is not job-related but there are a thousand things that are—and real men need to comment on them.

People need to know that they are noticed, that they count, that they are somebody. For odds are, they are going to leave. And worse, they'll leave psychologically and not physically, so they retire on the job.

Great leaders make employees feel like they are contributing to the team rather than detracting from it. If you don't make people comfortable with saying no, then you'll get groupthink.

Measurement

When we talk about vision, we also talk about measurement. When it comes to embracing change, great leaders know that that which gets measured gets done. It is a fundamental truth in psychology. The act of measurement conveys focus and importance. Before you look at personalities, before you point a finger at the individual, look at the measurement system. Measurement systems are often the source of dysfunctional behavior. The downside of measurement is that it gets the focus off the vision and goals and onto something very different.

There is a great book out called *Third Generation R&D*. The book describes the first generation as the strategy of hope, displayed as "hire good people, give them lots of money, put them away somewhere, given them time, and hope something good will come out of them." The second generation revolves around projects. The third generation R&D works from a vision statement that galvanizes and inspires. The two questions you need to ask first are: Why do we and R&D exist? Who would miss us if we were gone? The idea of vision is no boundaries, no walls between "us" and "them."

We will survive change through mutual vision, mutual goals, talking our thought, and continually asking employees: What are we doing right so we can continue it? What can we do even better? And, the most important question: What can you do to help us get there and vice versa?

Thank you.

Communicating Research Results

Dr. Jan Fryk[1]

Abstract: A research finding is of little value until it is known and applied. Hence, communication of results should be regarded as a natural, integrated part of research, and thus addressed in the research plans from the very beginning. A clearly defined information strategy and operational goals for information activities are needed for successful communication. For maximum impact, the information has to be tailored to the needs, interests, and abilities of various target groups. Numerous channels can be used to these ends. Significant resources should be allocated to information services. Making the customer pay for the information products has several advantages. Information activities should continuously be evaluated.

Effective communication of results should be a crucial issue for any type of research organization. How to carry out this task depends on what kind of research is being performed, who the customers or the target groups are, and so on. I will touch upon this subject from the perspective of an applied industry research institute, but hopefully some of my views also can bear relevance to other types of research bodies.

Essentially, forestry research in general and applied research in particular are aimed at bringing about improvements in forest management and utilization. But this cannot be achieved simply by accumulating knowledge from research. If changes are to be made, those people who can influence, determine, and/or implement the relevant changes must not only be made aware of the new findings, but must also understand and accept them. Finally, they must be capable of putting the necessary measures into practice.

Thus, a research task cannot be considered finished until the findings have reached all the relevant people who take the appropriate action.

In other words, I mean that a research result is of little value until it is known and applied.

The greater the number of research findings that are implemented, and the sooner this is achieved, the greater will be the return on the money invested in research. Consequently, there cannot be any doubt that the dissemination of findings is of strategic importance. Dissemination should be given equal weight to the research itself.

From a more visionary angle, one should pursue an information system where the customer can search and access the needed knowledge at any given time, as opposed to the situation today where the information is more or less pushed out.

Information Is an Integrated Part of Research

I believe that it is important to regard communication of results as a natural, integrated part of research. One should therefore have a clearly defined strategy, as well as concrete operational goals for information activities. As a matter of culture, it is imperative that everybody in the organization is aware of the emphasis put on information.

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As part of the strategy, researchers/scientists should be made responsible, albeit with assistance, for communicating their findings to relevant receivers. They are the ones most knowledgeable in the matter at hand. Presenting one's own results also gives a very immediate feedback and evaluation of one's work. Accordingly, information ability and pedagogic skills ought to be considered when research staff is being recruited. Continuous competence development within this field should be facilitated and encouraged, and good performance should render merits.

But even if the research staff have an individual responsibility to communicate their findings, it must be up to the organization to safeguard its external information functions according to the established strategy and overall goals, to ensure that quality standards are being met, and so on. It may then be a good idea to furnish the organization with professional staff that can act as support in information matters.

Setting Goals and Analyzing Target Groups

Successfully communicating results requires that information issues be addressed in the research plans from the very beginning. Right from the start one may ask the following questions:

- What effects or changes do we want the research to bring about?
- Which target groups need to share the findings so that desired changes can be implemented?
- What knowledge will these people need to be given?
- How shall this knowledge be passed on?

The answer to these questions may very well affect the way in which the research is structured and carried through. For instance, it is important that material and data, which later might be needed in the communication process, are collected in the research work.

The answer to the first question should really be the foundation for setting the goals for the entire project. These can then be broken down into individual objectives for research and for dissemination of its results.

Target groups need to be carefully analyzed. Are we talking about other researchers, professional foresters, woodlot owners, forestry contractors, authorities, politicians, journalists, NGOs . . .? It goes without saying that the information cannot be presented in the same form to all these disparate categories.

The information has to be adapted to the circumstances at hand and to the needs and interests of the respective group. For maximum impact, therefore, the same piece of information may often have to be produced in several different versions, so that it can be received and understood by all those one wants to reach. This may be a laborious and costly process but it is imperative.

Numerous Channels

There are numerous channels that can be used to communicate information, each with its own merits and suitability. *Publications* tailored to various needs, in every form from scientific reports and textbooks to news leaflets and manuals, are of course still a very useful and effective avenue. Another channel

is *courses, conferences, seminars, excursions, and field-days.* Through *mass media,* i.e., articles in the press, radio and TV programs, a wide public can be reached. However, increasingly important and with a tremendous potential are the possibilities provided by modern IT media, such as *direct-vision transmission, PC software programs, multimedia, and the Internet.*

Basically, I think that it is important that the research organization has a setup of its own controlled channels to major target groups and then use other channels creatively as complement.

Each communication channel has its pros and cons. When deciding on a suitable channel, one has to start by determining which is the most suitable for the relevant subject and for the target group in question. Other more general criteria include the total production cost for the information, the cost per recipient, and the scope for adapting the information to different target groups.

If the purpose is to pass on knowledge so that it can be applied in practice, we usually need to use more than one channel. For maximum impact, we should then use combinations of the methods and aids that are best suited to the relevant subject. A good way to start may be to follow the steps that we all take—consciously or subconsciously—when making any kind of decision:

1. Awareness — I must know what options are available
2. Interest — I must find at least one of the options interesting
3. Assessment — I assess the options on the basis of my experience
4. Decision — I settle for one of the options
5. Implementation — I start to use the chosen option.

A successful communication system must include all these steps and contain one or several information options for each.

Allocate Resources But Make the Customer Pay

Efficient communication of results is not for free. How it should be financed must be expressed in the information strategy. In my opinion, a quite substantial amount should be allocated to external communication. For an applied research institute, 15 percent of the total budget (outside of the primary documentation of findings) is not an unrealistic figure.

As part of the strategy one may also state that information services should be self-financed to a certain extent, which means that the customers must pay for the products. Less money has to be derived from research funds, and the customers can demand quality, good accessibility and short lead-times. In turn, this puts pressure upon the research organization and provides incentives for its staff to live up to required standards and to keep the customer satisfied. The market forces also help to find the optimum level of the information output.

Customer satisfaction is also an indicator of how successful one's external communication is. When, for instance, subscriptions are starting to drop, it is self-evident that an analysis needed and that measures probably have to be taken.

Quality Requirements

High quality in research, as well as in information, is essential. The information from a research-organization must be correct, comprehensive, and unbi-

ased. Regardless of form, it should also always be presented in ways that meet high quality standards. As mentioned earlier, the information has to be tailored to the various needs and abilities of different target groups. It should also be as current as possible. It may then be a good idea to set maximum lead times for producing the various information products.

Follow-up and Evaluation

Regardless of activity, I think that it is important to evaluate to what extent goals and objectives have been met as a part of an infinite process of continuous improvement. This is also applicable to research and research information, and likewise it is a classical dilemma. How, for instance, does one assess customer satisfaction and quantify the impact of one's research findings? However difficult, there are several tools for evaluating information activities.

One important tool is a *continuous dialogue* and close contact with the customers through the daily research work. *Formal channels* like the board, advisory groups, and so on can also be used for feedback. Now and then, ad hoc *external committees* can be formed and engaged to evaluate research work as well as communication activities from various perspectives. Another rather useful tool is *questionnaires* directed to various target groups. Questionnaires can be oriented toward whatever aspects one wants to have elucidated, for instance, as a means to evaluate how information products are perceived. And of course, as regards to more purely scientific publications, *referee and peer review systems* are in themselves tools for evaluation.

Conclusion

In a research organization communication of results should be considered equally important and as a natural part of research itself. To enable efficient external information, a basic strategy is essential and significant recourses are needed. Further, as a vital part of such a strategy, one must realize that for maximum impact the information has to be adapted to various target groups.

With acceptance for these views and by applying modern technology, the somewhat visionary concept of a system where the customer can access the needed knowledge at any given time is not too far away.

Partnerships for Optimizing Organizational Flexibility

Louis Poliquin, For. Eng. M.Sc.[1]

For the purpose of this conference, I was asked to discuss partnerships in general. We will first review the reasons that bring organizations to enter into a collaborative agreement, then provide examples of different types of partnerships, discuss some factors that seem to explain the success of partnerships, and review important points to consider before preparing for a partnership.

A Global Tendency

All the articles I have reviewed on this subject confirm that we are seeing an increasing number of partnerships today. Kumar, in his book on R&D consortia, provides the following reasons (Kumar and Magun, 1995):

Globalization of the world economy

Firms are becoming increasingly international, and to increase their competitiveness they are aggressively pursuing the acquisition of new technologies worldwide. Therefore, we are seeing an increasing number of mergers, joint ventures, consortia and technology acquisitions. Firms also need to overcome technical barriers to access foreign markets. An example of this is the work done on building codes and standards by Canadian research organizations in collaboration with Japanese scientists to increase the access of Canadian lumber to the Japanese market.

Greater role of government in shaping a nation's competitiveness

With the abolition of trade barriers, nations are relying more on technological innovation to increase their global competitiveness and are encouraging consortia. This trend is also explained by nations' perceptions that they are lagging behind other nations in key strategic technology, and it pushes governments to encourage R&D consortia (Potworoski, 1994).

Another trend that we are seeing, particularly in Canada, is that of major efforts toward deficit reduction and sound fiscal policies (Potworoski, 1994). What this means is that less government money is available to conduct research, and that governments are encouraging partnership with industry to leverage funding—all at the same time to increase the relevance of research as well as the dissemination of knowledge.

Technology trends

Products' life cycles are shorter, technologies are more sophisticated, and it is becoming increasingly expensive to undertake innovative R&D. Therefore, companies are seeking partnerships to reduce the cost of development, and the involvement of several research disciplines is often required to keep

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pace and solve sophisticated industrial problems (e.g., artificial vision in the wood industry).

Finally, another tendency that I have personally noticed recently, with the cutbacks in research funding, is the shift of several R&D firms, traditionally active in basic research, toward applied research and technology developments to increase their sources of funding. One example of this is Laval University, which has created a commercialization branch to market discoveries made in the university laboratories. Another example is the Centre de Recherche Industrielle du Quebec (CRIQ), which is now heavily involved in technology development after having revisited all its research priorities. With this trend, we are seeing more new research players in the forest sector. On the one hand, specialists in artificial vision are trying to better understand the needs of the forest industry in an attempt to find new applications for their technologies. On the other hand, the traditional forestry research organizations, more familiar with the forest industry problems, are trying to push their research projects a step further—i.e., into a new technological application. An example is acquiring expertise in other fields, such as artificial vision.

Perceived Disadvantages of Partnerships

Here is an illustration of some of the perceived disadvantages of partnerships, or comments that you often hear before entering into a partnership agreement:

- We may lose control of our project (loss of autonomy)
- We may have to share intellectual property (loss of exclusivity)
- We don't know their real objectives (question of trust)
- It will be time-consuming and costly to deal with another partner (loss of flexibility)
- Would we not be better off doing this ourselves!!!

Benefits of Partnerships

Each organization has it own views regarding R&D partnership. These depend on the culture of the organization, its capacity, the research field in which it is already involved, the field of research aimed at, etc. For example, academe and industry have always had symbiotic motives for collaborating. According to Sounder (1993), academe is a source for industry to keep up on developments, renew its idea-well and recruit new employees. Industry is a natural source of funding for academe's instructional and research programs; a means for academe to maintain its real-world relevance; and a source for faculty consulting work and student employment. Governments also have a natural interest in fostering collaborations that stimulate economic growth and ever-expanding employment opportunities. Firm-to-firm and academe-industry collaborations are perceived as one means for translating science into useful products and services that achieve these policy goals. Some of the reasons why organizations would consider partnership include the following:

- Sharing complementary expertise
- Reducing the duplication of research efforts

- Reducing cost of research
- Reducing cost of developing a new technology
- Sharing risk associated with an R&D project
- Gaining expertise in a new area
- Getting more direct access to a new technology

Type of Partnerships

Research partnerships may take many forms, based on the needs and desired objectives of the different partners. As Potworowski (1994) suggests, the models of partnership seem to be as varied as the partners themselves:

- some partnerships are essentially problem-driven;
- others aim at supporting a specific industry sector (Forintek-Laval agreement);
- others again are geared at developing and commercializing new technologies (CRIQ model); and
- some focus mainly on the advancement of knowledge or dissemination of knowledge (NCE).

One model of partnership aiming at supporting an industry sector is the Forintek-Laval agreement on small stem processing. By creating an official collaborative agreement with the university, Forintek can increase university research efforts in wood-related fields and contribute to the training of students. It also provides Forintek with a pool of researchers specialized in different research fields, who can work in the forest sector. Together, the two organizations can submit university/industry grant applications to granting organizations. So far, this arrangement has generated concrete results such as OPTITEK, which is a sawmill simulation software package.

Another example of partnerships aiming at commercializing technologies and increasing funding is the CRIQ model. Rather than selling a license for a new technology and obtaining royalties in exchange, CRIQ is now fostering joint ventures with equipment suppliers. To commercialize its technology and maximize the benefits, CRIQ creates a new joint venture company in which it becomes a partner. Its investment is limited to the value (patent) of the technology it puts in. As a partner in the new company, CRIQ has a say in the commercialization decisions. For example, it request that both partners invest part of the profits on the technology back into R&D at the CRIQ to further develop the technology (second generation). By doing this with several technologies, they have been able to raise several million dollars for their laboratories.

A third model of partnership is the Networks of Centres of Excellence (NCE) on sustainable forest management, focusing more on the advancement of knowledge. It involves some 25 universities, 5 federal laboratories, 11 industries, and 7 other organizations. The objective is to develop forest management strategies for sustaining all forest-related values. It is described as a network of researchers and scientists across the country conducting world-class research in areas crucial to Canada's long tem competitiveness. Some of the desired outcomes are to stimulate the production of leading-edge fundamental and long-term applied research, accelerate the exchange of research results, and develop strong university-industry partnerships to accelerate the dissemination of advanced technological knowledge to industry.

There are several other types of partnerships that could be illustrated, of which I provide a listing at the end of this paper for the benefit of the reader. These vary from the student project to the more sophisticated consortia.

What Works and What Does Not Work

Opinions vary a lot on what works and what does not, or on what are the key success factors for a successful partnership. On the one hand, some authors are saying that firms prefer to collaborate in basic research, while on the other hand certain authors contend that it is easier to collaborate in applied research. There are several such opinions that contradict one another in this regard. One model that I find interesting and that I would like to share with you is Sinha and Cusumano's (1991) model, which I feel provides good insight into the important factors to consider for successful partnership (figure 1). Their model explaining the probability of success of a partnership is represented by four quadrants. The vertical axis represents the expected benefits from research and the appropriability of technology or the proprietary benefits of technology. The horizontal axis represents complementary skills and resources.

According to Shina and Cusumano, there is a high level of complementary skills in Quadrant I and resources there are high proprietary benefits, such as in projects relatively close to commercial applications with clear and focused topics. A partnership in this quadrant requires few or no outside incentives because the technology has a higher value. In this quadrant, a vertical type of partnership involving supplier and user of technology has better chances of success (R&D organization, the equipment supplier, and the industry). In contrast, a horizontal model of partnership often fails here because competing companies will be cautious about revealing sensitive company knowledge due to the high value of the technology.

Quadrant II includes projects with high complementarity of skills and resources, but low expected proprietary benefits of research. Here, one finds projects involving basic but relatively focused and well-defined research, such as on the development of a manufacturing process; or one finds applied research, but on subjects for which patents would be difficult or unwise to obtain because the technology involved is difficult to specify precisely or because firms feel little need to protect it. Firms may need little incentive to collaborate, contrary to research in Quadrant I.

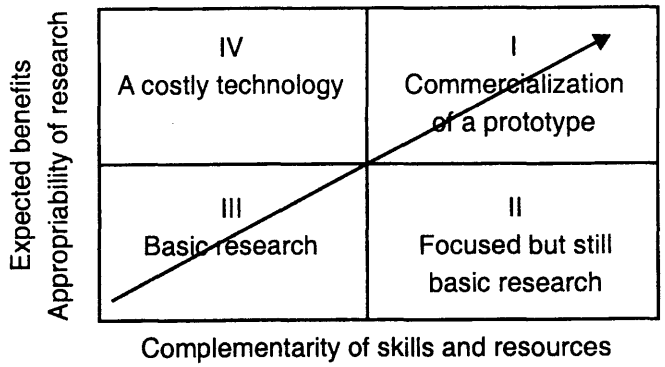

Figure 1—Probability of success of a partnership.

In Quadrant III, one finds projects with low complementarity of skills and resources and low proprietary benefits. Most of the basic research or research focusing on the advancement of knowledge would fall into this category. However, the authors do not suggest that collaboration is less successful here. On the contrary, this is where most organizations will prefer to collaborate, since competition is smaller. However, projects in this quadrant will need more incentive and stronger coordination efforts to succeed. The formation of successful alliances depends more on the attitudes and commitment of the individuals participating, and it is easier to lose track of objectives, considering the type of research involved. Collaboration here is more qualified as horizontal, where organizations with similar expertise will be less reluctant to collaborate. Based upon the results, the authors concluded that strong commitments, strong decision controls, a strong charter, and systematic management processes were very closely associated with R&D consortia effectiveness.

Quadrant IV includes large expected benefits from R&D but low complementarity of skills and resources. It is suggested here that firms cooperate for monetary reasons, i.e., combining financial resources to fund the development of a costly but promising new product or process. High-tech research consortia encouraged by government probably fall into this quadrant, where you have competing firms collaborating to develop a new technology.

There is much more that could be said about partnership. There were several authors that also had good suggestions about key success factors for successful collaboration. Here are some recommendations on how to prepare for partnership:

- Conduct an internal study of your own strengths and weaknesses relative to the long-range business targets.
- Be clear about why you are joining, because you may lose sight of your objectives when other partners with different culture, priorities, and approval processes get involved.
- Undertake a search for the suitable partner after defining your objectives, rather than the reverse.
- Take the time to explore all possibilities before committing to any joint partner.
- Look for complementarity of skills and resources; otherwise be ready to spend more efforts on coordination.
- Do not get into a partnership if you are not totally sure of what you are expecting from it.
- Do not discard a partnership too fast because it may increase probability of success of a project beyond that of you doing it alone.

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Appendix 1: Types of Collaborative Agreements (Sounder 1993)

Informal types of collaborations

Student projects
Interest groups
Study committees
Ad hoc forums
Advisory boards
Discussion groups
Consultation between parties
Information sharing networks

Examples of semi-formal types of collaborations

Equipment sharing
Fellowships
Consulting agreements
Field site agreements
Patron saint arrangements
Industry committees
Standards committees
Seminars and training courses
Release-time sabbaticals
Gentlemen's agreements
Joint bidding agreements
Co-production agreements
Cooperative grants

Examples of formal types of collaborations

Industry adjunct professorships
Cooperative educational programs
Direct sponsorships
Patent pools
Sharing of intellectual property
Joint R&D arrangements
Incubator facilities
Technology licensing programs
Industrial affiliates programs
Endowed research centres
Endowed chairs and professorships
Cooperative instructional programs
Industrial fellowships
University extension services
Science parks and centres
NSF Engineering Research Centres
NSF Science and Technology Centres
Industry-University Collaborative Research Centres

Popular multi-firm types of consortia

Trade or industry association
Industrial R&D institute
University research centre
R&D limited partnership
Industrial development cooperative
The basic research consortium

Intellectual Property Implications for Forestry Research Managers: Striving for Win-Win

Dr. Russell Haines[1]

Abstract: Competent management of intellectual property is now a key issue for research managers increasingly driven on the one hand by more commercial approaches to research management, and on the other by the need to enter into partnerships where both inputs and outputs are shared. Products of forestry research activities that are relevant to intellectual property discussions include genetic material, computer software, technological systems, and information and data. Relevant legal instruments for the protection of these include plant breeder's rights, copyright, patents, and confidential information legislation. This presentation considers the elements of each of these and the manner in which they are applicable to forestry research. Relevant issues for forestry research managers are identified for discussion at this forum. These issues include: the ethics of intellectual property management; recognition of a public domain; auditing and valuing intellectual property; access to skills in the management of intellectual property; the extent to which an organisation should be involved in ongoing commercialisation; in-house commercialisation versus partnerships; intellectual property agreements; and the application of royalties in forestry. For most of these, a variety of options is available to the research manager. In many cases, there are no firm rules for determining the appropriate course. Experience is critical, and the opportunities for sharing of experience afforded by a workshop such as this are invaluable.

Although not easily defined in precise terms, the "Intellectual Property" (IP) of an organisation can be broadly conceptualised as the rights relating to products of the creative activity of the organisation and its staff. Creation of these assets has usually involved investment, and the assets have recognised, if not always quantifiable, value. Fundamental to the concept of Intellectual Property is the right to profit from such ideas and effort.

Historically, many forestry research organisations, particularly those operating with public funding, have followed a more or less open access policy. Recent trends, however, have led to some changes:

- Increasing pressure on most research organisations in relation to funding, requiring managers to maximise returns on assets, including intellectual assets.
- Adoption of a more commercial management regime by many research organisations.
- Rapid technological advances, in particular biotechnology.

As a result, many organisations now adopt a much more entrepreneurial approach and are much more cautious about sharing IP.

Countering the above are some trends that render cooperation and sharing more essential than ever:

- Increasing commonality of the issues being addressed. For example, in research fields such as sustainability and genetics, the issues being addressed are increasingly fundamental and not specific solely to sites, species, etc.

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- Increasing need for multidisciplinary approaches, in many cases to the extent that single agencies cannot by themselves cover all disciplines involved.
- Increasing demand, by clients and funding agencies, that cost-effectiveness be maximised, and therefore that duplication be avoided.
- The increasing sophistication of R&D and consequent increasing expense.

Research managers thus face a major dilemma in relation to IP: the need to be cooperative in an increasingly competitive environment. This paper is intended to provide a basis for discussion on ways of addressing this dilemma. Covered in this presentation are the types of IP generated by forestry R&D activities, the ways in which IP can be commercialised, and issues to be addressed in IP management.

The Nature of Intellectual Property

The 1967 Convention establishing the World Intellectual Property Organisation (WIPO) defines Intellectual Property to include the rights relating to:

- literary, artistic, and scientific works;
- performances of performing artists, phonograms and broadcasts;
- inventions in all fields of human endeavour;
- scientific discoveries;
- industrial designs;
- trademarks and related designations;
- protection against unfair competition; and
- all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields (McKeough and Stewart 1997).

The Trade Related Aspects of Intellectual Property Rights (TRIPS), an important international convention, applies the term Intellectual Property to include copyright and related rights, trade marks, geographical indications, industrial designs, patents, layout designs of integrated circuits, and undisclosed information (McKeough and Stewart 1997). For several of these sometimes poorly defined "rights," little or no legal protection is available, and the extent of protection certainly varies from country to country.

Intellectual Property in Forest Research

According to the very broad definitions applied here, products of forestry R&D activities that might be subject to Intellectual Property discussions include genetic material, computer software, technological systems, and information and data.

Genetic Material

Traditional tree breeding programs generate improved genetic material in the form of superior provenances, selected parents, superior half- and full-sib families, proven seed orchard parents etc. Seed orchards are typically made up of many clones, and breeding populations are very large. In the most advanced programs for certain species, clonal testing programs have identified outstanding clones for commercial deployment in clonal plantations. Increasingly, the most advanced programs will be managing clones that have undergone genetic modification through recombinant DNA procedures.

Many countries have introduced Plant Breeder's Rights (PBR) legislation, based on the International Convention for the Protection of New Varieties of Plants (UPOV) of 1978 and 1991. The general criteria to be satisfied for registration include:

- novelty;
- distinctness, that is, the variety must be clearly distinguishable from other commonly known varieties (modern techniques using molecular markers are greatly facilitating the demonstration of distinctness);
- uniformity in the defining characters;
- stability after repeated propagation; and
- the involvement of a breeder, although breeding is defined to include discovery and selective propagation.

PBR confers a temporary monopoly (20 or 25 years) to reproduce the propagating material of the variety and to stock, sell, import, or export the material. An application for registration should prevent another breeder in a UPOV country from obtaining a grant of PBR for an indistinguishable variety. PBR can be interpreted to cover "essentially derived varieties" but does not prevent use of the protected variety by a breeder to produce new varieties.

In theory, PBR could be obtained for seed orchard parents or parents in the breeding population. This would be of limited value, however, as it would not prevent other breeders from using the genotypes in breeding programs to produce new varieties. It would also be expensive to obtain PBR for the large numbers of genotypes typically involved. For forest tree species, PBR is of most relevance to breeding programs that have generated, for commercial deployment, small numbers of widely adapted clones.

Patent laws of some countries permit granting of patents for novel DNA sequences; constructs containing genes isolated from nature; and novel combinations of genes and regulator sequences for plasmids, vectors, modified cells, and new, altered animals and plants (where their production has involved invention). Criteria for the issue of patents generally are more onerous than those applied to PBR, and the process more expensive. The protection offered, however, would be stronger, particularly in relation to preventing use of material to produce new varieties. There continues to be considerable international debate on the ethics of patenting higher life forms.

Although some material is thus amenable to protection through PBR and patents, it is clear that the majority of material in forest tree breeding programs is not going to be registered as such. Clearly there is a value in forest tree

breeding material that isn't particularly amenable to protection under PBR or patents. Research organisations must recognise the value of such material, maintain appropriate inventories, and take appropriate steps to control its distribution.

There is a clear value in research organisations working cooperatively on breeding of species of mutual interest, and forest growers stand to gain through access to improved genotypes. Such exchanges and provision of material in most cases will need to be covered by agreements not involving PBR or patents. Such agreements can be bilateral or multilateral. The breeding cooperatives are longstanding examples of the latter. In addition to standard clauses, agreements need to include provisions regarding: (1) ownership of the genetic material and (2) basis for payment for access to material. Some obstacles associated with commercialisation of improved genetic material of forest tree species include the following:

- Genotype X Environment interactions are frequently important, to the extent that genotypes could not usually be sold into a new area without prior testing. Therefore agreements are required that permit the exchange of material for testing purposes. Such agreements would usually include clauses prohibiting commercial use, repropagation, distribution to third parties, etc.
- Many forest growers do not fully appreciate the advantage of using genetically improved planting stock and are reluctant to pay a margin for it that would reflect its true value. Acceptance of the payment of royalties for improved material, although common for horticultural species, is rare in forestry.

Computer Programs

Included here are programs for seed orchard designs, data entry and management, data analysis, growth models, etc. The value of these is frequently more easily appreciated to potential users, and protection and assignment more straightforward as they are usually covered by copyright legislation.

Technologies and Technological Systems

Inventions may be patented provided that they meet certain criteria:

- The mode of manufacture meets certain standards. Both processes and tangible products qualify.
- The subject of the patent is novel and inventive.
- The invention is useful.
- The invention has not been the subject of secret use.

Patents must be applied for, and there is a formal patent examination procedure. Once accepted, a patent application and detailed specification are published. If subsequently not successfully challenged, the award of a patent prohibits unauthorised copying or use of the invention for a specified period, following which the invention is in the public domain. Many processes and products in the area of forest biotechnology have been patented. Similarly, some areas of processing R&D are amenable to patent protection. Many of the technologies and systems developed by forestry R&D organisations, however, are

not candidates for patent protection and are more appropriately handled as confidential information.

Patents are costly to obtain, particularly if a range of countries is to be involved, and the costs of action against infringements are very high. Some hundreds of thousands of dollars over the life of the patent is the likely investment required for the minimum protection. Protection offered by patent legislation in some countries is notoriously weak.

Information and Data

Intellectual Property generated by forestry research organisations includes traditional experimental data on taxonomic performance, responses to silvicultural treatments, and so on. More recently, marker sequences and other data have become recognised as valuable products of biotechnology research. Legal instruments relating to the protection of such data include copyright and confidential information law.

Copyright

Unlike patents and PBR, rights associated with copyright are inherent and exist from the moment a work is created. There are no formal requirements to obtain copyright protection. The work must meet certain criteria concerning originality and so on. Works meeting these criteria are protected—the form in which the information is presented, but not the information itself. Copyright rests with the author until transferred to another party. In scientific publication, copyright frequently is assigned to the publisher. The owner of the copyright has exclusive rights to reproduce copies of the work, prepare derivative works based on the work, distribute the work, and to perform or display it. It does not restrict use of the ideas or information or the ideas expressed therein. Copyright legislation in several countries is under review, with the intention of better accommodating aspects of electronic communication (Samuelson 1996).

The credentials of a scientist most commonly are established by the number and quality of scientific publications. This introduces a fundamental conflict, in that safeguarding rights through patents or legislation pertaining to confidential information requires that the information has not entered the public domain.

Confidential Information

Common law provisions of many jurisdictions offer protection of undisclosed or secret information. Liability for breach of confidence requires that the information have certain qualities of confidence (e.g., is not already in the public domain), that the information have been imparted in circumstances importing an obligation of confidence, and that there have been an unauthorised use of the information to the detriment of the party communicating it. Information which is already in the public domain, or is communicated without an understanding of the obligation of confidence, is not protected.

It is essential then that R&D organisations undertake inventories of information they hold and determine what information should remain confidential and what can or ought to be in the public domain. Appropriate actions must be taken to ensure that "undisclosed information" is treated accordingly—through appropriate security measures, confidentiality agreements with staff, etc. Sharing of such information with other parties should be subject to appropriate agreements.

Commercialisation of Intellectual Property

Business arrangements that may be used to commercialise IP include the following:

- Sale of Intellectual Property rights, including:
  - sale of PBR and
  - sale of patent rights.
- In return for a negotiated payment, rights are transferred permanently to the purchaser, who then assumes full control over subsequent use.
- Licensing of Intellectual Property rights, which includes licensing of genetic material to a party who then uses it for commercial purposes. The licensor retains ownership, but the licensee is permitted to use the IP in return for license fees or royalties. Such fees can be fixed or based upon production levels. Depending on arrangements negotiated, the licensor may be free to license the rights to other agencies.
- Direct involvement in commercial production and marketing of a product. This can be done alone, or in joint venture arrangements with a partner or partners (frequently from industry). A common example is the involvement of research organisations in the production and marketing of genetically improved seed. Organisations similarly can be partners in the production and marketing of technologies or technological systems.

The above alternatives progressively involve longer term involvement of a research organisation in the commercialisation of IP, a higher level of "downstream" activity, and potentially higher returns in return for acceptance of a higher level of risk.

Implications for Research Managers

It is essential that modern research managers recognise the importance of information and its protection. It has been argued that current systems of IP rights are inadequate to cope with rapid technological changes (e.g., Thurow 1997). The difficulties in agreeing on international conventions, however, indicate that current systems will apply for the immediate future.

Issues that forestry research managers need to consider, and that are appropriate subjects for the sharing of opinions and experience at this workshop, include the following:

- **The question of ethics.** Management if Intellectual Property necessarily involves the balancing of two conflicting social objectives—the promotion of creative activity versus deployment of the benefits throughout society. IP legislation and conventions attempt to address this balance. Different societies will vary in their perception of where the balance should lie.

  An extension of the ethical question concerns the rights of developing versus developed countries. This has been a subject of considerable discussion, with many authorities concerned that the former group is increasingly disadvantaged by the international trends with IP (The

Crucible Group, 1994). In many parts of the developing world, attitudes to IP are dictated by economic necessity and cultural factors.

There are several international conventions and agreements that are relevant and mostly in a state of flux. Apart from those mentioned above, these include the Convention on Biological Diversity and the International Undertaking on Plant Genetic Resources. There are many points on which agreement has not been reached, particularly those which related to developed versus developing countries. Research managers need to be aware of these conventions and the negotiations that are underway. Some research managers may be in a position to provide inputs to such negotiations.

- **Recognition of a public domain.** This is partly an ethical issue related to the above. It is frequently argued that, in the interests of expanding society's knowledge as rapidly as possible, certain classes of knowledge should be in the public domain. The Bellagio Declaration of 1993 also emphasizes the importance of the public domain as the "intellectual and cultural commons from which future works will be constructed" and suggests that each intellectual property right in effect fences off a portion of the public domain, making it available to future creators. Clearly it is in global and national interests for a balance to be maintained between public domain and proprietary rights. Apart from this broader ethical question, however, it is also in the interests of individual research organisations to share certain information through a public domain. The challenge for research managers then is to determine which of its IP should be in the public domain, and then to establish clear guidelines on release, bearing in mind that public disclosure precludes most legal protection.
- **Protocols for auditing and valuing Intellectual Property.** This involves the valuation of an organisation's own IP and that of potential partners. Most approaches to valuation rely on capitalisation of the estimated maintainable earnings or NPV of future cashflows deriving from net margins or royalties. Research managers need access to the required skills in valuation.
- **Sources of knowledge and skills in the management of IP.** Research managers need to ensure that they have access to appropriate legal advice in particular.
- **The extent to which an organisation should be involved in downstream commercialisation.** Research organisations generating IP have the options of selling the rights, entering into licensing agreements, or themselves becoming involved in its commercialisation. Research managers need to consider under which circumstances is each appropriate, and whether licensing should involve exclusive vs. non-exclusive relationships.
- **In-house approach versus bilateral versus multilateral alliances.** Research organisations electing to become involved in downstream commercialisation of IP need to consider:
  - the extent to which partnering is appropriate.
  - how to identify the right partners—those with complementary expertise and their assets. Can we make more use of brokering?

  - how to identify partners to avoid.
  - how to determine equity.
  - which form of shared ownership to use:
    - joint ownership—equal undivided share—either party may exercise the rights granted but may not license.
    - tenants in common—each owns part share only, therefore cannot deal with the whole without the agreement of the other.
  - management structures for partnerships.

- **Availability of standard agreements to cover access to IP.** The management of IP will be made simpler by access to models that can be used as frameworks. Managers need to consider:
  - the types of agreements required for their business.
  - how to handle international agreements—which jurisdiction?
  - how to protect IP in countries that are not signatories to the international conventions.
- **Promotion of the broader application of royalties in forestry.** The greater acceptance of the payment of royalties, e.g., for genetic improvement, will simplify management protocols for certain types of IP.

The above represent some of the issues that forestry research managers should consider when managing Intellectual Property. In many cases, there are no firm rules for determining the appropriate course. The right answer will vary with circumstance and be influenced also by organisational mandate and culture. Clearly, experience is a critical guide, and the opportunities for sharing of experience afforded by a workshop such as this are invaluable.

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Continuous Improvement in Managing R&D: A TQM Approach at SkogForsk, Sweden

Dr. Magnus Larsson[1]

Abstract: Continuous improvement is an imperative process for any organization, even in the R&D field, who wants to stay competitive and alive. Our experience is that the most important ingredients in this process are engagement and participation by everybody, shared visions, and a holistic view of the organization. Structural changes and quick fixes cannot accomplish this. It requires cultural changes brought about through a strong and committed leadership that starts, guides, and maintains the speed in the process. We have found the Total Quality Management concept to be a useful guide in our efforts to start this process in a R&D environment, where the special employee clientele, the heterogeneous group of customers, and the evaluation of results constitute challenges to management.

Continuous development and improvement is a natural state of all organisms in nature that intend to survive in this rugged world. And only the fittest of them do survive. By the same token, organizations that want to stay alive must continuously ask themselves what they are there for (the mission, for whom), the customers (how they are doing, quality), and how they can improve in order to justify their future existence.

Thus, change and improvement should be a major part of our management work. Problems ranging from the location of the bicycle stand to customer satisfaction are detected and solved. The approach is often reactive and the lack of a holistic view often creates problems somewhere else in the organization. Furthermore, the improvement is more often the result of a temporary project than of a continuous process. Consequently, the effect is often also very temporary.

R&D organizations, whose job it is to help others to develop, are by no means easier to change and improve than others; surprisingly enough, they could actually be even harder. We are often just as frustrated as other managers are because of losses of energy and efficiency in the organization when trying to implement our ingenious improvement ideas. Why do some of these highly skilled and educated researchers don't understand or aren't interested, and why do too few of them produce ideas of their own?

A few years ago SkogForsk started to work with the Total Quality Management concept in our organizational development work for the forestry sector. As continuous improvement is one of the cornerstones in the TQM concept, we found it very useful also for our own development purposes and started hopefully an infinite process where we put the entire organization under the microscope, question the way we do or don't do things, and look for improvement possibilities.

The essence of our experience I would like to share with you today—the take-home message—is that *continuous improvement must be based on:*

- *engagement and wide participation* in the organizational development,
- *shared visions* of the future mission, targets, strategies, etc., and
- *a holistic view* of the organization.

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Furthermore, this cannot be accomplished by structural changes and quick fixes. It requires *cultural changes* brought about through:

- *committed leadership* that trusts people's abilities, supports the improvement process itself, sets examples, and perhaps most importantly communicates, communicates, communicates (figure 1).

I will start by briefly describing the process toward continuous improvement that we just have started at SkogForsk. Then I will reflect on what we have learned from the process so far and point at some of the pitfalls in change management that we have to be aware of so that this approach doesn't become another "shot in the dark" wherein the effects slowly fade away. Finally, I will make some personal reflections on how R&D organizations differ from others and in what ways TQM could help us overcome the obstacles arising from these differences.

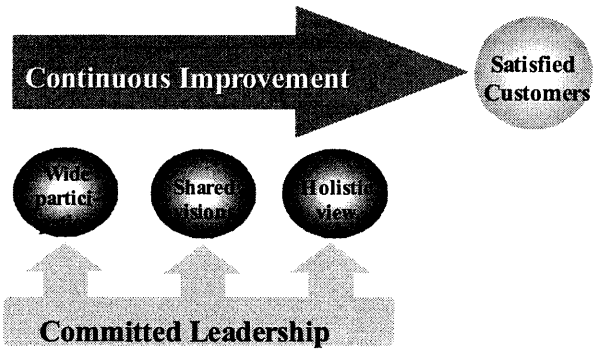

Figure 1—Some fundamentals of continuous improvement.

A TQM Approach at SkogForsk

Applied Research for the Forestry Sector From Seed Orchard to Mill

SkogForsk—the Forestry Institute of Sweden—is sponsored by the entire forestry sector, i.e., the industrial forest enterprises, the private forest owners' cooperatives (Associations), other forestry organizations, and private individuals. Consequently, our primary target group (customers) comprises everybody working in practical forestry in Sweden.

Our mission is to furnish Swedish forestry with the knowledge it requires to remain competitive and ecologically sustainable. We therefore work with applied research, which during the present program period focuses on four key issues: product value and production efficiency, forest management for biodiversity and timber production, organizational development, and regeneration material.

We have some 115 employees, about 70 of whom are researchers and the remainder technicians and information and administration personnel (figure 2). A key concept at SkogForsk is collaboration with the forestry sector and other research bodies.

Our research is organized in competence-oriented programs and problem-oriented projects, each headed by a leader engaging 2-10 persons. A group comprising four research managers has the collective overall responsibility for the research work. The work program is developed and monitored in close

cooperation with our members/customers represented by the board and four advisory groups.

The management of SkogForsk as a whole is the responsibility of the managing director, assisted by a management group comprising the four research managers, the managers of information and administration, and the heads of our three research stations. This is where the overall responsibility for continuous development of SkogForsk itself lies.

The TQM Concept for Holistic View and Continuity

Throughout the years we have worked with different kinds of organizational improvement activities: decentralization, research methods and skills, administrative processes, personnel competence, publication quality, and so on. With the exception of competence improvement, which we always have

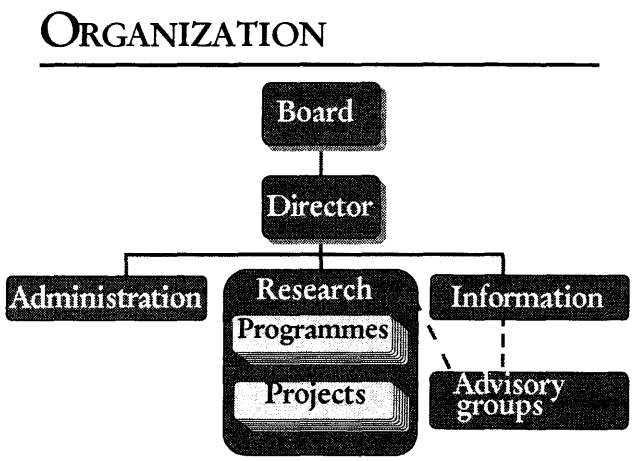

Figure 2—The organization of SkogForsk.

regarded as a major strategic development area, the improvement work has been of quite a reactive and sporadic nature and a conscious holistic approach has not always been applied.

A few years ago in our organizational development work for industry we became interested in the TQM concept (Thor et al. 1995). We are quite aware that this is just one of many management concepts around and it might not be the ultimate solution, but at this stage in our development we believe that TQM will serve our purposes. Why not live as we teach others? It has the holistic structure we were lacking and it encompasses continuity.

TQM, as I assume most of you know, was developed in Japan after World War II by the Americans Deming and Juran. Their new thinking focused on:

- the customers
- the processes
- engagement and participation by everybody
- continuous improvement.

But several other values are central, such as: committed leadership, competence development, long-range perspective, public responsibility, and learning from others (benchmarking). Thus, in TQM we focus on why and how we do things instead of only what the result is. That gives us a better base for improvement.

The Implementation of TQM

The TQM concept is a management philosophy/strategy—not a method. So in order to make it work we need a tool that makes us aware of how we run our business and the potential for improvement. The Swedish Quality Award is such a tool that is based primarily on the TQM values but also on other values and development concepts.

The Swedish Quality Award (The Swedish Quality Award 1996), just like the Deming Price in Japan and the Malcolm Baldridge National Quality Award in the United States, requires a very detailed description of the organization and how it works. If you want to compete for the award you, of course, have to submit your description for evaluation. But you may just as well have it evaluated for the sake of finding out where your improvement areas are and then go ahead with the actual improvement work. After a few years, when you may have run through this three-stage improvement cycle (description – evaluation – improvement) a number of times, you may feel ready to compete for the award which often give the winners lots of publicity and goodwill.

Even if you never win the Award, the process has taught you how you continuously work with improvement of the whole organization and hopefully the TQM core values will have been integrated in the organizational culture.

The description is made by answering a set of questions that have been found relevant to successful organizations (figure 3).

- The most important of these questions in the context of continuous improvement is: *How do you evaluate and improve your work?* Thus:
- *not only should you have* methods and routines to set targets, to establish what your results are, to discover if they reached the target values, and to measure if they satisfy your customers,
- *you should also have* established ways and means to continuously evaluate and improve these routines (the approaches) and how widely and frequently they are used (the deployment) in the organization.

The questions are focused on seven main aspects (criteria) and a number of sub aspects of the organization to get the best possible picture of how it is working (figure 4). This takes care of the holistic thinking.

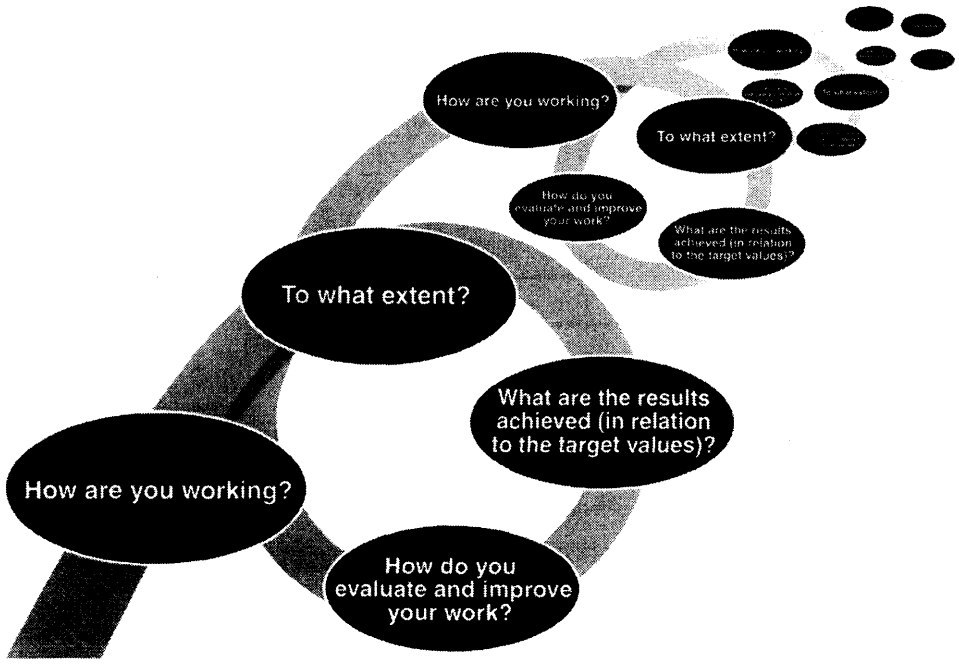

Figure 3—The TQM questions.

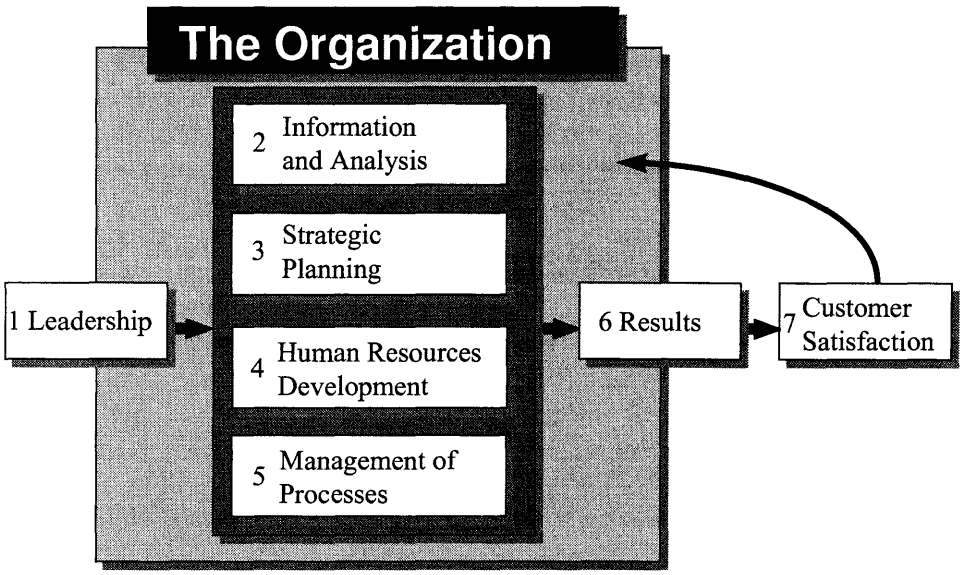

Figure 4—The TQM criteria.

How We Started

We felt the Swedish Quality Award procedure was very well structured and systematic and should serve our purposes. At the same time it would help us set a good example for the forestry sector we work for.

So we began by describing our organization about one year ago, got it evaluated in May this year, and are just in the process of organizing and getting the first improvement activities started.

The description was a rather heavy and time consuming effort resulting in a 70-page document. The work was initially done by the management group and in a final phase discussed and adjusted together with personnel from all parts of the organization. To get started we ourselves took part in seminars that we arranged for our members.

The next phase in the process was *the evaluation.* This was done by an external consultant. We regarded the set of questions, some 200 of them, as a kind of checklist. Our answers to the questions revealed gaps and shortcomings in procedures and to what extent the TQM core values led our approaches, deployment, and results.

The *feedback report* presented by the evaluator highlighted your strong points and potentials for improvement. Our strengths were management and strategic planning, whereas some of our weak points were the measurement of results and comparisons with others, which I am afraid we have in common with many other research organizations. This report now constitutes an excellent basis for the further planning of the improvement work.

We picked out a few of what we felt were the most urgent areas for improvement. Working groups with wide participation were formed, targets were set, and the planning of the work was well on its way. Various tools and methods such as the PDCA cycle will be used.

What We Have Learned So Far

Now come the interesting questions: What have we learned from the process so far and how do we keep the process going to avoid this becoming just another improvement project with temporary effects?

Our Own Experience

A strong and committed leadership is probably the most important ingredient in this process. Everybody in the top management must be convinced and agree that the strategy chosen is the way to go. The Managing Director must act as the process leader even if someone else may help out with the coordination of things.

Every opportunity must be used to inform about what is going on, why, and how. Every formal as well as informal channel must be used: newsletters, meetings, coffee breaks, etc. And the signals from "above" must be strong and unanimous. Researchers are not always easy people to convince.

You must have time and patience. This type of wide/holistic approach seems to take a lot of time. But if you try to add up all the effort you have spent on trying to implement improvements in less systematic ways with poor results, you probably will find that the systematic approach is worthwhile. You must give lots of time to the process itself and for the solutions to mature.

Some General Experience – Pitfalls

The overall cause for failures in organizational development is the underestimation of the need to manage change and to support the process itself (Södergren 1997). Too often we start by focusing on the final solution. Many of us, being natural scientists, think we can just install a solution—while behavioral scientists know that it is primarily the mental processes of thinking and learning going on in human beings that we have to deal with in organizational development.

To facilitate the further discussion on pitfalls in the management of change, I would like to point at some of the pulling and pushing forces that drive individuals and/or organizations to change. The pitfalls occur when one or more of these are too weak or neglected. Successful change managers know what triggers the forces and how their strengths are maintained (figure 5).

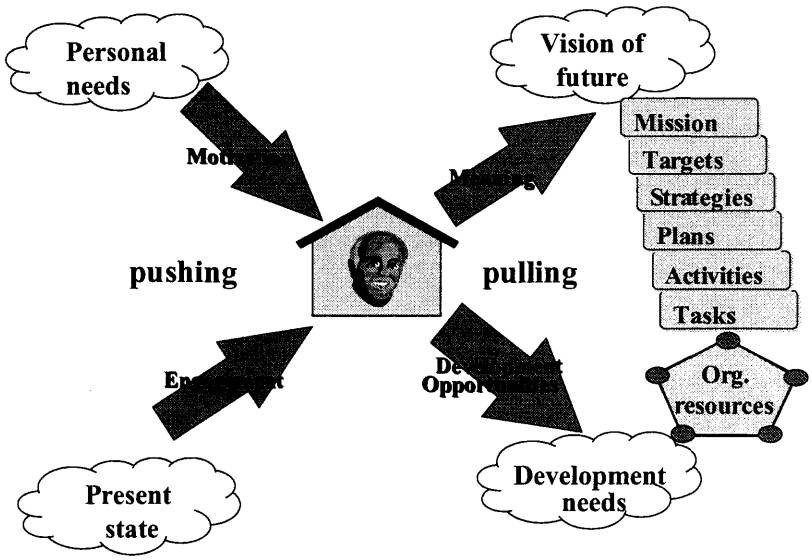

Figure 5—Pushing and pulling forces that drive individuals and organizations to change (Larsson 1998).

Meaning is probably the most important pulling force and very strong provided there is a vision of the future for the organization that the individual(s) can identify with. Individual visions should agree fairly well with that of the whole organization.

Engagement develops and can become a real pushing incentive to change when the gap between the future vision and the present state is wide. If the present hurts, the engagement thus strengthens the meaning force.

Motivation is another imperative pushing force. It is dependent on external remuneration variables such as salary, fringes, status, etc., and even more important internal emotional variables such as job satisfaction, trust, relations, self esteem, etc.

Development opportunities for the individual and/or the entire organization as it moves from the present to the envisioned future is the other strong pulling force I'd like to bring up here. If the future has something in store for me and if this coincides reasonably well with my own interests, I am much more inclined to jump on the train than otherwise.

However, in order to see the possibilities, the route between the present and the future vision (*the development process*) has to be mapped in terms of vision, mission, targets, strategies, plans, activities, and tasks.

A *holistic/systemic view* on the organization required to do the job also needs to be taken. This means that the personnel, the tools/technique and methods, the control systems, and the organizational structure required to perform the tasks/processes must be described and communicated and the development needs for all of these systems components sorted out (Johanssen 1998) (figure 6).

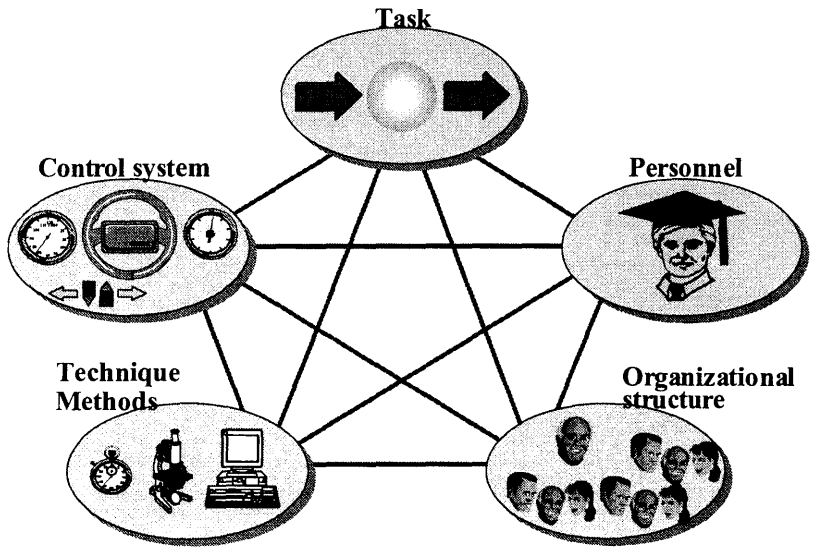

Figure 6—A holistic/systemic view of the organization where all components influence each other (Johansson 1988).

The *most common pitfalls* in change management are:

- lack of understanding of the need/urgency for change, which often stems from different or no opinions on the present state of affairs. It could also be that we cannot see any alternative for the future, i.e. we lack a common vision. If we do not agree on where we stand today or have a very vague idea of where to go, it is impossible to pick out a common route and go ahead.
- lack of holistic/systemic view, where we observe the needs of the entire system and the links between the components. Fundamental needs may be neglected in favor of those that are easier to meet but do not get us much closer to our vision in the long run. Troubleshooting from the hip and ad hoc problem solving only generate temporary solutions.

- lack of active and supportive management incorporating a united core group of management (guiding coalition) following, evaluating, communicating, and even celebrating the achievements. Great things may be accomplished if you keep looking for them.
- lack of continuity often due to a combination of the above and very limited engagement/participation of personnel. Continuous improvement must be founded on strong leadership, holistic approach, shared values and visions, and a constant watch by everybody in the organization for ways to do things even better than now.

Personal Reflections on Specifics of R&D Organizations

Naturally there are numerous reasons why change in general and continuous change in particular may be more difficult to implement in a R&D organization than in others. Moreover, because of the great variety of organizations within our field of work, it is very difficult to make too many general reflections here. I will therefore confine myself to the three factors that, from my limited SkogForsk perspective, seem to make life challenging for managers of change in the research field: the employee clientele, the customer profile, and the evaluation of results.

Researchers Are Very Special People

The first factor is the *special employee clientele* we are dealing with. Even if they are very open-minded by nature, they are often individualists and don't buy ideas or arguments without having given them many thorough thoughts. In spite of being a very heterogeneous bunch, most of them are well educated, committed, used to questioning matters, systematic, and not impressed by authorities such as managers. Many of them are even so devoted to their job within the program/project that they may have little faith in the necessity of management improvements in the first place (figure 7).

There may also be another reason for the lack of interest in organizational matters. A research organization is often rather fragmented in comparison to, for example, a production company. There is no obvious chain/line of operations/processes resulting in products yielding immediate revenues. Departments,

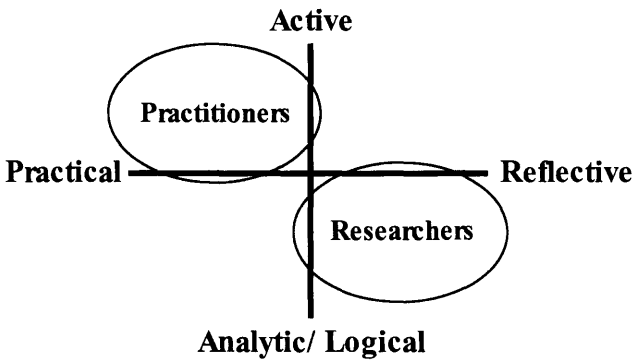

Figure 7—Researchers' learning styles are probably more reflective and analytical than those of the practitioners (Honey and Mumford 1982).

programs, or projects usually work fairly independent of each other with no traditional line responsibility. Consequently, a project leader is not used to the helicopter perspective of the organization and may have some trouble seeing the benefits of this holistic, continuous approach.

What all this probably boils down to is that researchers learn and are influenced in other ways than people with more operative/practical jobs.

We, the researchers, need models and proven or reliable theories presented by trusted colleagues whereas others may just try something and learn from their actions, as in the trial and error approach.

The conceivable implication of this is that much effort has to be devoted to the consensus of the need and direction of change. I believe that an accepted concept such as TQM can facilitate continuity in the improvement process, provided that we can establish efficient forms for communicating and agreeing on our visions and mission, set realistic targets, and together agree on common responsibility and methods to monitor and improve our approaches and results. This naturally calls for strong leadership.

Here I may add that the individuals in management groups of research organizations very often have a research background themselves—with basically the same characteristics as the rest of the pack. So before everything else it is of utmost importance to have thorough discussions within this group in order to share the values and visions and really get every single member to agree on targets and courses of action.

Heterogeneous Group of Customers

The other factor that may be specific to research organizations is the *customer profile.* We are to serve an entire Industry Sector with knowledge. This may be a bother especially for applied- or problem-oriented research organizations, such as SkogForsk and FERIC, where both short- and long-term practical problems are to be solved for a very heterogeneous group of customers who also happens to be our members/owners.

The problem here is how we can arrive at a common vision of roles and procedures together with small and geographically widespread companies and individual operators with very different, if any, visions of their own and very diversified opinions of what the most urgent research needs are.

Also here I believe that TQM can serve as a guide when it comes to customer orientation and the continuous contacts and communication embedded in the organization for that purpose.

Difficult to Evaluate the Results

The third and last factor I'd like to bring up here is the *evaluation of results.* There are ways to quantify the end value to the customer of some of our work. We have tried cost-benefit analyses, especially in very applied, short-term areas such as technical development. Other areas such as growth models are more difficult to evaluate. How do you evaluate their reliability? The only way out here as I see it is, again, communication with the customer from the initiation of the project through the final dissemination of results.

The other aspect of this evaluation is the efficiency of the work itself, which is a result of competence, organization, tools, etc. Here, close monitoring and comparison with others (benchmarking), which now are being discussed on both national and international levels, should help.

Summary: How We Intend to Safeguard Continuous Improvement in Managing SkogForsk

An organizational culture and management strategy based on the TQM core values, whose central features include:

- committed and unanimous leadership;
- wide engagement and participation, based on trust in each individual and common visions for the future;
- continuous watch for management improvement possibilities by built-in evaluation of results and approaches in all aspects of the organization (holistic view); and
- close customer/member contacts.

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Performance Management: People, Productivity, and Careers[1]

Gerhardus P. Smith[2]

The challenge for management is to ensure that the value and impact of people's outputs are greater than the cost of their inputs. Some measurements can include finances, growth, and employee satisfaction surveys. The role of a manager is sometimes that of an an expert and other times as a facilitator/coach. A manager helps align organizational goals with an employee's individual aspirations. A balance in leadership should be achieved between top-down direction and participative management.

[1]The following text and figures are from overheads submitted by the author for his presentation in the proceedings.

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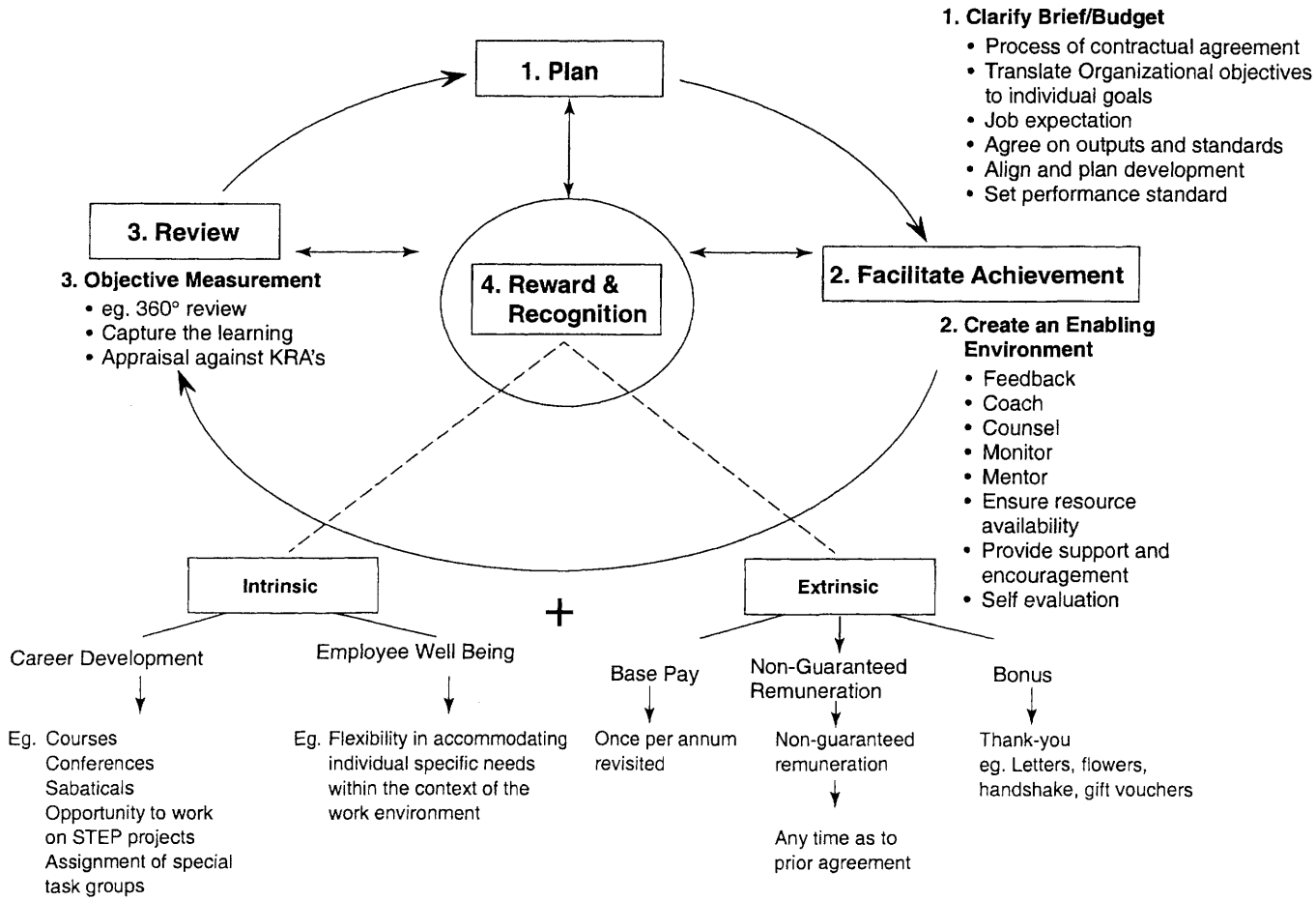
Performance Management Process



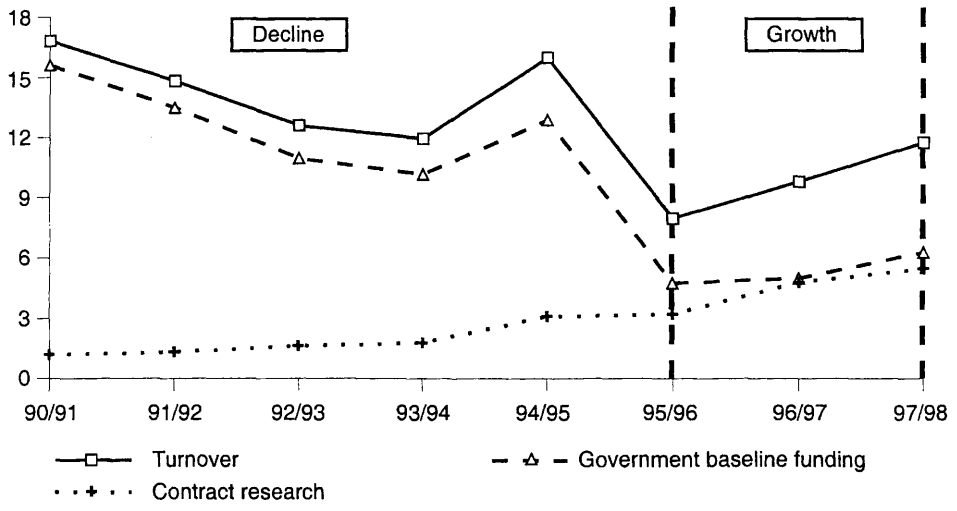
Performance Management

- Determine minimal acceptable performance management program
- Finalize criteria indicators per job, family, and career stage (minimum standards)
- Complete training needs analysis
- Obstacles to implementation of career development and performance models:
  - lag in reward and recognition
  - lack of supporting systems (e.g., database)
  - skewness in current HR profile
  - allocation and leveraging of resources
  - tension between short-term survival and long-term sustainability

Performance Appraisal Systems

Typical Performance Appraisal	CSIR's Performance Management System
Manager "does it" to employee	Employee actively participates
Manager judges	Manager coaches and develops
Doesn't tie behavior to results	Links individual goals and objectives with corporate division's goals
Bottom line: deflates employee morale; job performance and productivity suffer	Bottom line: boosts employee morale; job performance and productivity surge

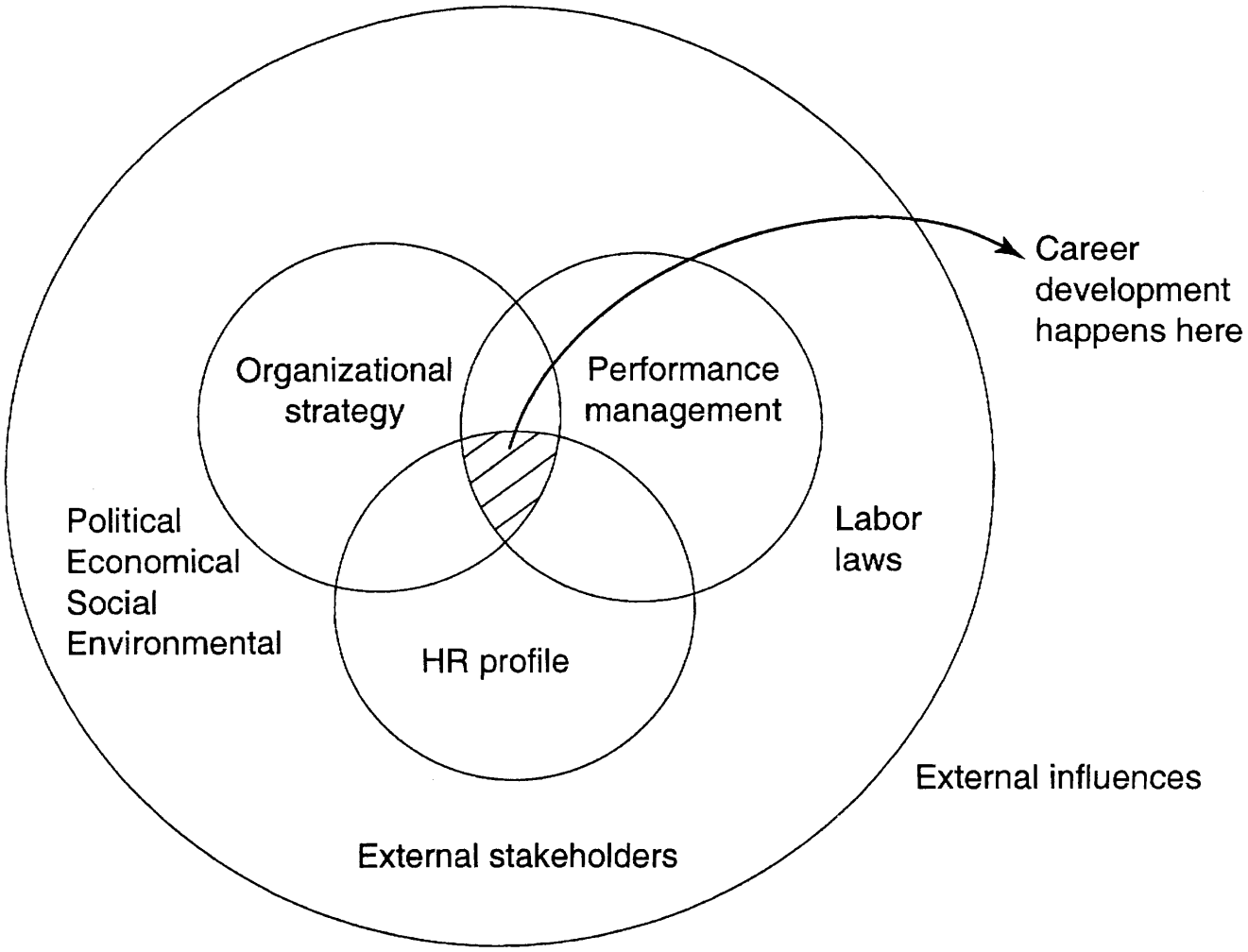
Results: Forestry and Foresty Products Programme



Some of the challenges associated with human resources management are:

- Customer orientation
- Short financials
- Consistency, integrity
- Human resources
- Selling value
- Portfolio management
- Individual marketability

Human Resources Management



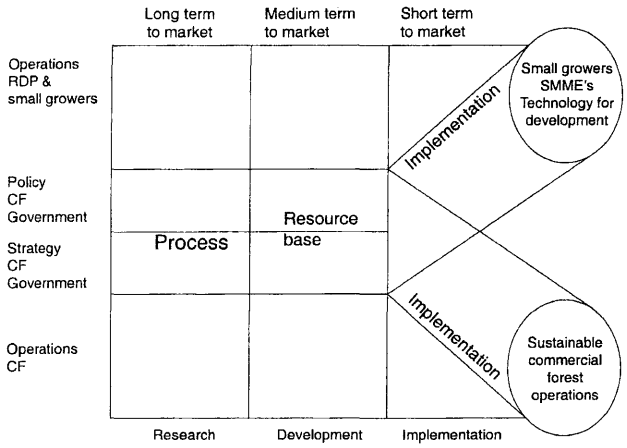
Career Development: Four Stages

Helping and Learning: Followership	Contributing Independently: Personal Leadership	Contributing Through Others: Local Leadership	Leading Through Vision: Organizational Leadership
Willingly accepts supervision	Assumes responsibility for definable projects	Increases in technical breadth	Provides direction to the organization
Demonstrates competence on a portion of a larger project	Relies less on supervision; works independently and produces significant results	Stimulates others through ideas and knowledge	Exercises power to influence decisions or obtain resources
Competent at detailed and routine tasks	Develops credibility and a reputation	Involved as a manager, mentor, or idea leader in developing others	
Shows "directed" creativity and initiative	Increases in technical competence and ability	Represents the organization effectively to clients and external bodies	Represents the organization on critical strategic issues
Able to perform well under time/budget pressure	Builds an internal network	Builds a strong internal and external network	Sponsors promising individuals to prepare them for leadership roles in the organization
Learns how "we" do things	Learns how "we" do things		
Stage I	**Stage II**	**Stage III**	**Stage IV**

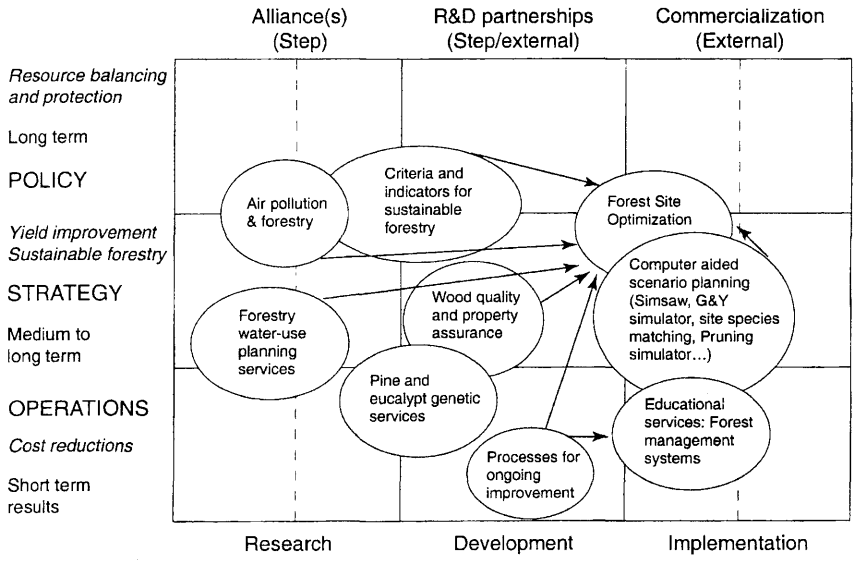
Career Development

	Stage I	Stage II	Stage III	Stage IV
Central activity	Performing sub-tasks under supervision	Establishing distinctive competence	Building, developing, interfacing	Shaping organization direction
Primary roles	Learner Helper Doer	Expert/technical specialist Individual contributor	Coach/mentor Idea leader Integrator Internal consultant	Entrepreneur Pathfinder Sponsor Strategist
Major relationship issues	Dependence and being influenced	Independence and collaborating with others	Assuming responsibility for others Influencing others in immediate area	Assuming responsibility for the organization Influencing others beyond immediate area
Contribution	Takes care of routines and details	Does cutting-edge work Improves own work processes	Builds team/ group productive capacity	Builds organizational productive/ competitive capability

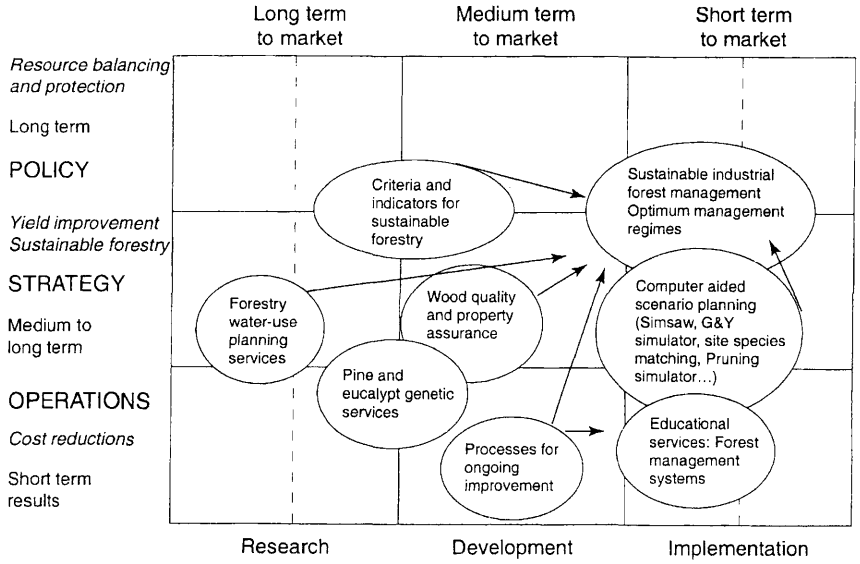
Forestry and Forest Products



Forestry and Forest Products



Technology for Productive Forestry Thrust



Workshop Reflections

To conclude the workshop, each participant shared one point that made an impact as a result of the presentations and interactions:

Universality of Issues

I was impressed with . . .

- how universal the issues are in research organizations throughout the world.
- the commonality of issues that research communicators face.
- how people struggle with the same things in South Africa as other people do elsewhere, even though organizational size and structure are different.
- realizing that we can still learn from each other no matter how different we are.
- the numerous references to shrinking resources, but also the stories of agencies who have succeeded. The dollars are out there. The more successful agencies ask: Why do we exist? What do our customers want?

Communication of Research

I was impressed with . . .

- the need to communicate research results in different ways.
- how important it is to emphasize communication skills of researchers when they are recruited.
- how important it is to evaluate researchers' communication skills after they're hired.
- the need for communication of research results in order to get recognition from clients and partners.
- the importance of knowing clients; you can't use the same tool for all of them. You must know what tool to use to reach them.
- the idea that we're all in the information business; we all struggle with assessing and evaluating our communication. The big struggle, especially in government agencies, is: How do we get credit for what we do?
- the need to find a way to invest more money for communication of research results and being able to address costs and benefits.
- the emphasis on communication; as an editor, I was heartened by the discussions.
- the need for more visibility of forest research through senior communicators.
- the challenge in communicating research results.

- the amounts of resources devoted to communications by some groups.
- how much time we spend communicating research results. We need to have a workshop on this.

Importance of Knowing Our Customers

I was impressed with . . .

- the need to be proactive in surveying our clients on *what* information they want and *how* they want it.
- hearing that it's more important to evaluate the *impact* rather than the *output* of research. The challenge is evaluating impacts on customers.
- the need to determine clients. But we must know what surveys to use and pay attention to the role that outputs play on stakeholders.
- how hard it is to identify customers, especially in the U.S. Forest Service.
- the clear identification of customers by some groups. I am looking forward to implementing a clear identification of my customers.
- the use of modern research tools to assess clients and the general public. We must do this because we lack support.
- the amount of emphasis on technology transfer as part of an employee's responsibility—up to 50 percent.
- how interesting it is to see the wide range of efforts made by organizations to get their research results implemented: from virtually nothing to everything.
- the fact that research results are of little value unless they are known and applied.
- realizing that we should be paying attention to technology's impact on communication. How will the internet impact how scientists will publish? Who's driving the vehicle?

Management

I was impressed with . . .

- the global challenge to strike an appropriate balance between management of science and the science of management. These go two directions. The Canadian Forest Service has concentrated more on the science of management and needs to balance it out with the management of science.
- a better appreciation of the differences between being a manager of scientists versus being a manager of managers of science. These are two different roles. The difference between the roles of manager and leader should be investigated.
- the need to pay more attention to measuring the effects of management processes. I'm interested in how to measure the effectiveness of what we measure.

- the creative and focused approach on evaluating resources.
- the upsides and downsides of managing and evaluating research.
- Gary Latham's four key points on vision, measurable goals, managing with integrity, and accessibility [see page 19].
- the level of investment into training in organizations—it's nice to get a spectrum of this.
- Gerhard Smith's discussion of the appraisal system. We should be coaches, not judges, and look at the ongoing process of performance.
- the workshop information that will help Forintek's evolution of its performance management system.
- the system for evaluating staff as presented by Gerhard Smith [see page 52].
- the discussion during Gerhard Smith's presentation and the analogies that were drawn.
- the contrast in organizational response to management—for example, government versus non-government—relative to roles and responsibilities. The more that government can clarify our mandate, the better we can manage and the more employees will understand their roles.
- knowing that when you fix objectives, the objectives should be linked with available resources (money and time).

Leadership

I was impressed with . . .

- finding out that there is a difference between leading and managing.
- Gerhard Smith's emphasis on linking the employee satisfaction index with the customer satisfaction index. We need to track both of these.
- my better understanding of privatization; it is new to me and helps me learn how to make resources go further.
- discovering that if you want to change behavior, you need to change the consequences—both positive and negative.
- the confirmation that success depends on the people we work with.
- how different people perceive the TQM (total quality management) concept.
- the usefulness of taking the team approach to solve problems.
- realizing that when you want to apply change, you need a unanimous leadership and a common vision.
- how fundamental it is to have a clear vision and send the right signals to employees. We should ask our employees: What can I do to improve the organization?
- the devastating effects of the lack of strong leadership, especially of scientists.
- the devastating effects of the inconsistency of signals from leadership.
- Gary Latham's emphasis on the integrity and consistency of signals from managers. This should also be discussed at the organizational level. How do we address it?

- Latham's 40/40/20 principle of aligning stated goals with vision.
- Latham's comments on a vision statement being a "superordinate goal"; this was a good description.
- the inspiration to continue "walking the talk."

Other Inspirations

I was impressed with . . .

- my reinforced confidence that we can share our secrets.
- the open discussions.
- the encouragement to celebrate failures.
- how we keep forgetting the basics and how important they are. If you don't concentrate on the basics, then the processes get lost. We need to get out of the box—for example, questioning the peer review process, finding out how to communicate better, and whom to communicate to.
- the workshop itself: benchmarking has tremendous potential for development.
- the cautious movement toward the ISO 9000 process.
- the confirmation that partnership is a viable practice but at the same time it's important to have someone ensure that the partnership is structured and moves properly.
- Scott Josiah's reminder of the S.M.A.R.T. objectives [see page 13].

Recommended Books

Novations: Strategies for Career Management (Dalton & Thompson 1993) ISBN: 0-673-18181-2.

Management of Research and Development Organizations: Managing the Unmanageable (Jain & Triandis 1997) ISBN: 0-471-146143-7 or 0-471-50791-1.

Third Generation R&D (Roussel, Saad, Erickson, & Saad 1991) ISBN: 0-87584-252-6.

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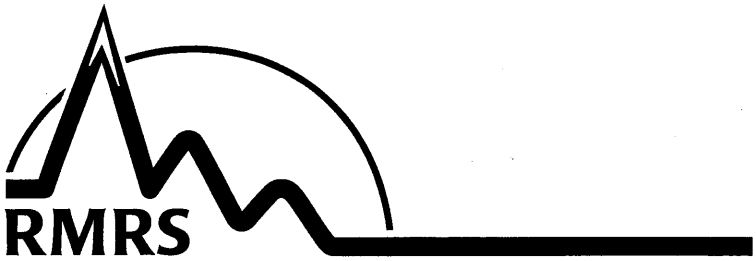

The Rocky Mountain Research Station develops scientific information and technology to improve management, protection, and use of forests and rangelands. Research is designed to meet the needs of National Forest managers, federal and state agencies, public and private organizations, academic institutions, industry, and individuals.

Studies accelerate solutions to problems involving ecosystems, range, forests, water, recreation, fire, resource inventory, land reclamation, community sustainability, forest engineering technology, multiple use economics, wildlife and fish habitat, and forest insects and diseases. Studies are conducted cooperatively, and applications can be found worldwide.

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