

Products Laboratory, and Affiliate Professor at the University of Idaho; and of course, was a member of this Society. He received many honors: The National Lumber Manufacturer's Award for Applied Research in Wood Products, Time, Inc., "Top Professor of the Year" award for contributions to the home building industry, and others.

In the words of one of our members who wrote a letter supporting the nomination of Dr. McKean for this award, "Dr. McKean's greatest contribution to the profession of wood science and technology was to promote recognition and dignity for the profession in the wood industry. He maintained contact with universities and with both FPRS and SWST, responded to invitations to speak or to counsel with students—and he encouraged scientists to write papers and attend professional meetings."

THE DILEMMA OF ACADEMIC RESEARCH¹

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Before we can discuss the management of academic research, we must have a common understanding of the typical setting and environment in which forest products/wood science research is conducted at universities in the United States. In my comments this morning, I will attempt to describe the environment and the dilemma that I see in the context of a typical U.S. academic institution. Because of my 12 years as Department Head at the University of Minnesota, however, I'm sure that my observations and comments will be heavily biased by what I see at our institution. However, our situation is similar to that at most other major forest products programs in the country.

In almost every forest products department or forest products program, research is only one of the primary objectives. This multiplicity of program objectives provides several sources of strength, including the stimulation from working with students, but it also creates problems, which we will discuss. It is my conviction, however, that the multiple objectives of academic programs in the U.S. create a stimulation and an environment for productive research efforts that could not be achieved if programs were singly oriented toward research only.

First then, let's consider the objectives of most academic forest products programs in the U.S., whether they be titled wood science, forest products, or forest utilization. Most forest products programs have four objectives, shown in Table 1. Undergraduate education is the foremost reason that most programs exist or were originally created, though today the teaching budget is typically not the main source of financial support. Most programs have evolved from a specialization within forest management and have grown over the past three decades into pro-

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TABLE 1. *Objectives of academic forest products/wood science programs.*

1. Develop graduates with a knowledge of process technology/management and wood materials. (Undergrad programs)
2. Educate the scientists and technologists of the future. (Grad programs)
3. Conduct research to create new knowledge and capture occasional flashes of "invention." (Research)
4. Solve problems and provide educational services for the industry and people of the state. (Research and extension)

grams with curriculums and course offerings entirely separate from forestry. The major implication that an undergraduate teaching program has for the research activities within a department is that it necessitates a wide variety of expertise in the faculty to cover the teaching needs in the curriculum. Further, it is necessary that some, though certainly not all of the faculty, have an orientation towards and a sincere interest in undergraduate students.

The second objective of programs, to educate scientists and technologists for the future through graduate education, requires a variety of specialized courses both in the wood sciences and in forest products management or business. The importance of a business orientation at the graduate level is sometimes overlooked, but in our experience less than half of our graduate students will go into R&D employment. The majority find careers in production and technical sales. Another implication of the graduate education objective of forest products programs is that they require expensive and modern laboratory and computer facilities and a faculty with an involvement both in scientific research and problem-solving research. Scientific research is of greater importance in Ph.D. programs, while problem-oriented research experience is important to graduate students who will find their careers in a production management setting.

The third objective of forest products programs is to create new knowledge through research and to capture the occasional flashes of inventiveness and innovation that faculty occasionally produce. Fulfilling this objective requires a strong commitment to research—both fundamental and problem-oriented—and requires expensive laboratory facilities as does the second objective. It further requires that faculty have freedom to work in any area where they feel their greatest contribution to new knowledge can be made. It is in the fulfillment of this objective that most academic programs either obtain their primary source of financial support or fail to do so and decline in overall program strength.

The fourth objective of academic programs, solving state problems and providing educational services for the industry and the people of the state, is extremely important to obtain support through the university structure and through state legislatures. The political and financial support for programs in most universities is based primarily upon two things: the number of undergraduate students in the program and the benefit of the program to the state as perceived by university administrators and legislators. In my opinion, programs are more likely to succeed with this fourth objective if the extension activities of the university are carried within the departments, rather than extension being a separate organizational unit

TABLE 2. *Problem 1.*

How can a balance be maintained between knowledge-generating research and problem-solving/economics-driven efforts?
Answer: 1. Recognize and agree on balance
2. Develop mutual respect

within forestry. The implication of the fourth objective in regard to faculty and the research program is first that every program needs an active and highly visible faculty member to act as its spokesman throughout the state and within the state's industry. This is not the type of role at which faculty commonly excel. Second, this fourth objective requires that a number of the faculty be interested and effective in interacting with the industry and other clientele groups in the state.

Considering these four objectives of forest products programs and the implications of each, we arrive at what I believe is one of the major problems in managing forest products research. The dilemma in which we find ourselves in regard to managing research is whether or not we should manage our research programs for the creation of knowledge or the solution of problems. As you recall, a dilemma is defined as a situation requiring a decision between two equally unsatisfactory alternatives. In this case, the solution to the dilemma is self-evident. We must do both, create knowledge and solve problems of importance to those who support university programs. The real problem then becomes not "which kind of research we do" but "how to manage a research activity in which the objective of creation of knowledge and solution of problems are complementary and not in competition."

At a few institutions it is possible because of the local situation to avoid this dilemma by concentrating on graduate education and research or perhaps on undergraduate education with a small and probably insignificant research effort. However, history suggests that most forest products programs that have limited their objectives in this way have found themselves to be weakened over the years. This is not to suggest that such limiting of objectives may be a poor strategy at some private institutions, but at state universities I would question such an approach.

There are three similar but somewhat different problems that must be dealt with in solving the academic research dilemma. The first is how to determine and then maintain a balance between knowledge generating research and problem-solving research aimed at serving the clientele within the state. Each faculty member in his research efforts must recognize and deal with this question. Few faculty can deal equally well with both kinds of research and in fact most are effective when their effort can be concentrated on one or the other. However, the faculty must be encouraged to recognize that both are important to the overall welfare of the program and that a balance must be reached between the two across the department. There is increasing pressure in universities for greater outside support through grants, contracts, and cooperative research efforts.

The answer to problem one (Table 2) seems to lie in a common recognition among the faculty of the necessity for both types of research in a program, a

TABLE 3. *Problem 2.*

How can we maintain a strong commitment to undergraduate education simultaneously with the increasing pressure to obtain grants/contracts/cooperative agreements?

Answer: 1. With great difficulty!
 2. Separate faculty?
 3. Realistic teaching-time allocation
 4. Develop mutual respect

general agreement of the balance to be reached within the department, and an understanding of which faculty will be involved with each type of research. This role recognition and agreement can be accomplished effectively only if there is mutual respect among the faculty members for the importance of both kinds of research efforts. To me the establishment of mutual respect within the faculty for the range of activities of other faculty members is the key to the solution to problem one.

The second difficult problem (Table 3) is how to maintain a strong commitment to undergraduate education simultaneously with the increasing pressure to obtain grants, contracts, and cooperative agreements. Despite continued administrative verbiage regarding the importance of quality in undergraduate education, the truth in most universities is that the faculty see their productivity as researchers being the primary determinant of salary increases, promotion, and tenure. Unfortunately their perception of the situation is not necessarily incorrect. One necessary factor in minimizing the stress on the faculty regarding their use of effort for teaching versus research is through a realistic allocation of their teaching and research time. If the faculty do not feel that they are teaching on research time or vice versa, they are more likely to be effective in the undergraduate teaching area. Again as with problem one, a key to maintaining the commitment to undergraduate education lies in part in maintaining a mutual respect among the faculty for those who spend a greater proportion of their time on education. If all faculty recognize and support the importance of the undergraduate program and of reasonable student numbers to the viability of their unit, undergraduate education is less likely to suffer as a result of a strong research emphasis.

Some institutions have approached the problem of maintaining the undergraduate program through the appointment of separate faculty with primary responsibility for teaching and little research commitment. In some situations this strategy may work effectively. In the long run, unfortunately, those faculty assigned responsibility for the undergraduate program have a tendency to become second class citizens. It is necessary that the administrators of academic programs dem-

TABLE 4. *Problem 3.*

How can we maintain a faculty that has an appropriate balance (50/50?) between scientists (discipline-oriented) and problem-solvers (engineers/generalists)?

Answer: 1. Clear program objectives
 2. Develop mutual respect

onstrate to the faculty that they do in fact receive credit and recognition for their contribution to teaching and to the related effort regarding employment coordination, scholarship development, and student activities which create a strong undergraduate program. Further, I believe that all faculty should be involved at least to some degree in undergraduate education so as to appreciate the problems of those who are.

Problem three is one that comes to light as new faculty positions are open and the decision must be made as to the type of faculty to bring into the group. This problem is less difficult if an agreement has been developed regarding the appropriate balance between knowledge-generating and problem-solving research. The tendency in hiring new faculty today is to hire those who can secure strong grant support. Thus it is necessary that the objectives of the program (the four mentioned earlier, or others) be reviewed carefully at the time new faculty are hired and from the very beginning new faculty be helped to understand the importance of all objectives to the viability of the program. This does not mean, of course, that all new faculty will necessarily be involved in all of the four objectives, but at least they must have an appreciation of others who are serving those objectives with which they themselves are not involved.

Generalizing dangerously one could say that faculty today are generally of two types, those who are interested in their area of research and who wish to develop a strong research program probably fairly fundamental in nature and those faculty who are interested in the education process, in working with students and are by nature more opportunists and generalists than specialists. We need both types of faculty. It seems to me that the second type is in shorter supply than the first.

Let me close with two observations about academic research and academic researchers. The outstanding researcher, whether he be a scientist or problem solver, looks for the important questions then seeks the tools to find the answer. The mediocre researcher looks for problems that can be solved with the tools he already possesses. Or in simple terms quoting Bob Youngs, "If the only tool you possess is a hammer, every problem looks like a nail." The second belief that I have is that all research, regardless of whether it is fundamental or applied in nature, should have a problem orientation. The objective of any research effort needs to be carefully defined, and beyond that definition, the implications of reaching the objective to extending knowledge or solving industrial problems need to be carefully considered and documented.

In conclusion, I believe that to maintain a balance between fundamental and problem-solving research in an academic forest products program requires three things: 1) A clear view and agreement among the faculty of all the departmental objectives, research, teaching and service. 2) A mutual respect among the faculty of the importance of all of the departmental objectives. The main problem to be overcome in this regard is the failure on the part of faculty to recognize the diversity of valuable services provided by others in the organization. 3) All research regardless of its type should have a clear objective and problem orientation.