

CONDUCT OF RESEARCH PROCESS AT THE RESEARCH INSTITUTE LEVEL

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Texas Transportation Institute (TTI) is the largest university-related transportation research program in the world by several measures — dollar volume, number of staff, and scope of research performed. Our current budget is \$25 million. We have offices in Houston, Arlington, San Antonio, and Dallas in addition to our headquarters at College Station, Texas.

We have almost 500 people, including 105 graduate students but not the 110 or so undergraduate students who are employed in our research program. Among the approximately 200 professional staff are 60 who are also faculty members at Texas A&M University. Some 40 are faculty in Civil Engineering, the remaining 20 are in other engineering, and non-engineering departments. The engineers are from departments of Industrial, Electrical, and Chemical. Other faculty include Computer Science, Landscape Architecture, and Range Science, just to name a few.

TTI's largest single sponsor is the Texas Department of Transportation. Also, we were informed in a recent GAO audit that we were the largest single receptor of research from both the U.S. DOT and NCHRP. TTI personnel generally present about 50 papers at TRB, and about 100 persons attend including 35 graduate students from Texas A&M who work in our research program.

This background is not for bragging purposes, but to tell you that as an academic research program TTI is large and complex. Staff includes all kinds of people—prima donnas and hard workers; theorist and practitioners; visionaries and problem-solvers; engineers and non-engineers, to identify a few. Our engineers use poor statistical design (according to our statisticians), and do not know economics (according to our economists). Our materials engineers look on operations as voodoo art, and, of course, our operational engineers are convinced that entirely too many research dollars are splurged on materials and structural research. The engineers agree on only one thing—the economists and planners are totally out of touch with the real world.

What are the principles that should be followed in managing an academic related transportation research program? There are at least four factors that are important: (1) recognize the motivational factors of faculty, (2) employ good people, (3) communicate continuously, and (4) manage by supporting not by supervising.

First, one must realize what factors motivate a faculty member. Anyone who tries to manage research in an academic environment without fully understanding that motivation will be very frustrated. A close friend left the Federal government after a long career managing really large research programs to join a university, that was

beginning a large transportation research program. He has since retired. He found out quickly that money is not the motivation for faculty. He has told me many times, "Sadler, I can't get these guys to work. I bring them the problems and the money — they don't want to work for me."

There are three measures that a faculty member is judged by within the academic community: Research, Teaching, and Public Service. However, most of them would say that the three measures are Research, Research, and Research. But research does not mean just any research; the research must lead to publication, and the publication must be in a peer-reviewed journal. Success in research is not in how valuable the results may be to transportation, to the sponsor, or even the traveling public or the monetary value of the contract. Success is measured by how valuable other learned people feel that knowledge has been advanced. Of course, nothing is more valued than a visionary faculty member who can identify opportunities for advances in knowledge in what may otherwise be viewed as a practical problem.

In the academic community, research that advances knowledge is valued — research that only leads to improved practice is not. The dollar volume of the research is of much lower priority. I heard our Dean of Engineering explain this by saying that 40 years ago or so engineering was completely an applied topic. Most engineering principles were in the form of handbooks, nomographs, etc. Today, he continued, universities are teaching engineering science. Scientific principles apply equally in engineering as in science. Today's engineer is expected to create a good part of the knowledge base that is used in his profession.

Research is also important to faculty if graduate students can use the topic as a basis of their thesis or dissertation. Graduate students are valuable as a resource, and the number of graduate students supervised is a part of the faculty's work load measures. Graduate students are also valuable to the research projects. It allows the use of some of the brightest young minds available at a low cost. Graduate students tend to work very hard because their degree is dependent on the research. Having a proven record of work makes for more marketable degree holders.

One thing that I have become increasingly aware of is giving young faculty both opportunity and encouragement to do those things that will be used to judge their effectiveness by fellow academics. Neither TTI nor our major sponsors, whether they be Texas DOT, U.S. DOT, or a transit authority, require that research results be published in academic journals, but

it is important to the faculty. If a young faculty member does not accomplish an adequate number of peer-reviewed journal publications within a specific period of time (usually six years) tenure will be denied and then has only one more year to find a new position at another institution. Thus, the penalty for not providing an opportunity for a young faculty to write those articles is that at tenure time, the individual will not receive tenure and will be lost to the research program. Thus, faculty must do more than non-faculty researchers in that they must write journal articles in addition to maintaining the research quality required to meet the sponsors needs.

In most cases, research quality is not an issue when dealing with both faculty and graduate students. Unfortunately, far too many state DOTs have had the experience of funding a university to solve a practical problem only to find later that the funds had been expended on developing material for journal articles of little value to the state. Some others have had the experience of graduate students being given problems with little supervision and insufficient experience to develop practical solutions. Faculty, like all other researchers, need to keep the needs of sponsors in mind. The sponsor comes first, and it is an additional responsibility of the faculty to identify journal quality research out of what may be very practical research.

In this respect good faculty researchers are no different than good non-faculty researchers. Good ones are good and poor ones are not. Which leads me to the next factor employing good people. Beyond the basic objective of retaining people with the prerequisite research skills, we must recognize not everyone is suited to working in certain types of organizations. Not everyone is suited to working in an environment in which future support for their job is not known until contracting agencies made their annual funding decisions. These same people can work very successfully in a different environment. For example, I know a person who left the research field due to stress over future funding and is now the successful manager of computer facilities at another university.

I cannot over emphasize the importance of communication. In cases where the quality of research was not up to our standards, most often the researcher had felt isolated from support. I did not say the researcher was isolated, I said they felt they were isolated. It is so very easy for any research manager to get so involved with day-to-day activities that one fails to communicate enough with key personnel. Everyone in the organization must realize that they are not isolated,

that support is available, that resources and personnel can be committed to helping with their problems. This is important for everyone, but it is particularly important for less-experienced researchers. Everyone must understand that the organization is a team. Research is a team sport; it is much more like football or basketball than tennis or boxing. If it is your job to block Lawrence Taylor you better know exactly what the rest of your team is doing and where you can get help. If you do not know your team will lose. It is exactly the same case in research.

There is a big difference between talking to people and communicating with them. Communication is two way. Communication means you not only hear but understand the other person. Management text books talk about MBWA or management by walking around. I submit that if one walks without also communicating that you do not know what MBWA means.

The fourth factor is to manage by supporting not by supervising. This is actually just another way of emphasizing communications. For an individual who has the innovation and originality to be a good researcher, the worst thing is to supervise. Researchers are good because they do not "stay within the lines." In a real sense a research manager works for the researcher not the other way around. It is management's job to find those tasks that researchers are not good at, do not want to perform, or are better doing other tasks. The research manager should provide for these tasks to be completed for the researcher.

If a researcher is a poor writer supply an editor. But do not force one—make sure it is the researcher's idea, not yours. For the researcher who is a poor manager, do not force them into managerial situations. If the researcher is also on tenure track, make sure that they do not take on so much research that they have no time to develop scholarly articles. If a piece of equipment is required, see that it is purchased. These are just a few examples of things a good research manager can do to manage by supporting not by supervising. Researchers do better when they do research and not other tasks.

The four factors discussed here are important to the conduct of research in a university environment. Again, the factors are: (1) recognize the motivational factors of faculty, (2) employ good people, (3) communicate continuously, and (4) manage by supporting not by supervising. These are obviously not the only things one has to watch for, however, I feel they are the most important.