Discussion

Margaret A. NEMETH

Monsanto
St. Louis, MO 63167
(margaret.a.nemeth@monsanto.com)

The challenge that statisticians face in industry has been addressed a number of times since the "Preparing Statisticians for Careers in Industry" report by Snee et al. (1979). Nemeth and Kasprzyk (1990) presented an invited paper on educating statisticians in the field of chemometrics at the 1990 Joint Statistical Meetings. Hahn and Hoerl mention several additional publications since 1990. The basic theme of all these works is the same: What can statisticians do to enhance their credibility? What skills are needed for the statistician to be perceived as providing a service that has an impact on the bottom line? Because, let's face it, part of the problem, since we have been discussing this issue, is perception.

What is particularly bothersome is the fact that we are still discussing these same issues after almost 20 years. Why have we not learned or changed our behavior? Because of competitive pressure the workplace is changing more rapidly than ever. If we do not change now, I am afraid the role of the professional statistician, within industry, may become obsolete.

Just yesterday I met with one of our analytical chemists from a California subsidiary. This location has 700 researchers, none of which is a statistician. He was here in St. Louis to request my help in optimizing a new process and in validating an analytical method. The location had contracted with a local university for statistical consulting but it was a disaster because "the statistician gave us a lot of theory but could not apply it to our problems." Thus, the problems remained unsolved. I have seen this time and time again. What impression do we as statisticians leave behind when we walk out of a client's office? Why are we continually surprised by people's attitudes about statistics and statisticians in general? What should we be doing to change our practices so that we in turn change these attitudes?

The climate in industry has changed dramatically in the past few years—organizations are flat, teams are empowered, and the emphasis is on *rapidly* producing a quality product. The potential for statisticians in this environment is huge. How should we capitalize on this changing environment?

One issue raised by the authors is the availability of statistical software. At Monsanto, researchers have access to JMP. With this easy availability of software, researchers are doing more and more of their own statistical analyses. Thus, we must change how we interact with our clients. In the past, I designed experiments for clients, analyzed the data, discussed the results with the client, and wrote a report. Now I spend a portion of my time talking to teams about "statistical thinking" and teaching them how to use statistical software appropriately. When a team indicates that its members will be using JMP, I have them send me representative data, and my presentation is geared toward analyzing data of this type. We also discuss assumptions, hypotheses, estimation, and so forth, but everything is in terms of their data and very few symbols and very little statistical "jargon" is used. I do emphasize when they should contact me and the limitations on what they have learned. I find this interaction more fulfilling, and it certainly beats sitting at a computer cranking out output.

The team environment has created additional problems for statisticians. Most researchers at Monsanto are on 1–2 teams, and all their effort is concentrated on supporting the team(s). As a statistician I am not on any teams, although I am an adjunct member on four teams and I consult with many more individuals from other teams. As an adjunct member, I attend team meetings and spend somewhat more of my time interacting with these teams. But I am never part of the inner circle of the team. When the teams are evaluated at the end of the year to determine the amount of bonus based on performance, my contribution is not part of this evaluation process. Because in a sense, I'm still an "outsider," I have to work harder to get the statistical component integrated into the team results. When the team writes a report, I do not want the statistical results to appear in only the appendix. I want the statistical results to be integrated into the discussion section of the report. This is another situation in which statistical thinking plays an important role. Another way to get the researcher to start thinking statistically is to be very proactive when researchers give team technical reviews. Statisticians need to challenge the statistical thinking component of their research along with the techniques that they used to analyze the data.

What other skills should a statistician have? Very definitely you need to listen and ask questions. You need to know as much as possible about the "process." The authors mention that it might be a good idea for a statistician to have some training in an applied field like physics, chemistry, engineering, and so forth. I actually did do that—double major in math and psychology. I have spent the last 13 years working with chemists and biologists, however. I never felt that not taking more courses in biology or chemistry was a detriment. But I did have to work harder in understanding what the researchers were attempting to do. I believe that if an individual realizes that he/she will need to constantly learn—for example, I recently took a seed course—that success will be assured. The statistician also needs to realize that the consulting process is an *equal* exchange between parties and the statistician's goal should

be twofold—first, to make the researcher feel comfortable, confident, and knowledgeable about the statistical problem-solving portion and, second, to encourage the researcher, via questions, to thoroughly explain the problem and/or underlying "process." Of course, a statistician needs to continually upgrade his/her statistical knowledge and should remain professionally active. This lends more credibility to the statistician.

The proliferation of large databases also poses problems for the statistician. I just received a Microsoft Access database with seven years of yield data from across approximately 200 sites in the United States. Several questions were posed, and I was asked if I could analyze the data and present the results at a February 2 meeting. I just laughed (humor does help a lot). We need to educate our clients regarding the time it takes to do an appropriate analysis. The perception is that we just throw it into the computer and, voila, a few hours later the results pop out.

If a statistician is supporting a small group of people, then the statistician needs to be proactive in his/her interaction with the group. Being proactive gets extremely difficult when you are supporting a large group of people. At the present time, I and another statistician support approximately 600 people (we have just hired a third statistician). In addition, I support approximately eight manufacturing plants—four U.S. and four ex-U.S. It is very difficult to be proactive in a situation like this, but I must be proactive because of the changing business climate. (Apart from cloning myself, I see no easy solution to this dilemma.) If I am proactive, I will have more clients and I will get to the point where I will not be able to help them. At this point in time I can request additional support, but it is extremely difficult in today's leaner business climate to get requests for additional personnel approved.

The authors discuss statistical process control (SPC) as a proactive tool. I have never approached SPC as anything other than a proactive tool. When I introduced SPC into our Brazil manufacturing facility approximately four years ago, I tied SPC to experimental design and process improvement. I spent two weeks at the plant becoming familiar with the different processes and discussing both SPC and experimental design. I had been told that the plant had been trying to introduce quality control charting for approximately six years. They brought several consultants into the plant, but after the consultants left the issue died and the charts were not implemented. I returned to the plant with some trepidation 18 months later in a follow-up visit. I was pleasantly surprised to find control charts up and running on almost all the processes. Moreover, experimental design techniques were being used for process improvement. And just recently we started control charting as part of our round robin testing for our glyphosate analytical assay.

The authors ask about "generic career paths" in business and industry. With the changing and evolving business culture along with the team-based flat organization, individuals no longer "move up the career ladder." At Monsanto everyone is expected to contribute in the team environment and "rank" is no longer used. In fact, we are not allowed to have any rank designation in the title we choose for our job description. Everyone is responsible for his/her own growth, both professional and personal. We are expected to coach each other in areas where we need to grow or improve. We get out of the job what we put into it, and we are expected to maximize our potential. This is a very different environment from just five years ago. Moreover, keep in mind that our growth and development is geared toward making the company successful.

To summarize, the challenges that statisticians face in industry and business are formidable. To tackle these problems we must change our old outmoded behavior patterns. If we do not, the future of statisticians in business and industry is indeed bleak.

ADDITIONAL REFERENCES

Nemeth, M., and Kasprzyk, R. (1990), "Chemostatistics: Educating Statisticians," unpublished paper, presented at the Joint Statistical Meetings, August 6–9, Anaheim, CA.

Snee, R., Boardman, T., Hahn, G., Hill, W., Hocking, R., Hunter, W., Lawton, W., Ott, R. L., and Strawderman, W. (1979), "Preparing Statisticians for Careers in Industry," Report of the Committee on Training Statisticians for Industry, presented at the Joint Statistical Meetings, August 13–16, Washington, DC.

Discussion: Increasing the Value of the Statistics Profession

Ronald D. SNEE

Bell Atlantic Corporation
Sleepy Hollow, NY 10591
(psmarge@aol.com)

AN OUTWARD FOCUS IS NEEDED

Many changes must be made if the statistics profession is to be broadly valued by U.S. corporations and viewed as exciting, important, vibrant, and on the leading edge. The quality revolution of the 1980s and the work of W. Edwards Deming and others brought the value of quality improvement and statistical thinking to the attention of many