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Discussion of "Statistical Thinking and Methods in Quality Improvement: A Look to the Future"

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We begin by thanking the authors for an inspiring paper. They have made a thoughtful contribution in the discussion about our profession's future.

There is a certain paralysis in the field. The sense of urgency is there, we think, but yet there is not enough momentum to get the profession moving. The majority of statisticians in the field have had their training and experience mainly in the old paradigm, and we imagine that many of them feel insecure about the challenges of the new paradigm. We imagine a person trained in mathematics, who has never been taught anything about engineering or management, who is suddenly challenged by the new paradigm to "provide leadership to the organization." Empathy is not our strongest trait, but we can imagine that this person will at best react passively but probably will resist.

The angle we take in our reply is that our profession is best helped forward by providing a path for us and our colleagues, which provides practical steps a statistician can take for moving himself from the old paradigm to the new one—to help those shivering on the brink to go into the water step-by-step. We do not pretend to provide such a path in this reply but at least wish to provide a few first ideas.

A WELL-FORMULATED AND GROUNDED VALUE PROPOSITION FOR STATISTICS

A technique in Lean Six Sigma's toolbox for change management is the "elevator pitch"—project leaders are challenged and helped to prepare a few lines that are effective in creating enthusiasm and interest across the organization for what they are doing. We need to help each other in preparing an elevator pitch for our profession.

We think the traditional value proposition, based on the notions of quality and variation reduction, and often biased toward a manufacturing context, has become ineffective. These concepts reflect the origins of the profession but do poor justice to what our profession currently delivers, and they link on poorly with theories in business economics (De Mast 2007). There are important signs that quality and variation reduction are

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no longer recognized by business as important objectives (Bisgaard and De Mast 2006). Quality and variation may have negative connotations to many CEOs, nonstrategic issues they would rather see go away and like to delegate. Quality is perceived as something of the 20th century (the U.S. Council on Competitiveness, as quoted in Bisgaard and De Mast 2006) or as an impediment to innovation speed (Cole and Matsumiya 2007). Of course, we know better, but that is irrelevant for the effectiveness of a value proposition—perceptions and connotations do matter!

Bisgaard and De Mast (2006) proposed the notion of systematic innovation as a value proposition for quality engineering, and De Mast (2007) showed how this notion links to the theories of evolutionary economics, identifying as the value of Lean Six Sigma that it facilitates routinization of incremental product and process innovation.

The essence of our profession is the methods, techniques, and paradigms for empirical inquiry and routine decision making. Routine decision making provides the application context for statistical techniques such as sampling, control charts, and proportional integral derivative (PID) controllers. Inquiry is the context of applications such as design and analysis of experiments and exploratory data analysis, but also of the design, measure, analyze, improve, control (DMAIC) method; this is the "statistics as a catalyst to learning by scientific method" context of statistics (Box 1999, p. 16–29).

The value of our profession is that it enables organizations to elevate inquiry and routine decision making to a more professional and scientific level. These competencies are critical to management decisions on all levels, to improvement and development projects, and to routine responses of the work floor or automatic equipment, especially in a world that is overwhelmed by increasing amounts of data and information.

Continuous improvement and innovation of one's own work environment will increasingly become everyone's task. Combined with the fact that a critical part of innovation is inquiry, we conclude that mastery of statistical tools and thinking will be important for a large number of professionals, whether line managers, engineers, marketers, or, for example, nurses in a hospital. Industrial statistics may find itself at the heart of the knowledge economy.

AN ARTICULATED RESEARCH PARADIGM

The sort of scientific research entailed by the proposals of Hoerl and Snee (statistics as an engineering discipline) presents academics with challenges. Mathematical statistics is safe; problems are typically well defined, and although solving the puzzle is an intellectual challenge, at least the sort of methods that should be used are clear and recognized. Real problems, of the type that Hoerl and Snee suggest, are vague and ambiguous, and it is not clear how to go about them while still being scientific and not ending up with "just opinions."

For academics, the safe bet is to stick to the familiar sort of problems (mathematical statistics), whether they are relevant or not. And until quite recently, journals and academic evaluation committees tended to stick to the familiar and reward mathematical rigor over relevance. Note that this phenomenon is not limited to statistics (Bennis and O'Toole 2005).

Much of the research in statistics is not mathematical but methodological research; that is, research after the usefulness and effectiveness of methods. De Koning and De Mast (2005) made an attempt at formulating sound and scientific research approaches for studying methods. In particular, they demonstrated how the approaches of grounding research and rational reconstruction can provide explicit templates for studying many questions about methods. A well-articulated research paradigm may help us and our colleagues in setting up research projects and in reassuring academic evaluation committees, who might scowl at proposals that do not fit in the familiar scientific disciplines.

PRACTICAL EXPERIENCE

Statistics is the science of methods and techniques for empirical inquiry and routine decision making. It is difficult to teach, study, and develop methods and techniques for empirical inquiry if one has virtually no experience doing empirical inquiry oneself.

Our institute at the University of Amsterdam combines academic work with consulting and teaching in business and industry. The confrontation with real empirical inquiry—problem solving, process improvement projects, product development—has

had an impact on the way we see statistics that can hardly be overstated. And we hear similar experiences from statisticians who are in a similar position, among whom are the authors of the paper discussed here.

The profession can pave a path for colleagues by providing realistic (as opposed to sterile and stylized), practical case studies. These act as inspirational teaching exemplars for statistical techniques and enable learning about the diversity of application contexts of statistics. In recent years we have run a lot of projects in health care and finance. Close cooperation has been initiated with directors, managers, physicians, nurses, and other professionals. It has resulted in a long list of joint publications; see the references in the book of De Mast et al. (2006) and some of the recent "Quality Quandaries" in this journal, among others.

A step that colleagues can take themselves is to accept the challenge to go beyond one's known environment and tackle a high-impact, real problem. To the suggestion made by the authors (tackling the financial crisis), we could add helping to control cost or improving reliability and safety in health care.

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