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Statistical consultancy

3.I

A statistician in industry

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The role of statisticians in industry has for many years been a source of anxiety. In this chapter, we review some papers on this topic, and give comments based on our own experience as statistical process control and Six Sigma experts and as statistics consultants.

Snee (1991) gave his view on the role of the statistician within the context of total quality, a program in which statistics is only one aspect. He distinguished different roles according to whether or not the statistician, his client, and the organisation are passive or active (see Table 3.I.1). Snee's view is that in order to survive, the statistician should seek an active role, whether his organisation is passive or active. Especially in organisations that actively pursue total quality, statisticians can be of real help only when they influence management as leaders or collaborators, although good technical work is as important as ever. So they need to learn the techniques of organisational development. According to Snee, 'understanding the

Table 3.I.1 Different roles of the statistician.

Organisation		Passive		Active	
Client		Passive	Active	Passive	Active
Statistician	Passive	None	Helper	Teacher	Data blesser
	Active	Crusader	Colleague	Leader	Collaborator

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behavioural aspects of statistics and using organisational development techniques are the greatest opportunities and challenges facing statisticians today'.

Unfortunately, many statisticians appear not to be equipped with the skills required to be effective in industry. Hoerl *et al.* (1993) give as most important reasons:

- a broad set of values, attitudes and behaviours that do not support industrial needs;
- a reward and recognition system that reinforces these values;
- an inward focus on the profession;
- a lack of emphasis on the fundamental role of statistics and its use in the scientific method;
- a consuming focus on tools and methods rather than the use of statistics in a systematic approach to solving problems and making improvements.

The authors recommend a set of non-statistical skills:

- solid grounding in the fundamentals of modern quality principles;
- basic understanding of the economic and technical issues of the business;
- knowledge of the field of organisational effectiveness;
- consulting and training skills.

They also give advice on the necessary statistical skills to survive, as well as suggestions on literature to acquire those skills. Related to the statistical skills, their general theme is the need to understand how to apply statistical methods to solve real problems.

In a challenging paper, Banks (1993) reinforces this theme: 'Companies must have access to PhD level statisticians internally, who may not be developing new theory, but can comfortably command the old.' Banks refers to the Japanese practice of dealing with statistical methods:

> I would guess that intelligent use of simple tools will achieve about 95% of the knowledge that could be obtained through more sophisticated techniques, at much smaller cost. Also the simple tools can be applied more quickly to all problems, whereas the complex tools are unlikely to be ubiquitously used.

His recommendations for industrial statisticians are more or less the same as those of Hoerl *et al.* He also compares industrial statistics with academic statistics, and notes that the greatest gulf of all between the two is one of respect. He noticed that some academic statisticians regard most industrial statisticians as those who were not good enough to succeed at a university, while applied statisticians are often

openly sceptical of academics' practicality. He fears that these divisions cannot be repaired easily, but hopes that universities design curricula that take better account of the needs of applied statisticians. After all, that is what the majority of their PhD and master's students will be.

In his comment on Banks's paper, Hahn describes the industrial statistician:

> Graduates suited for industry are likely to become impatient with the academic environment and slow pace of the university. High grades is *one* of the things that we, in industry, look for in candidates – but it is only one of many. We need excellent communicators (who can talk in their customer's language, rather than in statistical jargon), good listeners, hard workers, team players and fast learners. We look for people who are enthusiastic, who are willing to work simultaneously on multiple projects, who are self-confident – without being arrogant, who can rapidly diagnose a problem and see the big picture, who are willing to ask fundamental questions and challenge assumptions, who are good at selling projects and themselves, who can cope with frequent management reviews and changes of direction - and who are still cheerful at the end of the day. It is not an environment that is conductive to proving theorems – but it is hectic and exciting!

With so much attention to non-statistical skills, we might easily forget that statistics is still the core competence of a statistician. Gunter (1998) warned strongly against watered-down quality, and quality professionals without a specific set of core skills. But he blames statisticians for sticking to the 'now archaic and simplistic' control charts, while there are so many new and powerful methods: 'We have become a shockingly ingrown community of mathematical specialists with little interest in the practical applications that give real science and engineers their vitality.' Gunter observes that the computer scientist is eager to step into the breach.

Hahn and Hoerl (1998) also observe that the impact of computer science on statistics is large. The first reason for this is the accessibility of statistical software responsible for the 'democratization of statistics'. Then there is the introduction of various new approaches to data analysis (such as neural networks, fuzzy logic and data mining), often independently of the statistical community. And finally, we now have the opportunity to work with management information systems. In this world of 'statistics without statisticians' the unique value of the statistician may, according to Hahn and Hoerl, bring 'an "improvement" mindset – based on proactive avoidance of problems – to the team and the ability to take a holistic approach to problem definition and resolution, as well as our critical quantitative skills'.

Meyer, Trost and Vukovinsky, commenting on Hahn and Hoerl, pose the question whether we are facing a shortage of effective consulting statisticians:

> Our field has not been wildly successful in attracting individuals who innately have the characteristics it takes to be effective. Statisticians, as a group, tend to be introverted. It is not likely that an introvert

> can be trained to be an extrovert. Therefore, the statistical profession should step up efforts to recruit more dynamic individuals to the field. Unfortunately, there is much competition, and these individuals are likely to be attracted to fields that appear to be more exciting or have better pay.

These authors see conflicts with the theoretical rigours of the typical statistics PhD programme at universities. Many students stop at a master's degree, and others get their statistics doctorate in a more user-friendly department (such as industrial engineering).

We are aware that all the above observations are from American authors. We have a strong feeling, however, that the situation is largely the same in Europe. The perceived inward focus of the statistical community is, in our opinion, perfectly illustrated by a discussion in the Netherlands Society for Statistics on the introduction of a certification system for statisticians. Traditional statisticians felt threatened by the 'democratisation of statistics', and wished to limit the harmful influence of dabblers. We are sure that clients are well able to distinguish good from bad statisticians. Moreover, good and bad might well be defined differently by different types of statisticians. Another aspect of the inward focus of the statistical community is the reaction to new methods from outside. The denouncing in the past of the methods of Taguchi is telling. And these days many statisticians appear to dissociate themselves from the success of the Six Sigma programme of Mikel J Harry (see Harry, 1997), even though several world-class companies use it.

A closer co-operation between industry and academia would be useful in Europe as well. The gap between academic and industrial statistics exists here too. For this reason we think that it might be a good idea to recruit industrial statisticians among industrial engineering students, although this is not without problems. The founding of a consulting unit at a university, such as the Institute for Business and Industrial Statistics of the University of Amsterdam (IBIS UvA BV), is another improvement. This is certainly useful for the education of students, for research in applied statistics, for the potential for its co-workers to improve their skills, and for the industry to get expert statistical support and reap the fruits of the latest developments in the field. We deem ourselves fortunate to have the opportunity to work for IBIS UvA, and we are sure that the employer, Philips Semiconductors in Stadskanaal, of the second author during the period 1994 to 2000 has benefited from his experience. A statistician in industry can usefully coach students in research or application projects, and we believe that giving lectures for students is also very important. That the statistician needs good training and communication skills is beyond doubt; he will not succeed in his own company without them.

We totally agree with all authors who stress the need for non-statistical skills. But Gunter has a valid point when he argues that the core skills are still the basis. Otherwise it would be difficult to put the occasional hypes in the right perspective.

For example, within Philips there was a time when 'world class quality' (Bhote, 1991) was hot. The indiscriminate user would have followed the trend, disregarding the many opportunities from traditional experimental design theory. Especially in the rather complex world of semiconductors industry, this would have led to many disappointments.

Regarding statistical software, our experience is that many problems can be solved with simple tools. The statistical possibilities of (simple) programs such as MINITAB or even Excel might often suffice. In this respect we again fully agree with Banks's comments on simple tools. A statistician needs more specialised statistical software, but the ordinary person does not. The non-statistician may not understand much of the output of specialised software. There is a clear trend for enormous amounts of data to be available for analysis. This requires new methods and skills for statisticians, as Gunter, Hahn and Hoerl rightly observe. Our experience is that it is still a difficult matter to combine the relevant data from the separate databases all over the organisation. Knowledge of database management might well be a useful skill for a statistician.

We conclude this section with some remarks about the career of a statistician. We think that for many it may well be a lifetime job; however, the average industrial statistician occasionally wants new challenges. For some the ever-changing world will offer enough of these, but many (and especially those Meyer *et al.* are hinting at) will need more. We can certainly recommend a part-time job at an outside consultancy agency or university. On the other hand, being a part of a large company also offers opportunities for more or less closely related activities within the company. A truly active statistician will notice that several things can be done in all sorts of disciplines such as quality, organisation, and logistics.

References

Banks, D. (1993) Is industrial statistics out of control? (with Comments). *Statistical Science*, **8**, 356–409.

Bhote, K.R. (1991) *World Class Quality*. Amacom, New York.

Gunter, B.H. (1998) Farewell fusillade: an unvarnished opinion on the state of the quality profession. *Quality Progress*, **32**(4), 111–119.

Hahn, G. and Hoerl, R. (1998) Key challenges for statisticians in business and industry (with Discussion). *Technometrics*, **40**, 195–213.

Harry, M.J. (1997) *The Vision of Six Sigma* (5th edition), 8 volumes. Tri Star Publishing, Phoenix, AZ.

Hoerl, R.W., Hooper, J.H., Jacobs, P.J. and Lucas, J.M. (1993) Skills for industrial statisticians to survive and prosper in the emerging quality environment. *American Statistician*, **47**, 280–292.

Snee, R.D. (1991) Can statisticians meet the challenge of total quality? *Quality Progress*, **24**(1), 60–64.