

# The consulting model

**John Henstridge**

The mathematical sciences are frequently claimed to be highly applicable to business and industry. Indeed mathematical theory such as that underpinning linear programming is one example with a lasting impact and the page rank algorithm of Google[1] has enormous practical and commercial value. However there are few mathematicians in industry (and those you do find rarely go under that name).

My career path has taken me very much into industry and I still call myself a mathematician and statistician. Indeed, I market the services of myself and my colleagues at Data Analysis Australia using those titles. In writing this column I have decided to take a very personal approach and relate how I have arrived at this point.

For me it goes back a long way, to when I was doing my graduate work. Despite starting off with the intention of being a very theoretical statistician and working with Ted Hannan, an exceptionally good mathematician, I found that my talents and interests were in seeing mathematics applied. This led initially to work in computational statistics and then to a consulting role as a biometrician at The University of Western Australia. There I was regarded as being very theoretical by the biologists and very applied by the statisticians of the mathematics department. This probably meant that I got it about right.

In 1983 I left academia to join Siromath, a commercial offshoot of the then Division of Mathematics and Statistics of the CSIRO. One attraction of the move was the number of colleagues already with Siromath. It had an almost evangelical feel, with statisticians and mathematicians wanting to do something worthwhile. And it was exciting, seeing mathematics applied across many industries. The timing was right for much of the work to be statistical — good software was available and computing was becoming cheap enough to be used commercially, even if the power seems miniscule by today's standards.

It was also a time to learn about business. When I look back at it now, I see that Siromath was always struggling to learn how mathematics could be made to work in a commercially viable way. Part of this challenge was simply learning basics such as how to run an accounting system and manage people, but the more difficult aspect was adapting what was an essentially academic discipline to a business environment. It took time to understand business communication — few consulting reports are like papers — and how services should be marketed.

I left Siromath in 1987 after a change in management, and in 1988 I set up Data Analysis Australia, initially competing directly with Siromath.[2] From a very small start — myself in

[1] See Kurt. Bryan and Tanya Leise, The $25,000,000,000 Eigenvector: The Linear Algebra behind Google, Siam Review, 48, 569–581 (2006). It is rare to see the value of mathematics expressed so clearly in financial terms.

[2] Siromath collapsed financially in late 1989. The reasons were complex but one of the major issues was the difficulty in bridging the academic and business divide. Most of its employees have had successful careers since then, but I believe that I am the only one who is still doing commercial consulting.

a home office — the company has grown to about 20 employees, mostly mathematicians and statisticians. Over that time we have, sometimes by hard experience, developed a model of what seems to make commercial mathematical consulting successful.

Central to this is the recognition of the gap between the academic and commercial worlds, a gap not unique to mathematics but perhaps greater there then most other areas. The key issue is that commercial clients are naturally results oriented and mostly don't care whether the mathematics is advanced or not. Simple solutions are preferred, with 90% of the result for 20% of the effort often seen as appropriate. Once a solution is provided, often to inform a decision, clients move on. Publishing the work is low priority, even if appropriate — most work is covered by confidentiality agreements and open publishing runs counter to the commercial advantage of keeping work secret.

The staff of Data Analysis Australia

The reality is that mathematics in industry is hard work, particularly since the mathematician often has to learn enough about the application area to correctly pose the questions. In the consulting framework, this is a constant challenge since every project is potentially different — today forecasting in the justice area and tomorrow analysing benthic (bottom dwelling) communities for an environmental study of Cockburn Sound. Constant change and learning is a challenge not to everyone's liking but I believe it is of immense value. It is common for a solution first developed for one area of application to become useful in other areas.

I have consciously used the term 'mathematics' above even though many would describe most of what I do as 'statistics'. My reason is that the boundaries rapidly disappear in an application context. Problems don't respect the subtle distinctions between sub-disciplines used in academia and it is common for a project to require tools or at least thinking from several areas.

An example is a recent project on locating suburban Magistrates Courts in Perth. This had to consider locations that would be optimal in the future. The solution required demographic modelling (a relatively simple matrix model), a spatial statistical model giving the relationship between offence locations and where offenders live, a model for access to locations (actually a network model that optimised travel time) and finally an integer linear programming model for selecting optimal locations. The team included both statisticians and applied mathematicians but the work was only roughly split along those lines.

While no one denies its mathematical foundations, some of my statistician colleagues state that statistics is a subject separate from mathematics. I largely disagree with this approach. In my practical experience I have had to call upon almost everything I have learnt in mathematics, albeit often not in a formal sense. What makes statistics different is its strongly developed applicability to real problems — a set of tools that is remarkably useful and, since the advent of modern computing, highly accessible. This practical side of statistics co-exists with a strong theoretical side that is not so concerned with applications. Perhaps other areas on mathematics need to develop a similar duality.

The example above also illustrates another feature of applying mathematics — the mathematician's skills bring a logic to many problems that is quite distinctive. The mathematician can rapidly obtain 'guru status' that is surprising at first.[3] My success in the justice area means that I am now consulted on a range of quantitative issues associated with the Courts and sometimes have to take the lead on projects where I am supervising consultants from other areas such as social policy or even accounting. I strongly believe that there is no reason why mathematicians should see themselves as only having a support role — they should also lead.

My satisfaction comes from seeing clients use the results of my mathematical work, even more so when they come back with more work. This reward is not as public as publication in journals and such achievement is not often recognised by the profession.[4] But it does pay the bills and enable me to employ more mathematicians. That is the point in business. I don't just apply mathematics in industry; mathematics is my industry.

For myself, a second, but just as important source of satisfaction, is seeing the development of staff as effective and confident consultant mathematicians. In some respects this has taken me back to my academic roots since my role is often as a teacher and mentor, teaching what neither they nor I were ever taught at university. Much of this material is strongly based upon experience, such as which theoretical assumptions tend to be more important when applying a method, and what potential problems have to be checked before proceeding. But some of the material is about what is important to the clients and to the business.

This experience leads naturally to thinking about university courses. I would hate to see soft 'business mathematics' options diluting what is taught. Students need as much real mathematics as they can get. Perhaps what does need to change is the culture surrounding the courses to one that says, 'this is not just exciting, it is also really useful'. That is the culture that I try to have in my work.

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John originally studied at Flinders University and then did his PhD at The Australian National University in time series and signal processing. He is a Chartered Statistician and Fellow of the Royal Statistical Society and an Accredited Statistician of the Statistical Society of Australia. He is a past President of the Statistical Society of Australia (WA Branch) and of the Geostatistical Association of Australasia.

John's early work was in time series and statistical computing but in recent years this has broadened to cover a number of other areas relevant to consulting.

[3] I first encountered this thirty years ago when I solved a major problem in the Western Australian egg industry by pointing out that, with inflation constant, absolute differences in prices lead to declining relative differences. This had led to an oversupply of small eggs because it was financially sensible for producers to produce them. My presentation of this led one member of the Egg Marketing Board to say that 'in his thirty years of working in the industry he had never heard anyone talk with such understanding and knowledge of the industry' as I did. I was too inexperienced to realise that I should have been charging them ten times as much as I was!

[4] A partial exception is the accreditation of the Statistical Society of Australia that focuses exclusively on applied work and evaluates non-published reports, giving them comparable weighting to published work.