ROYAL STATISTICAL SOCIETY

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Review into Knowledge Exchange in the Mathematical Sciences: Royal Statistical Society response to Call for Evidence

The Royal Statistical Society (RSS) is a learned society and professional body for statisticians and data analysts, with almost 8000 members worldwide. As a charity, we advocate the key role of statistics and data in society, and we work to ensure that policy formulation and decision-making are informed by evidence for the public good. Our response has been informed by our Academic Affairs Advisory Group.

Our response provides our views on Knowledge Exchange in the Mathematical Sciences from the viewpoint of Statistical Science in the UK. The Knowledge Exchange culture in Statistical Science is extensive, deep-rooted and long-standing. It is well-recognized that application areas benefit hugely from Statistics, but also the lifeblood of Statistical Science is the constant flow of interesting problems that arise from an enormously wide range of domains. The strength and breadth of the statistics/applications interface was nicely summarized by the eminent statistician, John Tukey who said, “The best thing about being a statistician, is that you get to play in everyone’s backyard.”

Two key components of knowledge exchange in the mathematical sciences are people and dissemination routes. The dissemination routes are many, but include person-person communication; papers, reports and patents; software; networks; conferences, workshops and seminars; and social media. Knowledge Exchange in Statistical Science benefits from funding from a wide range of organizations, ranging from industrial groups (e.g. statistical centres in large multinational energy companies, or statistical learning research in data-centric companies, financial statistics within banks), to support from almost every UK Research Council (e.g. obviously EPSRC, but, overall, more so from the other Research Councils. For example, the Medical Research Council’s Biostatistics Unit, extensive initiatives in public health, health informatics; multidisciplinary grants with stakeholder partners, such as with the Environment Agency, Scottish Environment Protection Agency, examples such as the NERC GloboLakes programme; quantitative and statistical research funded by the Economics and Social Research Council, such as in multilevel modelling, econometrics, longitudinal studies). “People” means research-level statisticians, but also knowledgeable domain specialists or `bridge’ people who frequently link statistics to a variety of domain areas. There are not enough research-level statisticians or bridge people, especially in our age where many disciplines are moving to evidence- and data-based modes of operation.

Evidence of Knowledge Exchange in the mathematical sciences is often hard to come by. However, a study of the 2014 Research Excellence Framework (Pullinger and Varley-Winter, 2017) estimated that 53% of impact case studies submitted to the Mathematics Unit of Assessment (UoA) were statistical and nearly 200 additional statistical case studies were submitted to UoAs other than Mathematics. Indeed, 75% of UoAs included impact case studies containing some statistical element.

The strength of the Knowledge Exchange culture in the Statistical Sciences arises due to the strong pull and needs of applied disciplines, the recognition of the importance of the applied user in statistical training (e.g. this experimental design arose from agricultural field trials in the 1930s, but is now being used by online advertisers to maximize revenue), and running of interaction activities such as bespoke workshops and statistical consulting activities within universities. For the latter, some universities run professional statistical consulting outfits, building links with academics as necessary; others run informal statistical consulting labs, which invite local academics to share and discuss “data problems”. Some Universities (e.g. UCL, Bristol and others) have formalized the latter, employing generic data scientists who serve any academic as “Data Science Support”, in the same manner as IT support. We believe that this practice should be rolled out across the UK, and could be facilitated by UKRI. Many Centres for Doctoral Training are closely aligned with several industrial partners. All of this is seen as desirable, welcome and necessary.

For Knowledge Science in the Statistical Sciences the key problem is one of people in an age when data-driven technologies and industries are growing at a furious rate. (Many UK corporations are developing their own data science centres, for example). There are not enough people being produced at the highly skilled PhD-level or at the level of PhD plus some postdoctoral experience. The same problem applies to top level academics who train such PhDs, but also provide repositories of cutting-edge knowledge to exchange with users in application areas including industry. As such, the UK is lagging far behind our international competitors in the vital data-driven industries of the future. Far behind. This is problem shared with our colleagues more widely in the mathematical sciences. Our view is that those responsible for coordinating and funding research training in the statistical sciences in the UK have been slow off the mark and not put in place adequate initiatives to seize the opportunity afforded by the data revolution. There has been an increase in Centres for Doctoral Training in Statistics, for example, but not enough compared to the massive pull of international data science. Other PhD funding schemes, e.g. the EPSRC Doctoral Training Partnership, appear to have inadvertently shrunk the number of studentships, due to harmonizing of funding rules across disciplines, which do not take the geographically even spread of the mathematical sciences into account. Historically, the UK produced highly trained people in Statistics at the Masters level, who were snapped up and often part-funded by industry. It is no longer clear whether any national public body in the UK has national oversight for this valuable high-level training, and withdrawal of pump-priming funding has result in the death of most of these over the years. These Masters contributed enormously to the transfer of statistical knowledge and skills to developing industrial areas, for instance, in manufacturing (process development, quality improvement) and pharmaceuticals.

A serious problem experienced by those in Statistical Science research (and in the mathematical sciences, more generally) is in the difficulty in winning research funding for multidisciplinary research and training. Research Councils UK has a protocol (“Application across Research

Councils" and the "Cross-Council Funding Agreement"). This has worked in certain cases, but overall it is perceived as awkward and has not really embedded itself in the UK research culture. Further, the Agreement seems very clunky with respect to interactions with more than two Research Councils. For example, an attractive Centre for Doctoral Training in Statistical Science might rightly involve ALL the Research Councils. Such a CDT would enhance and mimic those generalist MSc programmes of old, which were perceived as `gold-standard' research training and plugged into several application areas. A real opportunity is the advent of UK Research and Innovation (UKRI). We hope that UKRI realizes that the discipline of Statistics is something that needs to be encouraged and nurtured across the currently irrelevant boundaries and puts in place actions to resolve this issue.

References

Pullinger, R. and Varley-Winter, O. (2017) The impact of academic statistics as shown through "impact case studies" submitted to the 2014 REF. Royal Statistical Society, London.

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