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The Royal Statistical Society: Current Issues, Future Prospects

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Abstract: The Royal Statistical Society (RSS) is a thriving learned society which is about to merge with the Institute of Statisticians (IoS), a professional body. The new RSS will be both a learned and professional society of over 6,000 members and will award a professional qualification, the CStat. Apart from the problems of merger, the main issues currently facing the RSS are professionalism, education and training, and official statistics.

1. Introduction

The Royal Statistical Society (RSS) is a learned society with about 5,000 members most of whom are designated Fellows of the RSS. Its main activities are to hold meetings on topics of interest to the members, to publish journals and to express views on issues of importance in the area of statistics. The RSS Council, with the assistance of the Research Section, is responsible for organising the Ordinary Meetings, the proceedings of which are published, with the ensuing discussion, in the Society's journals. Ten Ordinary Meetings were held last session. These meetings are the flagship of the Society's activities and the discussion format, with its usually incisive comment, is now widely adopted in other statistical journals. The RSS is organised in seven sections; Business and Industrial, General Applications, Medical, Official Statistics, Research, Social Statistics and Statistical Computing. These sections organised 42 meetings last session (1990–91), some of which were joint with other learned societies.

Most of the Section meetings are held in London and, to cater better for members from outside the London region the RSS has set up 18 Local Groups, including the Highlands of Scotland and Northern Ireland, which between them organised a further 109 meetings. In addition to its Section and Local Group meetings the RSS holds several workshops and one day meetings with sessions on topics such as geodemographics, cluster analysis in chemistry and the education/practice divide. The RSS publishes three journals, JRSS Series A, B and C, and a monthly newsletter, News and Notes, and will shortly be starting the *Royal Statistical Society Lecture Note Series* in association with Oxford University Press. It also publishes reports on topical issues such as AIDS, Drug Regulation, and Official Statistics. These reports show that the RSS is still faithful to its origins which are outlined in the next section. With this level of activity the RSS is one of the most active statistical societies in the world.

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2. Some History

The Statistical Society of London was established in 1834 with the help of Adolphe Quetelet and with Charles Babbage as one of its leading founder members. Its aims were "to collect, arrange, digest and publish facts, illustrating the condition and prospects of society in its material, social and moral relations." The Society was granted a Royal charter in 1887 and was renamed The Royal Statistical Society. From the outset the RSS was a learned society, not a professional society, open to all who were interested in its aims, subject to being proposed by two Fellows. During the 19th century many Members of Parliament were Fellows of the RSS, and several prime ministers were elected as presidents. At one time Gladstone had five Fellows in his cabinet, including himself!

Between the wars, despite the development of statistical theory and methods, the main concerns of the RSS remained those of economic and social statistics. The fellowship remained constant at about a thousand. The importance of government in the collection and publication of statistics and the imperfections of much of official statistics led the RSS in 1919, at the instigation of A.L. Bowley, to propose the establishment of a Central Thinking Office of Statistics and the creation of a statistical officer class in the Civil Service, see Barnard and Plackett (1985). It was not until 1941, following an intervention by Winston Churchill, that the proposal reached fruition when the Central Statistical Office was established.

The second world war stimulated the application of the new methods of statistics and of probability theory in a large number of areas. Many good mathematicians were converted to statistics and when the war ended they joined universities and started teaching the new methods. However, the demand for qualified statisticians exceeded the supply and this led the RSS to introduce examinations for certificates and diplomas in statistics. There was opposition to this more from the Royal Economic Society and the RSS decided to abandon examinations which ended the first move towards professionalism. In 1948 the void was filled by the creation of the Association of Incorporated Statisticians, later to become the Institute of Statisticians (IoS). The IoS is a professional body and in addition to conducting examinations and awarding qualifications it validates external courses and has a code of conduct. During the 1950s and 60s both organisations flourished and the overlap in membership and activities was not a problem. By 1970, however, many institutions of higher education in the U.K. and abroad were teaching advanced courses in statistics and so the demand for professional examinations was declining.

In 1970–71 a series of informal meetings was held between the IoS and the RSS to see if a merger was feasible and practicable. Progress made was modest, and no agreed basis for a merger emerged. In 1980 a formal joint working party was set up to undertake a feasibility study for a plan of amalgamation. After a great deal of discussion an interim report appeared in March 1981 and was presented to both bodies for discussion. The general tenor of the open discussion held on this report by the RSS was favourable, as was true of the corresponding IoS meeting, but some important issues were left unresolved. Again the impetus for a merger fell away and no final report appeared.

In 1988 the merger issue was raised yet again. Some informal discussions between senior members of the Society and Institute took place which resulted in a formal joint working party being set up in early 1990. The climate of professionalism had now

changed. Fuelled in part by the impending Common Market in Europe, the need for explicit recognition of professionalism seemed more pertinent than it had been in earlier years. A window of opportunity had emerged and there was a desire to achieve a breakthrough and to raise the standing of statisticians in the U.K. by removing the previous artificial division and enabling them to speak with one voice.

This time the negotiations have been successful and both memberships have voted overwhelmingly for merger. By 1993 we should have an enlarged RSS in which the professional activities of the IoS will be merged with the learned activities of the RSS. The RSS will become both a learned and professional society with a combined membership of over 6,000. All the existing arrangements for meetings, sections and publications will remain in place and a new Professional Affairs Committee will be established. The key proposal is to award the title of Chartered Statistician (CStat) to those in the IoS with rights to this status, whilst any Fellow of the enlarged Society can also apply for such status. The award of CStat will be based on a combination of statistical education and professional experience and holders will be required to abide by a code of conduct. These are exciting changes at a time when the U.K. is going more firmly into Europe. They will help to keep U.K. statisticians in the front line and we hope will encourage European statisticians, and those from other countries, to consider the advantages of the CStat qualification.

3. Current Issues

It is clear that the major practical issue currently facing the RSS is the impending merger with the IoS. Inevitably there will be administrative problems in merging two Societies with differing substantial cultures, but the goodwill generated during the negotiations and the overwhelming support of the membership should ensure that these are surmounted. We now address some of the issues of principle that will stem from the merger and some related issues in U.K. statistics.

3.1. Professionalism

What are the requirements for a discipline to be a profession? Should statistics be a profession? In its most pejorative interpretation a profession is a trade union for legitimising the restrictive practices of the middle classes. As the porter says in Macbeth, "I had thought to have let in some of all professions that go the primrose way to the everlasting bonfire." The RSS must avoid the primrose way in its attempt to define the profession of statistics. In its broadest interpretation a profession is an occupation or vocation, especially related to some branch of learning or science. In this sense statistics is already a profession. Is there a position between these extremes that statistics should occupy?

In established professions we find their power is directly related to the extent that their activities are governed by law. Thus only medical doctors can prescribe drugs and only qualified accountants can audit the accounts of public companies; but anyone can set up a church and preach a sermon; you do not need an architect to build a house, nor do you have to be an accountant to offer advice on taxation.

Statisticians would appear to be closer to accountants than to medical doctors. The regulations for the control of clinical trials already require some input from statisticians, and if this activity were ever to become a formal auditing role then the standards and independence of these statisticians would have to be guaranteed in some

way. Codes of conduct already exist in market research and, arguably, should exist formally in the field of official statistics. The enforcement of these codes, to the extent that they refer to statistical operations, should rest with statisticians. On the other hand statistical advice is governed by judgment, especially in the interpretation of data, and the most that could be required is some evidence of professional skill through qualifications, training and experience. The IoS already requires this evidence for the award of its Fellowship (FIS) and operates a code of conduct. The RSS will be adopting these standards as a basis for the award of Chartered Statistician (CStat) status.

A distinction should be made between statistics used in scientific research, broadly interpreted, and statistics in the public domain. In the former, personal integrity and publication are usually adequate to guarantee standards. In the public domain, statistics are published to inform; they are part of the data base of a mature democracy, and they must be trusted. If professional status can help to guarantee the independence and integrity of statisticians who may occasionally be subject to external pressures then we think it a direction that should be followed.

3.2. *Education and training*

All professions in the U.K. set standards for entry. Some arrange their own entrance examinations, others accredit institutions, while still others rely on qualifications awarded by other institutions. The IoS currently runs a mixed system; it arranges its own examinations leading to the award of a diploma, and it gives exemption from all or part of its examinations for graduates with a substantial amount of statistics in their degrees. In the latter case the contents of each course are monitored and good marks are required for exemptions to be granted. The full professional qualification of FIS requires in addition evidence of the equivalent of three or four years work in some area of statistics. The award of CStat by the RSS will primarily be based on the IoS procedures.

Most professions also require some form of continuing education in order to maintain the standards of those in the profession. This is not currently required by the IoS, but it will be considered by the new Professional Affairs Committee when it is established. Possibilities include attendance at conferences, workshops, short courses, and so on. There is plenty of scope here for collaboration with other institutions which provide training, such as Eurostat, the Market Research Society and Research Councils. A Europe-wide scheme is an interesting possibility.

Degrees with a substantial amount of statistics will provide the main route to the CStat. However, changes in the school curriculum, allied to the difficulty of recruiting well qualified teachers in mathematics, have led to a lowering of the mathematical skills of those entering higher education in the U.K. The consequential changes in the advanced curriculum, compounded by the ready availability of sophisticated computer packages in statistics, has caused the content of many theoretical courses to be eroded in favour of data analysis. For many students this is beneficial, but the decline in the numbers of well trained theoretical statisticians is becoming a cause for concern. The RSS recently endorsed a proposal that some degrees in mathematics in England and Wales should be extended from three years to four years in order to produce more graduates of the required theoretical standard. At a time when some European degrees are shortening, we may see a welcome convergence in the lengths of degree courses in Europe.

The demand for mathematical skills in the

workplace has risen dramatically during the last half century, and there is widespread complaint from industry and elsewhere that standards are declining. There is little hard evidence for this and these criticisms seem to echo those of the 19th century. What we are probably observing is a selection effect with industry now recruiting from further down the skill distribution due to the competition from the service sector, including education, for the best graduates. For employers in industry, however, the decline in skills is real.

The mathematical skills used at work are of two types. The first are those of numeracy; an appreciation of quantities, of measurement, of orders of magnitude, of proportions and percentages. The second are those of problem formulation and of problem solving; the ability to apply mathematics to help solve real problems. Basically applied mathematics is much harder than pure mathematics, and it is very difficult to formulate many real problems in mathematical terms, and so the attempt to make mathematics applicable often flounders.

Statisticians are expected to be both numerate and to be able to model complex stochastic systems, but probabilistic modelling and reasoning are advanced skills, the subtleties of which are rarely appreciated. In an attempt to make school mathematics more relevant, probability has been allowed to enter the curriculum at an earlier stage. The following examples, taken from national examinations, Howson (1992), demonstrate the dangers of spurious relevance.

1. John cycles to school on average 3 days out of 5. Bill cycles to school on average 2 days out of 5. Find the probability that on a certain day they will both cycle to school.
2. If the probability of there being a drop in temperature tomorrow is 0.8 and the probability of it raining is 0.5, what is the probability of neither event happening?

The implied assumption of independence in these examples is both mathematically naive and scientifically wrong. It undermines good teaching in both areas, and instead of being relevant is misleading. For hundreds of years probability theory has been successfully taught and illustrated using urn schemes, cards and dice. The failure to recognise that modelling by analogy to these simple schemes is the basis of many areas of science, and is also the basis of much of statistical inference, leads to the use of apparently relevant but actually erroneous examples such as those above.

This lack of understanding appears at all levels of society. The following exchange in the House of Commons between three Members of Parliament, all of whom are graduates, was reproduced in the March 1992 edition of the RSS monthly newsletter, *News and Notes*, in a column headed "Forsooth!"

> **Mr Arbuthnot** (Wanstead & Woodford): The Labour Party's suggestions of a minimum wage is in itself rather obscure and bizarre. As I understand it, it is tied to the average and would therefore not only be relatively high at £3.40 but would increase as the average wage itself increased. With each increase in the average rate of pay, the minimum wage itself would have to go up and it would be forever chasing its own tail.
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> **Mr Tony Lloyd** (Stretford): Perhaps I can help the hon. Gentleman. It will be tied to the median, which is not the same as the average. It is simply a mid-point on the range and would not be affected by changes in the minimum wage.
>
> **Mr Arbuthnot:** From what I understand, even an amount tied to the median

would be affected because if the lowest wage were increased to £3.40 per hour, the median would have to rise.

Mr Tony Lloyd: I shall put the matter in simple terms. The median, the mid-point in a series of numbers such as 2,2,5,6 and 7, is defined as being the difference between 2 and 7, which is 3.5. If we alter the figures 2 and 2 to 3.5, the middle figure of 5 would remain unaltered because it is independent of the bottom figures.

Mr Arbuthnot: I do not understand the hon. Gentleman's mathematics and I slightly doubt whether he does.

Mr Matthew Carrington (Fulham): I am extremely confused. I studied mathematics for some years at school and I have not totally forgotten all of them. The median is not the mid-point between the first number and the last. It is where the largest number of items in a sample comes to, whereas the average is obviously the sample multiplied by the number of items. The hon. Member of Stretford (Mr Lloyd) is obviously extremely confused. The median has a precise mathematical definition which is absolutely right, and my hon. Friend is correct in saying that the median is bound to alter if the number at the bottom on the scale is changed. That will alter the average as well in a different way, but it is bound to alter the median. Perhaps the hon. Member for Stretford wishes to define median in a non-mathematical sense.

Mr Arbuthnot: I am grateful to my hon. Friend for sorting out at least the hon. Gentleman's mathematics with obvious skill and knowledge.

Clearly education for numeracy in the U.K. must have a higher priority! At the same time it has to be conceded many numerate individuals find difficulty in communicating to their less numerate colleagues. What is required is a national crusade to make numeracy an equal partner with literacy in the basic education of all individuals, even though specialisations will inevitably occur in tertiary education.

The RSS has taken an interest in education at all levels through its Education subcommittee, and its meetings, reports and published papers. In a recent paper Conway (1986) examined current problems in the schools and suggested that the development of statistics in schools needed to be regarded as part of the larger and urgent problem of adapting school mathematics to meet the needs of the many less exact sciences that now use it.

Some years ago Shewhart (1939) expressed a similar view:

> "The long range contribution of statistics depends not so much on getting a lot of highly trained statisticians into industry as it does on creating a statistically minded generation of physicists, chemists, engineers, and others who in any way have a hand in developing and directing the production processes of tomorrow."

Shewart's view could be extended to all areas of business, not just production.

In his presidential address Moore (1991) highlighted the suggestion by Roberts (1990) that, whilst there is considerable room for an increased role for professional statisticians in all aspects of business, the number of well-qualified professional statisticians will always be small compared with the potential applications of statistics in any business. The situation can, Roberts argues, only be eased by augmentation with 'statistically minded' individuals whose primary professional allegiance lies in other fields. These individuals would not only carry out simple statistical tasks, but also be able to spot areas where the expertise of the complete professional is required. Such persons,

Roberts suggests, should be labelled *parastatisticians*. They are not statistical assistants, but professionals in their own right who combine in their person a substantial statistical understanding. Parastatisticians would either be resource persons within an organisation, or managers with statistical capabilities that can be drawn upon in carrying out their own job. The overall aim is to facilitate the more effective use of statistical thinking within all departments of an organisation. The feasibility of the approach turns on the view that a relatively small core of well-understood statistical techniques can, in the hands of able people, provide a base for a wide range of commercial application.

The education challenges facing statisticians are the twin ones of producing enough well trained mathematical statisticians to carry out the advisory and teaching roles discussed above, whilst at the same time increasing and improving the teaching of numeracy at all levels so that industry and commerce can rise to the information challenges of the 21st century. There is, of course, room for an increased role for professional statisticians especially in education. But even though the ranks of professional statisticians may grow, as many hope, they will need to be augmented by 'statistically minded' people with primary professional allegiance to other fields, so that the numbers of statistically sophisticated people will still be small compared to the potential applications of statistics in business. This prediction demonstrates clearly the need to widen numeracy to embrace all who aim to be an educated person.

3.3. *Official statistics*

From its inception the RSS has been concerned with the statistics that describe the state of society. Now that most of these statistics are collected by government, this concern is expressed through its interest in official statistics. A high percentage of presidential addresses at the RSS are devoted, at least in part, to issues related to official statistics, and the Society's journals provide a vehicle for publication by government statisticians.

In a recent working party report, "Official Statistics: Counting with Confidence" (1991), prepared by a group of senior members of the Society, the position of the RSS was clearly stated:

"Public confidence in the objectivity and independence of the Government Statistical Service is vital to its work. It is, *inter alia*, an important factor in maintaining public co-operation and high response rates to questionnaires. Without this co-operation, the quality of official statistics will be undermined and their value diminished to both the government and the public. Additionally, public confidence in official statistics has a direct bearing on the ability of politicians to explain policy and to justify their actions. Extensive use is made of statistical evidence to this end and there are clear benefits to government, and the political process generally, if arrangements for the collection and publication of official statistics are seen to be shielded from direct political influence. If statistical information is not seen to come from an authoritative, independent source, it loses its value as a currency of public debate. Confidence in the debate itself will then be eroded. Automatic public confidence cannot be assumed; rather it has to be developed and continually nurtured."

The Working Party found no evidence of a lack of integrity among government statisticians. However, the organizational and operational framework of the Government Statistical Service was regarded as inade-

quate. Accordingly four important sets of recommendations were made.

1. *Centralization and Control:* the major activities of data definition, collection, processing, primary analysis and publication should be centralized in a Central Statistical Service. In addition, there should be small Statistics Policy Units in the major ministerial departments. The Head of the whole Service, here called the Director of Statistics, should be responsible for the operational and personnel aspects of the entire Service.
2. *Methodology:* A research unit should be established to strengthen evaluation and methodological research. There should be a continuing programme of evaluation for all the major statistical series. A programme of joint research with academic and other institutions should be set up, together with visiting appointments from home and overseas.
3. *National Statistical Commission:* An advisory National Statistical Commission is required to support the objectivity, integrity, timeliness and scope of U.K. official statistics. It should report annually to Parliament, via the sponsoring Minister.
4. *U.K. Statistics Act:* An Official Statistics Act safeguarding the autonomy and constitutional position of official statistics is in place in most western countries. Such an Act is necessary for the U.K.

The decline in public confidence in official statistics stems from several sources. Because they are decentralized, official statisticians have an unclear image both nationally and internationally and cannot speak with one voice. This led them to fail to rally adequate support in response to the Rayner review in 1980 of the Government Statistical Service (GSS), see Hoinville and Smith (1982), which was directed primarily towards limiting the range of statistics produced to those seen as essential to government and by so doing to the cutting of costs. Little consideration was given by Rayner to non-Government users and there was no discussion of the constitutional role of statistics in a democracy. This narrow view has contributed to the loss in confidence and has led to reductions in coverage and quality, the consequences of which are only now being realised.

Recently, economic statistics have been centralized in an expanded Central Statistical Office (CSO), and the CSO has become an executive agency. This move should give the CSO some of the autonomy that the RSS would like to see. However, it leaves the rest of the Government Statistical Service (GSS), some 70 per cent of the professional manpower, in a sort of limbo. How this tension will be resolved remains to be seen.

Most governments use administrative records as sources of statistical information and, for example, in the U.K. claims for benefit are the main source of unemployment statistics. When the administrative system was stable this series gave reliable measures of the changes in, and distribution of, the numbers registered as unemployed. When the system became subject to frequent changes, as during the last twelve years, this reliability disappeared, and public confidence in official statistics was seriously eroded. It was not the statisticians who had caused the changes in the administrative system, but their low profile and the lack of a strong central organisation meant that their case went unheard.

The extent to which administrative records can be relied upon to monitor performance, when the system is under the control of those being monitored, is a problem of current concern to the RSS. For example, administrative records in education and in the health service are being used to create league tables in an attempt to measure performance. The ambition is admirable, but

the failure of most performance indicators to produce systems which actually perform well is itself well known. We need criteria for determining when administrative data can be reliably employed for monitoring performance. This is another area where international collaboration would be beneficial for the setting of standards.

4. Conclusions

As we move towards 1993 the RSS is increasingly looking towards Europe for collaboration on issues of mutual interest. We have identified several such areas; professional qualifications, the provision of continuing education and training for statisticians, the exchange of ideas about statistics at schools, the content of the curriculum in higher education, the length of degree courses, the organisation of official statistics and criteria for the use of administrative data for monitoring performance. In all of these areas statisticians in the U.K. could benefit by the wisdom and experience of their colleagues in Europe. How to achieve this collaboration is not yet clear and the authors would welcome positive suggestions.

From its inception the RSS has been concerned about the statistics that describe society. The current lack of confidence in official statistics in the U.K. is a matter of concern to all statisticians; criticism of one group is criticism of us all. We have stated the Society's views and we would welcome the views of readers of *JOS*, either to correct our misunderstandings, to support our position or to suggest alternatives. In the information society of the future, statistics will become even more widely used and hence potentially abused. The criteria for employing administrative data for monitoring performance is one issue that we have identified.

The RSS is a thriving learned society which will enter a new era when it merges with the IoS and becomes both a learned and a professional society. The RSS will be awarding the professional qualification, CStat, as soon as the merger is completed and it is hoped that this qualification will become widely accepted. The best traditions of the RSS will continue with an increasing range of meetings and conferences, and the Society will remain open to all who have an interest in statistics and their application.

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