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ABSTRACT

This first evaluation in a Scottish national program of higher education quality assessment reports on evaluation of programs in the fields of economics and electrical and electronic engineering. Section 1 contains background information about legislation establishing the evaluation program, quality assessment and quality audit, the role of the Scottish Higher Education Funding Council (SHEFC), and the aims of the assessment. Section 2 outlines the SHEFC approach to quality assessment and provides a definition of quality that emphasizes fitness for purpose. This section also details the framework components which include: aims and curricula; curriculum design and review; teaching and learning environment; staff resources; learning resources; course organization; teaching a l learning practice; student support; assessment and monitoring; students' work; and output, otcomes and quality control. The assessment process, which included institutional self-evaluations and site visits, is also described. Section 3 details the 1992-93 quality assessment process. Section 4 presents the findings of that process for the two "cognate areas" of economics, and electrical and electronic engineering. Section 5 discusses the quality rewards. Section 6 briefly describes efforts and plans to evaluate the assessment process. Appendixes contain terms of reference and names of staff and assessment team members. (JB)

Scottish Higher Education
Funding Council

Annual Report on Quality Assessment in Scottish Higher Education 1992-93

November 1993

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Foreword

I have great pleasure in commending the first annual report of the Scottish Higher Education Funding Council's Quality Assessment Committee on the quality of provision in Scottish higher education.

Following its establishment in June 1992, the Council developed and implemented, following extensive consultation with the Higher Education community in Scotland, mechanisms for assessing the quality of education in funded institutions as required by statute. During the last year these mechanisms have not merely been put in place; they have already been employed to assess the quality of provision in the two *'cognate areas'* of economics, and electrical and electronic engineering.

Quality assessment yields many benefits. The published reports on provision in named institutions are a source of reliable and independent information for potential students and their advisers, and employers of graduates. They also serve to inform the funding decisions of the Council itself. The process of preparing for quality assessment has been acknowledged by many of those involved to have been a most valuable experience: it has obliged them to think carefully about their teaching and learning objectives, environment, student experience, and outputs and outcomes. This experience is enhanced by the visits by assessors to institutions.

The first report takes an overview of provision in the two cognate areas drawing attention to common problems faced within each area, and highlighting examples of best practice discovered by assessors. By helping to disseminate these examples, this report will contribute to the continuing improvement of the quality of teaching and learning throughout the sector.

Professor John Sizer
Chief Executive
Scottish Higher Education Funding Council

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1. Background

1.1 Legislation

The Scottish Higher Education Funding Council (SHEFC) was established by the *Further and Higher Education (Scotland) Act 1992.* Under the terms of this Act, the Funding Council is required to:

> *secure that provision is made for assessing the quality of education provided in institutions for whose activities they provide, or are considering providing, financial support* [para 39(a)]
>
> and
>
> *establish a committee, to be known as the 'Quality Assessment Committee', with the function of giving them advice on the discharge of their duty under paragraph (a) above and such other functions as may be conferred on the committee by the Council* [para 39(b)].

The Council agreed the membership and terms of reference for the Quality Assessment Committee (QAC) at its meeting on 8 October 1992. Details are given in Appendix 1.

1.2 Quality Assessment and Quality Audit

Quality Assessment, which is a statutory responsibility of the Funding Councils, should be distinguished from Quality Audit, which is the function of the Division of Quality Audit of the Higher Education Quality Council. This latter body has been established by the institutions of higher education themselves, and is collectively funded by them.

Quality Audit focuses on the quality control arrangements within an institution as a whole. It is therefore concerned with taking an overview of institutional structures and mechanisms for quality assurance. In the course of an audit cycle, institutions are likely to be visited only once over a period of several years. By contrast, Quality Assessment provides for external evaluation of the quality of provision of higher education in individual disciplines or 'cognate areas', through a process of scrutiny of institutional documentation and student work in each area; direct observation of teaching and facilities; interview of staff and students; and by reference to outcomes as revealed in pass rates and employment of graduates. Over the assessment cycle, institutions may be visited several times each year.

1.3 The Role of the Funding Council

The role of the Funding Council is to establish a framework within which the Quality Assessment process may operate and to support this process financially and administratively. The Letter of Guidance from the Secretary of State requires Council to take account of the results of Quality Assessment when determining its allocation of funds to institutions of higher education.

1.4 The Aims of Quality Assessment

Quality Assessment serves several purposes:

- it informs Council of the quality of teaching and learning in the full range of subjects offered by the institutions of higher education which it is responsible for funding;
- it produces reports arising from assessment visits which highlight the strengths as well as weaknesses of teaching and learning;
- it informs potential students, employers and the general public on the quality of teaching and learning in all subject areas;
- it helps to disseminate good practice observed by assessors amongst all institutions.

2. The SHEFC Approach to Quality Assessment

2.1 The Meaning of 'Quality'

" 'Quality' does not lend itself to easy or precise definition. There is general agreement, however, that in this context the quality of any activity may only be assessed in relation to the *purpose* of that activity. It is for that reason that the Council's quality assessment will be conducted always in the context of an institution's own declared aims, purposes and mission. At the level of a specialist subject-area, faculty, departmental and course aims will be relevant... but these should be consistent with, indeed contribute to the pursuit of, institutional aims." (SHEFC, *Quality Assessment: the SHEFC Approach*, QA/1, February 1993, p.2).

In the process of the first round of quality assessments, critics sometimes suggested that assessors were seeking to impose a 'hidden agenda' upon Scottish higher education. This criticism arose, in particular, in two contexts: first, that SHEFC was trying to force all courses into a narrowly vocational mould; secondly, that SHEFC would recognise only 'innovative' teaching methods as 'Excellent'. As will be clear from the above quotation, however, neither vocational orientation nor innovativeness are necessary for the SHEFC concept of quality; and they are certainly not sufficient

in themselves to merit a high rating. Their relevance for quality assessment depends wholly on the contribution which they make to the stated aims of the curriculum under review, within the context of the institutional mission.

2.2 The Quality Framework

The emphasis on quality as 'fitness for purpose' might appear to imply that it should be assessed by a comparison of results with intentions. While such comparisons are highly desirable, their use is limited in practice because of the difficulty of measuring the results of higher educational processes with any kind of precision. In view of these difficulties, a 'Quality Framework' has been devised which includes evaluation of inputs and processes as well as of outputs and outcomes.

As with other aspects of the SHEFC approach, the Quality Framework was developed after a great deal of consultation, and following a pilot programme undertaken in four institutions during the period January-March 1992, and the issue of two discussion papers by the Scottish Office Education Department in March and May 1992. Institutions were encouraged to comment on the pilot programme and on the preliminary proposals which arose from it, as published in a SHEFC Consultation Paper in August 1992, *Assessment of Quality of Provision of Education in Higher Education Institutions*. Following the responses received as a result of the consultation exercise, the Quality Framework was established as an operational definition of what is meant by 'the quality of provision of higher education'.

The Framework, as applied in the first two rounds of assessment, consists of eleven 'aspects', enumerated below. As will be seen, these incorporate a blend of outputs, processes and inputs:

Aspects

A. Aims and Curricula
B. Curriculum Design and Review
C. The Teaching and Learning Environment
D. Staff Resources
E. Learning Resources
F. Course Organisation
G. Teaching and Learning Practice
H. Student Support
J. Assessment and Monitoring
K. Students' Work
L. Output, Outcomes and Quality Control

Within each aspect, a variety of further 'elements' are defined to provide more detailed guidance as to the content of that aspect. The framework is designed to be broad enough to cover the great majority of courses; thus it includes aspects (and, *a fortiori,* elements) which are likely to be of limited relevance to any single course.

2.3 The Process of Quality Assessment

A key feature of the SHEFC approach is the notion of *peer review* within well-defined *cognate areas.* Cognate areas are distinct homogeneous subject-areas such as Economics, Civil Engineering, Chemistry or Geology; each such area would normally be assessed once within a five-year cycle. Experienced practitioners within that cognate area are recruited as 'subject assessors'. Most are drawn from academic institutions, particularly but not exclusively from Scotland; however, each team of assessors would include where relevant an assessor from outside the academic world, and representing any broader vocational and social interests likely to be served by graduates qualified in the cognate area. Of the academic assessors, the majority are nominated by the institutions themselves.

Another very important feature, on which indeed the whole process might be said to be founded, is the principle of *self-assessment.* Each institution is invited to conduct a critical evaluation of its own provision in the cognate area under review, and submit a report to Council with an overall assessment which, in 1992-93 accorded to a *three-point scale:*

- **Excellent:** satisfactory in all and outstanding in most aspects;
- **Satisfactory:** satisfactory in most aspects; overall, strengths outweigh weaknesses;
- **Unsatisfactory:** unsatisfactory in several aspects; overall, weaknesses outweigh strengths.

As a result of further discussions with the institutions during the 1992-93 assessments, it was decided that for the 1993-94 assessments a further intermediate category would be added:

- **Highly Satisfactory:** satisfactory in all aspects and with areas of particular strength.

Following the assessment visit, a summary report for the cognate area in each institution is prepared from more detailed reports submitted by individual assessors. After the factual detail in the summary reports has been confirmed by the institutions, these reports are submitted to the Quality Assessment Committee and to Council. Once approved by Council, the reports are published.

3. The 1992-93 Quality Assessment Process

The first academic year of the assessment cycle began only four months after SHEFC commenced operations, and before several of the staff in the Quality Assessment Branch had been appointed. Thus it would not have been possible to undertake a full round of assessments, and in the event only two cognate areas were included: Economics, and Electrical and Electronic Engineering. Both were assessed in the period January-March 1993.

During October, letters were sent out to Principals and Directors of all the funded institutions describing the arrangements for the 1992-93 round, inviting submissions of self-assessments and asking for nominations of subject assessors.

The self-assessments were received at the end of November and were scrutinised during December. It should be said that the self-assessment documentation varied between institutions, both in comprehensiveness of analysis as well as in the degree of care in the reference to the evidence base on which results were founded. The best documentation included statements of known weaknesses as well as strengths and gave the scrutineer ample confidence in the main findings contained within the document. On the other hand, self-assessments which made broad statements, without justification or reference to evidence supporting their claims, gave little confidence to the scrutineer.

Prior to receipt of the assessments, a commitment had been given to visit all those institutions which had assessed themselves as 'Excellent', but it had been intended only to sample those which claimed a 'Satisfactory' standard of provision. In the event, the decision was made to visit all the institutions, partly as a consequence of the high proportion claiming 'Excellent': ten out of 11 in the case of Economics, and seven out of 11 in the case of Electrical and Electronic Engineering.

In total, 13 institutions received assessment visits. Nine of these were visited for both cognate areas, two for Economics alone and two for Electrical and Electronic Engineering alone.

Lead Assessors or members of the Quality Assessment Branch made 'pre-visits' to each institution to discuss arrangements for the visit, and to alert the departments to the issues which had arisen out of the initial scrutiny of the self assessment.

The normal practice was for each visiting team to contain at least two academic members from elsewhere in Scotland, one academic from outside Scotland and a representative of external interests (details of the pool of assessors in each cognate area are given in Appendix 3). The inclusion of non-Scottish and 'industrial' assessors in the team was intended, *inter alia*, to allow for independent scrutiny of the assessment process. Another measure to the same end was to ensure as far as possible that assessors were not sent to their close neighbours. Visits in Electrical and Electronic Engineering lasted for three days, except in those establishments which took part in the pilot assessment, where visits were confined to two days. In

Economics, where departments were generally smaller and student numbers less, most visits lasted for only two days.

Before the visits took place, all assessors attended a training conference from 11-15 January 1993. The first assessment visits began on 20 January, and all visits had been completed by 12 March 1993.

The teams were very well received by staff and students involved in the assessment process. They were generally impressed by the willingness of staff to discuss the problems of their departments in an open and constructive manner.

At the end of each visit, the team discussed its findings in a closed session and reached a conclusion as to the standard attained by the department in the cognate area. During the subsequent week, each assessor wrote up a report on those aspects of provision which he or she had scrutinised: these reports were collated and a draft report sent to the institution, which was asked to comment on its factual accuracy; at this stage, the final judgement in terms of the three categories was omitted. Once those amendments which were accepted by the assessors had been incorporated in all the reports, they were sent to the Quality Assessment Committee for comment; final reports were then submitted to Council, which approved them, with minor changes of detail, on 14 May 1993. The reports were published on 14 June 1993.

4. Findings

4.1 Economics

4.1.1 Results

Of the 11 institutions which submitted self-assessments in Economics, four were classed as having 'Excellent' provision - Dundee Institute of Technology, the University of Aberdeen, the University of St Andrews and the University of Stirling - and seven as having 'Satisfactory' provision - Heriot-Watt University, Napier University and the Universities of Dundee, Edinburgh, Glasgow, Paisley and Strathclyde.

4.1.2 Curriculum

The discipline occupies territory on either side of the shifting and ill-defined boundary between business subjects and the social sciences. This was apparent from its location within the eleven institutions which submitted self-assessments: provision fell within faculties of arts and/or social sciences or social studies in six cases, in business or management schools or faculties in four cases, and in a hybrid Faculty of Information, Social and Management Sciences in one.

Vocational orientation:

Course aims were in the majority of cases consistent with the mission statements of the parent institutions. In most institutions, the emphasis was on providing a broad grounding in economics which was considered to be of benefit to graduates seeking employment in a wide range of occupations, whether in private business or commerce, or in the public sector. While it was intended that the first degree would also provide a base from which a good graduate could go on to postgraduate study in order to become a professional economist in academia or industry, departments expected that this route would be chosen by no more than a small minority, an expectation confirmed by graduate destination statistics.

In a few cases, the courses offered were aimed at more precisely-defined market niches than these comments would imply. This was signified by their titles: 'Business' Economics, 'Financial' Economics or 'Economic Policy'. The business economics courses generally required students to take some units from other disciplines (organisation theory, accounting and marketing, for example); within economics, they tended to emphasise microeconomics units, although not to the exclusion of macroeconomics. 'European' economics was being vigorously developed in some institutions.

Flexibility:

Even where courses were not focused in this way, it was usually still possible for students to construct their own more specialised programme by judicious selection of options. Several departments emphasised the merits of such flexibility. In the traditional universities, further flexibility was provided by the opportunity to opt for a 'joint honours' programme which often permitted economics to be combined with a second major subject drawn from a very wide variety of disciplines. Several institutions had embraced modularisation, sometimes (but not always) associated with a move to a semester system; some had introduced a Credit Accumulation and Transfer Scheme.

As well as flexibility in content, some institutions offered flexibility in mode of study. At the University of Aberdeen, economists contributed to an access course by distance learning covering centres in the north and east of Scotland: this involved tutorial sessions conducted through interactive broadcasts. Napier University operated a part-time degree scheme in Business Economics which was undertaken in the evenings.

There was no evidence of formal articulation agreements with the further education sector, presumably because no FE colleges offer sub-degree qualifications in the cognate area. However, some institutions did provide sub-degree level exit points, including a certificate after one year of study and a diploma after two.

The problem of quantitative methods:

There was one respect, in particular, where the scope for flexibility and also for widening access was severely limited by the requirements of the discipline. Much mainstream economic analysis proceeds by formulating hypotheses mathematically,

and testing them statistically. Honours specialists are obliged to achieve a competence in mathematics and statistics which goes well beyond school leaving certificate in certain areas. Yet some students embark upon the study of economics with very limited prior mathematical knowledge, possibly without even having attained a pass at Standard Grade.

It is clear from the assessment exercise that there are no simple solutions to the cluster of problems associated with the role of mathematics in economics. The main alternatives were as follows:

- *Teaching mathematics from first year onwards to all economics specialists* vs *teaching mathematics in later years only.*

The first approach was used at Paisley, Dundee Institute, Napier and Heriot-Watt, where some attempt was made to identify economics specialists from first year; and it was also used at the University of Dundee, for all students taking the economics course. A variant was used at Edinburgh, which required all entrants to the honours programme to have passed a preliminary mathematics course at some time during the first two years. It has several disadvantages: it discourages some students, especially mature ones, from specialising in economics; it either requires separate non-mathematical courses for non-specialists, which is resource-intensive, or a mathematical input to a common course which runs the risk of being too difficult for non-specialists but not sufficiently advanced for specialists. On the other hand, to leave the mathematics teaching until the third year of the programme limits the use which can be made of maths in the third year itself, and runs the risk that not enough material may be covered.

- *Requiring all economics students to have Higher mathematics* vs *accepting all students with Standard grade or less.*

Higher maths was not required of potential economists by any of the Scottish institutions; as a result, a great deal of ground had to be covered by the less mathematically qualified, frequently in classes where there were other much more numerate students. On the other hand, to have insisted on Higher maths would have denied some potentially able economists the opportunity to specialise in economics.

- *Teaching mathematics in a separate block* vs *teaching it as part of the economics course units.*

The institution which went furthest to integrate mathematics teaching within first year economics teaching was the University of Dundee. This approach has the advantage that students are given a clearer motivation to learn mathematics, since they immediately see its economic relevance; but it is particularly difficult to implement when students have varied quantitative backgrounds.

Industrial linkages:

There was frequent evidence of personal contact between individual staff and outside organisations for purposes of research or consultancy, whether in industry, commerce or public administration. Formal linkages to encourage systematic external input into course design and review were much rarer. Dundee Institute of Technology had an Advisory Board which served this function; in a few other cases, advice was sought from individual contacts or outside agencies at the time of course reviews, but these cases appeared to be the exception rather than the rule. The use of external lecturers at key points to illuminate the relevance of course material was also quite infrequent.

Transferable skills:

The successful study of economics necessarily involves the acquisition of certain generally useful skills, which were often drawn to the attention of assessors: the power of abstraction, the practice of logically rigorous thought, the habit of critical appraisal of received ideas, the use and interpretation of statistics (with the aid of a computer where appropriate), the ability to communicate clearly. All the institutions visited could legitimately claim to be developing these skills to some extent. Some were paying more attention to such matters than others. At St Andrews, a recent innovation had been to alert first year students, in the first lecture, to the need to acquire 'six transferable skills': abstraction, analysis, numeracy, communication, criticism and teamwork. At the University of Aberdeen, in the context of the 'Enterprise in Higher Education' initiative, the department had evaluated all courses in terms of their contribution to competencies in analytical, presentational, verbal and communication skills. In these and other institutions, such skills were fostered in teaching and, less frequently, assessment: this issue is taken up again in section 4.1.4.

In terms of the use of the computer , the picture was more mixed. All institutions gave students hands-on experience in the use of statistical computer packages. There was some resistance to the suggestion that there might be a similar emphasis on practical experience of business packages, such as spreadsheets, word-processing and databases. Some departments saw this as more appropriate for business studies courses than for economics ones. As against this, assessors tended to take the view that such skills were very useful in the occupations sought by most economics graduates.

4.1.3 Environment and Resources

Physical resources:

Accommodation observed was at best very good and was never less than adequate, although in some institutions careful planning had been necessary to provide for rapidly increasing enrolments, and there was also some evidence of wear and tear caused by pressure of numbers. Teaching aids were of good quality. Computer facilities were also generally adequate for the courses taught, and in some cases of an excellent standard. Most complaints about the infrastructure, both from staff and students, focused on library facilities: significant problems were identified in seven out of 11 institutions. The complaints concerned both the seating space available at peak periods and the availability of books.

Social environment:
Student opinions on the social life of their institutions varied widely, although some spoke highly of the willingness of staff to contribute to social events. Student economics or business clubs sometimes provided a focus for a very active social life, and were also used to provide links with outside organisations; they tended, however, to undergo cycles of death and reincarnation, reflecting the enthusiasm and organisational ability of different cohorts of students.

Staff resources:
There was little evidence of slack in staff resourcing, reflecting a general increase in student-staff ratios in recent years. In some (though not all) cases, this had led to larger tutorial classes than assessors considered desirable. Staff also complained that heavier teaching loads inhibited research. Despite this complaint, most departments had managed to undertake research and related activities sufficient in both quantity and quality to support the teaching programme. In the former central institutions, where teaching loads were particularly heavy, there was less research in total, and a lower ratio of academic research to consultancy work than in the longer-established universities. However, this by itself did not adversely affect the quality of teaching; for while consultancy may do little to improve a department's research ranking, it can often provide a very useful background for teachers whose students will mostly find careers in industry, commerce or the public sector rather than within the discipline itself.

In the sector generally, staff development programmes tended to emphasise research and scholarship more than pedagogy. Nevertheless, there was evidence that more and more departments were coming to insist on some basic training in teaching methods for new staff. Unfortunately, this training was not usually extended to part-time staff or to postgraduates used as teaching assistants. In a number of cases the facilities available for lecturer training appeared to be more impressive than the use which was made of them by economists.

4.1.4 Teaching and Assessment

Most teachers used traditional methods, with a mixture of lectures and tutorials. Much of the teaching observed was thoroughly competent, and some was of a very high standard. In certain institutions, however, assessors were concerned at the heavy reliance on inexperienced part-time staff to provide tutorial backup in large first-year classes. Here, the standard of performance was of mixed quality, and might well have benefited if tutors had been more closely supervised and had been offered more training.

Some innovative forms of teaching are worthy of note. One of the most striking examples was the 'Negotiation' option at the University of Edinburgh. As well as having an imaginative subject content, this sought to develop teamwork and communication skills. In another course, also at Edinburgh, seminars took the form of debates between teams of students. At Paisley, student participation was encouraged through the extensive use of casework in certain units: the 'business' orientation of the

Paisley programme facilitated this practice. The quality of course documentation varied substantially both between and within institutions, although it could sometimes reach very high standards.

Assessment methods still relied heavily on traditional three hour examinations, which in a number of cases provided the only numerical basis for final degree categorisation. However, in some institutions much more use was made of continuous assessment. At the University of Stirling, for example, 50 per cent of the final marks came from this source.

Examples of good assessment practice which were not universal would include:

- *the use of extended honours dissertations as a major component of final assessment.*

Final honours dissertations are an excellent form of assessment since they may be used to develop a variety of skills. Depending on the nature of the project, these might include the following: structuring a plan of research; gathering information from a wide range of sources, whether literary or statistical, and whether by fieldwork or from secondary sources; understanding the use and limitations of databases; shaping a range of ideas into a coherent whole; critically evaluating a series of opposing arguments; and learning how not to lie with statistics. Some departments made the dissertation a compulsory unit of assessment for final honours, but others either left it as an option, or did not use the mark for final classification, thus reducing the incentive to take this demanding assignment seriously.

- *the assessment of oral and visual presentational skills.*

Typically, departments were reluctant to assign marks for oral and visual presentational skills in final assessment. The reason given was that such marks could not be moderated by external examiners, or by another internal. In one case (Paisley), this problem was overcome by recording presentations on videotape.

- *the assessment of group casework skills.*

A number of departments gave credit for the contribution made by individual students to group casework. One way in which this was done (Aberdeen) was by awarding marks to teams who were responsible for distributing them to individual members. This was intended to discourage 'free riders'.

- *the provision of detailed feedback on student assignments.*

Again, practice here varied very widely, often within individual departments: some lecturers covered assignments with helpful advice, while others offered no comment whatsoever other than that implied by the numerical mark itself.

4.1.5 Student Guidance and Support

As a generalisation, students in later years of their courses were content with the levels of support offered by departments, often provided informally for relatively small numbers of specialist students; indeed, students often spoke very highly of the approachability and helpfulness of staff. Problems arose chiefly in earlier years, where especially in the older universities intending economics specialists might only be a small and unidentified minority within very large classes. Some institutions had introduced effective 'mentor' or 'personal tutor' systems which operated well even in these classes; others, however, did not appear to have any adequate mechanism for dealing with students who were running into difficulties, or even for identifying such students before it was too late to rescue them.

Few student complaints were received about central support services such as Careers Advisory Services, although some departments seemed to have only tenuous links with these facilities.

4.1.6 Outcomes and Quality Control

All the institutions visited had mechanisms for quality assurance in place, although in a number of cases these were of recent origin and had not yet settled down. Departments employed a wide range of approaches to monitor their performance in relation to their objectives. Since the methods and measurements used generally contained peculiarities unique to each department, they were of rather more use in making time-series comparisons within individual departments than in making cross-section comparisons between institutions.

External Examiners' reports:
These were generally favourable, sometimes highly so. They varied widely across institutions in terms of the detail provided, but in general tended to confirm that departments were turning out the kind of graduates implied by their course objectives. Most institutions had a well-understood mechanism for ensuring that departments responded to criticisms made by their externals.

Student appraisal:
The use of student feedback questionnaires was very widespread. In one or two institutions, the results of this feedback were treated as confidential between the member of staff and the head of department, but in other cases they were made available to course committees and sometimes were even more widely publicised. Normally, action arising from criticisms was the responsibility of the head of department or course leader. Student comments were sometimes expressed less diplomatically than those of the external examiners, but the majority of ratings given for courses were quite favourable.

Success indicators:

Cohort progression rates were often difficult to calculate, particularly for those institutions in which students delayed final specialism until third year; thus they were not always routinely recorded. First year pass rates, however, were generally above 80 per cent, and several institutions had recently been successful in reducing failure in this year.

Unfortunately, in the case of graduate employment the recent trend has been less favourable. With a few exceptions, institutions recorded sharp increases in the unemployment rates for new graduates.

4.2 Electrical and Electronic Engineering

Electrical and Electronic Engineering (EEE), and Electronics in particular, has played a crucial role in the development of the Scottish and UK economy over the past twenty years and its continued development remains critical to the future prosperity of Scotland. Paramount to the success in this development is the continued supply of qualified personnel of the highest quality through the various institutions of Higher and Further Education.

The electronics sector of industry in Scotland has grown rapidly with output rising by 113% between 1983 and 1990 and now employs around 50,000 people. Scotland now produces some 14.4% of world production and electronics represents 40% of Scottish exports, 20% of Scotland's manufacturing output, 21% of Europe's semiconductor output and 35% of Europe's personal computer manufacturing output.

Within Scottish higher education, enrolments on courses in EEE increased considerably throughout the early 1980s, reaching a peak around 1985/86. Various government initiatives have aimed at raising the awareness of potential students and educationalists to the importance of engineering, science and technology to the UK economy and the manufacturing industry in particular. The most notable government support came through the Switch to Technology and Manufacturing Systems Engineering initiatives which were designed to increase the output of graduates in key technological disciplines, of which EEE was one of the most important. The Switch to Technology initiative ('Switch') was introduced in 1984-85 and operated over a three year period. The first year of the exercise saw an increase in overall enrolments, with some institutions exceeding their target figures but this trend was not uniform and in some cases reductions were experienced. By the second year of Switch enrolments had already reached their peak and then experienced a decline for the next few years. even though overall enrolments in Higher Education were increasing. All engineering courses were losing their market share, predominantly to areas like accountancy and business studies. This downward trend in enrolments appears to have halted and at worst is static and overall is rising in sympathy with general enrolments in Higher Education.

4.2.1 Results

In Electrical and Electronic Engineering, three out of 11 institutions were judged as having 'Excellent' provision - the University of Edinburgh, Heriot-Watt University and the University of Strathclyde - and the remaining eight as having 'Satisfactory' provision - the Universities of Aberdeen, Dundee, Glasgow and Paisley, Dundee Institute of Technology, Glasgow Caledonian University, Napier University and The Robert Gordon University.

4.2.2 Curriculum

The curriculum of electrical and electronic courses has undergone considerable change over the past ten years reflecting the continuing developments in the various technologies. Of particular note have been the developments in semiconductor technology processes, optoelectronics, digital communications, information processing, electrical power systems and the over-arching advance of computer-aided design techniques. The need for graduates from the various courses to meet the needs of industry has influenced the introduction of much new material, but not necessarily accompanied by a complementary reduction in the old curriculum. As a consequence the curriculum has, in general, become overcrowded. This is a phenomenon common to all branches of engineering and has been recognised as an important factor in the relatively low progression rates in many engineering courses.

One of the consequences of the rapid advance in technology is the extremely short life-time of knowledge. Industry recognises that future graduates will have to be much more flexible and adaptable to change and that a rigorous understanding of fundamentals, coupled with more general concepts is more likely to meet the needs of the future than highly specialised courses. In addition the importance of more general transferable skills, including communications, management studies and foreign languages is recognised. On the other hand the engineering curriculum is having to stand comparison with equivalent courses in member countries of the European Community and beyond; from this standpoint there is pressure to increase the overall length of courses, especially when compared with the most prestigious courses in France and Germany. The curriculum is therefore under extreme pressure from all angles at the present time, with institutions striving to produce a curriculum which is well balanced, technically and intellectually demanding, which meets the needs of industry for the foreseeable future and which appropriately qualified students find stimulating and challenging, but which at the same time is achievable by the majority in the scheduled time.

Flexibility:

The range of provision covered the broad spectrum of HND, BSc, BEng, MEng, PGD and MSc programmes offered by wide modes of attendance, including part-time, full-time and sandwich and increasingly attracting a wider spectrum of new entrants to the various programmes. Perhaps of particular significance has been the move towards a 'seamless' provision of courses brought about by much closer articulation and the introduction of modular programmes. This is particularly true of the HND/BSc but

there has also been introduced more flexibility into the 'ladders and bridges' links between BEng and BSc programmes.

A good feature of many courses has been the improved articulation between appropriate programmes allowing easy transfer between courses as well as direct entry to second or even third-year level. This flexibility has enabled a much closer matching of the curriculum to the needs and abilities of students.

Aims:

Specified aims of courses varied both in the manner in which they were expressed as well as in the extent to which they were clearly understood by staff and students. At their best there was a clear link between the overall mission of the institution and the objectives of the department or school and these aims were unambiguously expressed and understood by all concerned. In some cases quite laudable aims were expressed within the general mission statement but the translation of these aims into a well-reasoned *modus operandi* within the cognate area was less convincing. It was generally found that students responded more positively to their overall educational experience when there were clear goals and targets specified for their various courses.

The best examples of a well thought out curriculum were typified by a careful balance between fundamental principles, specialist technologies and the inculcation of personal and transferable skills: these features were present in particular at Heriot-Watt and Strathclyde Universities, The Robert Gordon University and the University of Edinburgh. Increasingly the demand by industry for better communication skills by graduate engineers is being addressed within the curriculum. The pressures on the curriculum, which are demanding greater breadth, the ability to adapt to fast changing technologies and at the same time to create a deep-rooted understanding of fundamental principles, are intense and they all tend to increase the demand for more, rather than less, time; these demands are happening at a time when the trend is towards shorter course lengths throughout the UK and a widening of the ability range of students entering higher education. As noted earlier, there is evidence that the engineering curriculum, within the normal time span of courses, is overfull and that the learning experience of students is necessarily affected.

Industrial linkages:

In the development of new courses the views of industry were sought through a variety of means, both informal and informal. Formal contact was invariably achieved through Industrial Advisory Committees and, in some cases, through the appointment of industrial professors; such communications were an important and invaluable component of the consultation process. In many instances, however, it was the informal and very diverse range of contacts which staff had with industrial and research employers which led to the most valuable interaction. These could be exploited with merit to a greater degree by institutions, thus widening the consultation process.

Curriculum review:

Regular curriculum review is now an accepted feature of good departmental management. The means by which this was achieved varied from highly structured and formal processes of review, which often had strong links with the institutional quality assurance systems, through to much more loosely defined processes of an *ad hoc* nature. There is no hard and fast rule on the best style of management for curriculum review; it is however essential that effective review takes place on a regular basis in order that improvements are continuous and that all changes are recorded faithfully and communicated appropriately. The best example of effective review was that at the University of Edinburgh, which had a good balance of informal and formal processes; it was the professionalism and team spirit exhibited by staff which ensured that developments took place rather than the bureaucratic systems in place.

4.2.3 Environment and Resources

Physical resources:

In most institutions accommodation for lectures, tutorials and laboratory work were well matched, in terms of appropriate size, to the requirements of the courses on offer. There was, however, a considerable variation in the general environment and ambience in which learning took place. At best accommodation and facilities were extremely impressive, with careful thought being given to design and layout, resulting in an environment highly conducive to learning, such as that at Heriot-Watt University. There were some instances where conditions were far from ideal, for example, scattered and poorly maintained annexes, drab decor to teaching accommodation, cluttered laboratory areas housing outdated equipment, departmental staff and laboratories distributed over several floors, poor student facilities and teaching accommodation which was barely adequate to house all students. These deficiencies were certainly in the minority and in general staff were fully aware of their existence.

The general standard and supply of laboratory equipment was good. The beneficial effect of funding through the Government's 'Switch to Technology' initiative was noticeable, especially in the provision of computer-aided design equipment. This initiative, particularly helpful to the old centrally-funded sector, enabled institutions to have significant pump priming in an area from which they have been able to grow significantly. The availability of and easy access to personal computer suites, equipped with appropriate word-processing, spreadsheet and database software, has become an increasingly important facility especially out of normal hours. The availability of such laboratories varied considerably between institutions.

In those institutions where research activity plays a significant role it was most encouraging to see the strong inter-link between laboratory and project work, particularly in the later years of courses, and the use of the same resources by both undergraduate and postgraduate students. Such resources could not have been justified for undergraduate provision alone; some examples of such provision being -

microelectronic circuit fabrication, optical communications, condition monitoring, underwater communications and power electronics to name only a few.

Library provision in support of EEE was in general good but there was a variation between institutions. The best had adequate study areas at peak periods coupled with flexible opening times in the evenings and weekends, a good supply of recommended books were evident on the shelves, the library was used extensively as a resource base for project work and students were encouraged to carry out their own research after an initial literature survey by library staff. There were, however, some cases where provision was considered less than ideal, and in one instance where it was considered unsatisfactory - in this latter case the institution was fully aware of the situation, which had been recognised over a considerable time, and was about to result in a new faculty provision which should overcome the problems of the past. It should be stated that all library staff consulted were most helpful and were supportive of and sympathetic to the requirements of staff and students alike.

Staff resources:

Student:staff ratios (SSRs) varied considerably between institutions. Even though there is still no precisely agreed definition of SSRs there is no disputing the fact that the observed variation between 8:1 and 16:1 is significant, the mean being around 13:1. This latter figure is a major increase compared with generally accepted figures of only five years ago and represents the trend of accepting higher enrolments on all courses in higher education. It is generally accepted by engineering academics that if the style of undergraduate teaching is to be maintained, with the present emphasis on good laboratory practice coupled with traditional lectures and tutorials, SSRs are probably as high as they can go without changing the overall format of teaching to a significant degree.

The practice of staff development needs being identified through a regular appraisal system varied considerably both in its application within an institution and in its acceptance by staff. In many cases well-structured systems have now been introduced with each member of staff undergoing appraisal by a senior colleague. At the University of Dundee a novel peer review process had been introduced whereby a member of academic staff would comment on the teaching effectiveness of a colleague. It was also pleasing to note that staff at many institutions were availing themselves on a regular basis of opportunities offered under the auspices of the institutional staff development programme. Staff reaction to appraisal has been a mixture of recognition of the potential of the process but tinged with a healthy degree of scepticism. It is of significance that the University of Glasgow has stated clearly within its aims that teaching would be rewarded equally with research for promotion purposes; the implementation of this laudable policy had still to be recognised fully by staff.

4.2.4 Teaching and Assessment

The best teaching and learning provision, such as that observed at the University of Edinburgh, was noteworthy in being very well organised at all levels but with a flexibility which encouraged both innovation and experimentation. Students were also kept well informed about their programmes of study and current progress. The University of Glasgow had developed a database, to which students had access, which gave comprehensive details of curriculum aims, content and other information contributing to all the degree programmes, a valuable tool for students when making choices on options. The effectiveness and responsiveness of the best arrangements were also due to the excellent team attitudes of staff and the fluid but informal communication links within the departmental or faculty structure. Where communications were less than ideal organisation and development tended to be fragmented or overburdened with a complex hierarchy of committees, feedback to students was also limited.

General standards of teaching within a formal lecturing situation were good but there was a considerable variation in the style and approach both within and between institutions. Lectures were generally well prepared, supplemented by effective handout material, but often lacked variety in the delivery process. In some instances students copied notes from the blackboard or via dictation with little or no interaction with the teacher; these situations were, however, in the minority. The best teaching observed resulted from a process which had been refined to remove difficulties identified by students and staff, resulting in programmes of a high level of technical quality and a breadth and depth in the skills expected of students. Particular attention was also taken to ensure a freshness in delivery. There is a general need for more attention to be given to the lecturing process as a means of transmitting new knowledge and ideas to students; in many cases the traditional 'talk and chalk' process is by far the most effective means of delivery, but lecturers should be encouraged to vary their delivery in appropriate circumstances.

The assessment of learning is a considerably more difficult task than the assessment of teaching, but in many respects is the more important and can only be realistically achieved by the lecturers themselves over a long period of time. There is evidence from research undertaken by Professor Entwistle that all engineering courses suffer from having a curriculum which is overcrowded and in consequence the learning process concentrates on the acquiring of knowledge and less on the deep understanding of fundamental, and often difficult, concepts. This was often supported by the fact that assessments were becoming an increasing element within the curriculum, especially with the move towards modularisation. Little or no emphasis has so far been placed by staff on the effective learning of students. With a general move towards a broader curriculum, the need for a greater depth of understanding and less factual knowledge should lead to a better assessment of a student's learning.

Some of the most effective teaching observed took place in laboratory or group situations:

- At the University of Edinburgh the third-year BEng students undertook a series of assignments which were purposely designed to be of an open-ended nature; the design brief of each assignment was such that the average student could complete the exercise to a minimum requirement but there was plenty of scope for the best students to be fully stretched and to go well beyond the minimum specification.

- At The Robert Gordon University group activities and inter-personal skills development play a highly significant role within the curriculum. The highlight of the BEng course is considered, by staff and students alike, to be the three-day residential course in the third year in which students are divided into small 'company' teams. For the duration of the exercise each team has the responsibility of carrying out a technical feasibility study and drawing up a business plan leading to the production of a particular product. Staff, and sometimes visiting industrialists, are present to offer professional advice but the emphasis is on teamwork. Assessment is based on the final presentations by the team and on discussions arising from the presentations.

- The University of Strathclyde has developed a series of laboratory sessions with the emphasis on group activity. Each member of the team has a particular role to play and assessment is carried out based on both individual and group activity.

- The Engineering Applications (EA) laboratories and the appointment of some dedicated EA supervisors (at a grade between technician and academic staff) has been a highly successful venture at The Robert Gordon University. The EA activity is both challenging and highly relevant to the requirements of both chartered and incorporated engineers. Students react very positively to EA which they find complements the more academic components of their courses.

- The fourth-year dissertation classes at the University of Edinburgh presented challenges to both the technical and communication skills of students in a stimulating fashion. Small groups of around five students met with a member of staff each week over a six to eight week period. A common topic is chosen for all students but each student has the task of researching a different aspect of the same topic. Each week each student in turn gives a brief presentation updating the findings of his or her researches and discussions take place with colleagues and the member of staff. At the end each student presents the outcomes resulting from the research in the form of a written dissertation.

In spite of written guidelines distributed to students at the beginning of the session, the scheduling of coursework was often the source of difficulties resulting occasionally in an uneven workload for students. In some cases this was due to unavoidable changes which had a knock-on effect to the schedule. Sometimes students were unsure of the requirement, in terms of expected time, for a particular assignment and in consequence spent too much time on completion. In general there

is a need for greater care to be given to the precise requirements for individual assignments and for more co-ordination of the overall schedule.

A most encouraging aspect of much of the teaching in those establishments with well developed research programmes was the high degree of integration between undergraduate and postgraduate studies and the use of common laboratories, especially in the final year of BEng courses. It was common for final year projects to be in fields closely related to research activities of staff and in some cases to act as a catalyst for further research work. Quite often graduates continued to work in a field related to their undergraduate project, either in the same institution or in industry.

4.2.5 Student Guidance and Support

A common feature of all institutions visited was the excellent rapport which existed between staff and students and the genuine caring attitude and interest which staff showed towards their students' education. Students were also invariably appreciative of the educational experience they were receiving. Where problems existed students would air their views in a spirit of constructive dialogue with staff, for instance through a staff/student liaison committee. This general climate of co-operation between staff and students can only auger well for any future developments.

Institutional support services, including counselling and welfare, chaplaincies, health services and careers guidance were well established in most institutions and performed an essential role in providing the necessary professional help when required. Advisors of Studies acted as the first line of contact for students within a department and often they were able to deal effectively with particular problems but where it was felt necessary referral to the relevant central service would be made. For this system to work effectively it is important that good communications are established between departmental and central services and for careful selection of academic staff to act as Advisors; this was invariably the case.

Where learning difficulties had been identified departments had developed a variety of mechanisms aimed at assisting students. Small group, tutorial/mentor schemes were a feature at some institutions, including Heriot-Watt University and the Universities of Edinburgh and Strathclyde and were having the desired effect of resolving difficulties at an early stage. Such provision is costly in terms of staff resource but is increasingly being recognised as essential at the critical early stages of courses when students are most at risk.

4.2.6 Outcomes and Quality Control

Success indicators:

There was a marked variation in the range of data collected by departments and used in the production of performance indicators. This was often a reflection of different perceptions by institutions on what performance indicators were to be used. Many departments had comprehensive data on student progression, entry qualifications, first destination of graduates and other aspects of student performance as a requirement for

the process of accreditation by the Institution of Electrical Engineers. There was, however, no consistency either at institutional or departmental level on the production or use of performance indicators as a management tool. Probably the most commonly used indicator was that of progression rate, but there was no uniformly adopted definition. The recommendations of the newly constituted Working Party on Performance Indicators are eagerly awaited in order that an agreed group of indicators may be used by all institutions and calculated on the same basis; until that stage is reached there will always be difficulties in making national comparisons.

The monitoring and recording of student progress is accepted as an essential part of good management practice: where it was carried out effectively, demonstration of improvements could be shown. In one case progression rates prior to 1990-91 were between 65 per cent and 70 per cent, after the introduction of regular monitoring the rate has now improved to over 85 per cent.

Institutional quality assurance:
Quality assurance procedures at institutional level were in a state of flux and significant developments had taken place recently. Many institutions, which hitherto had limited experience of quality assurance, had created a senior academic post specifically to develop policies and to co-ordinate quality assurance centrally; where such policies had been developed effectively their effect was being felt at departmental level. As the process proceeds the benefits, in terms of consistency of standards at all levels of the provision, should be made easier to achieve.

Student appraisal:
The importance of the use of student questionnaires as a means of providing feedback to staff was acknowledged; however, the effectiveness of such feedback was variable. Increasingly such evidence undergoes considerable analysis and staff take seriously the overall student perception of their delivery. Best practice was typified by having the results of such an analysis as a major item on the staff/student liaison committee. In many cases, however, there was little evidence that analysis of the data resulted in positive action or of the feedback loop being closed by keeping the student body informed.

5. Quality Rewards

Following publication of the results of the assessment, Council decided to reward those institutions which had achieved 'Excellent' ratings by allocating them five per cent more funded places in the cognate areas than they had previously been granted. This implied increments to grants for 1993-94 which ranged from £9,000 to £75,000. The awards are paid to the relevant funding subject groups (Social Sciences for Economics, and Engineering and Technology for Electrical and Electronic Engineering); but the Council has expressed the view that, wherever possible, institutions should in fact deploy the extra places in the cognate areas which were assessed as 'Excellent'.

6. Evaluation

On 24 June, a 'feedback' seminar was organised for staff of the Quality Assessment Branch, assessors and members of the departments which had been assessed. The purpose of this seminar was to facilitate an evaluation of the 1993-94 quality assessment exercise. The evaluation is being undertaken by an independent team led by Dr Ronald Barnett of the Institute of Education of the University of London. Dr Barnett's report is due to be submitted to the meeting of Council to be held on 12 November 1993 and will be made available to institutions shortly thereafter.

Terms of Reference and Membership of the Quality Assessment Committee

Terms of Reference:

To advise the Council on the conduct of its responsibilities for the assessment of the quality of teaching and learning in higher education institutions, and in particular:

- To maintain a general oversight of the quality assessment process.
- To advise Council on quality standards, criteria and assessment methods appropriate to higher education, taking account of the views of higher education institutions and of the development of arrangements for assessments in England and Wales.
- To advise Council on the structure and content of Council's programme of quality assessments.
- To review periodically the forms of evidence (internal documentation, performance indicators, students' work, observation of teaching etc.) used to arrive at quality assessments.
- To consider and propose, in the light of assessment findings and developments in higher education, aspects of quality meriting particular attention.
- To receive and consider reports on institutional assessments carried out on behalf of Council.
- To make recommendations to Council on the publication of institutional assessments and on the scope and coverage of published reports.
- To report annually to Council on the quality of provision in Scottish higher education, on the basis of Council's quality assessment activities.
- To consider representations from institutions and other organisations on the assessment process and advise Council accordingly.
- To advise Council on such other matters as it may from time to time refer to the Committee.

Membership:

Dr Chris Masters (Chair)	Chief Executive, Christian Salvesen PLC
Professor John Butt	Professor of Economic History, University of Strathclyde
Mrs Elaine Dunphy	Chief Librarian, The Robert Gordon University
Professor Noel Entwistle	Professor of Education, University of Edinburgh
Professor Bernard King	Principal, Dundee Institute of Technology
Mr John McClelland	UK Director of Manufacturing and Product Development, IBM UK Ltd (Council Member)
Professor James Trainer	Deputy Principal, University of Stirling
Mr David Woods	Chief Executive, Scottish Provident
Mr James Wright	Vice-Chancellor, University of Newcastle-upon-Tyne (Council Member)

Council's Assessor: Mr James Donaldson

Scottish Office Education Department Assessor: Mr Tom Kelly

Observers:

Higher Education Funding Council for England

Higher Education Funding Council for Wales

Higher Education Quality Council

Scottish Vocational Education Council

Appendix 2:

Directorate Staff 1992-93

Mr Jim Donaldson
Director of Quality Assessment

Ms Betty Stirton
Personal Secretary

Mr David Kelso
Head of Quality Assessment

Professor Gareth Owen
Senior Assistant Principal

Mr David Russell
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Professor Alistair Young
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Ms Mary Boyle
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Ms Maureen Masson
Programme Development Officer

Assessors in Economics and Electrical & Electronic Engineering

Economics:

Professor Philip Arestis, University of East London
Ms Jo Armstrong, Royal Bank of Scotland
Professor Richard Barnett, University of Ulster
Mr Fred Hay, University of Glasgow
Mr David Jenkins, Bank of Scotland
Mr Kneale Johnson, BP Exploration
Mr David Kelso, SHEFC
Professor Brian Loasby, University of Stirling
Dr Eric Rahim, University of Strathclyde
Professor David Simpson, Standard Life Assurance Co.
Dr Alan Sproull, Glasgow Caledonian University
Mr John Troy, Napier University
Professor Peter Vandome, University of Edinburgh
Mr Grahame Wright, Dundee Institute of Technology
Professor Alistair Young, SHEFC

Electrical & Electronic Engineering:

Professor Ian Chalmers, University of Strathclyde
Dr Thomas Crawford, Hewlett Packard
Professor Norman Deans, Robert Gordon University
Mr James Henderson, NCR (Manufacturing) Ltd
Dr Oliver Hinton, University of Newcastle-upon-Tyne
Mr Bernard Howard, GEC Ferranti Defence Systems
Dr Barry Jefferies, Dundee Institute of Technology
Professor David King, Glasgow Caledonian University
Professor Philip Mars, University of Durham
Mr Fred Moran, IBM UK Ltd
Professor Gareth Owen, SHEFC
Mr Les Paton, IBM UK Ltd
Professor James Penman, University of Aberdeen
Professor John Robertson, University of Edinburgh
Professor Aeneas Rosie, University of Strathclyde
Mr David Russell, SHEFC