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Stubkjær, Erik

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RESTRUCTURING OF THE STUDY PROGRAMMES IN GEODETIC ENGINEERING

Erik Stubkjær

Aalborg University
Department of Development and Planning

Summary

Restructuring of the university education of geodetic engineering is needed occasionally, due to changes of the society and the applied technology. A discussion of restructuring methods takes its point of departure in the recent discussion on quality management of university education. Reference is made to British and Danish practices, and to the methods applied in the PHARE/TEMPUS Project 'Improved education on environment and infrastructure'.

Keywords: university education, quality management, geodetic engineering, land surveying, development methods.

1. The Need of Methods for Developing Study Programmes

During the 1970s and '80s a growing proportion of the youth went to universities to have an academic education. The rising cost of university teaching triggered concern of the cost-effectiveness of the teaching activity. This concern was motivated as well by an emerging demand that education at large should contribute to economic growth. From the 1980s several OECD countries installed governmental units in order to audit the quality of university teaching (OECD, 1987), the EC Council issued a statement on quality assessment of higher education (O.J. 12.12.91; 91/ C 321/02), and the quality issue was addressed by journals of engineering (e.g. Hedberg & Riis, 1994), and of higher education, see (Stubkjær, 1992) for references.

The growing concern for quality issues was followed by an emerging specification of quality criteria in the field of university education. A definition of quality reads 'the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs' (British Standard BS 4778). Quality, in this context, does not refer to excellence, rather it means that which is necessary and sufficient to meet the needs of the client (Dale, 1993). The stated or implied needs thus refer to a customer or client, but who is the client of university education: The student? or the ministry who finances the business? or others? These questions were addressed explicitly by (Morgan, 1993) who ponders whether the 'product' is the student with added skills. This would mean "that the buyer of the service - the client - is society, either directly, as an employer, or indirectly, as an educational funding body" (Morgan, 1993: 55-56). Similarly, (Lindström, 1994: 256) regards "the labour market which has a continuous need for educated people" as the (prime) customer of university

services. Graduate and postgraduate research activities, and commissioned research points to the parts of the labour market concerned. Besides the labour market, Lindström refers to society in the wider sense: the international research community, the spokes people of interest organisations, and political bodies, but, also, to "those individuals among the general public who need new knowledge". Reported practices of

- consulting local industry about their needs and their views of a course
- the establishment of industry liaison groups (Dale, 1993: 43).
- course reviews by professional bodies concerned with the exempting status of various degrees (Morgan, 1993: 58)

support the position that the society is the main client of university education. Consequently, the needs of the society deserves special concern when quality criteria for university education are stated.

The needs of society may be established at the national level, or for larger regions, say the European Union. For example, a Swedish investigation into the quality of programmes of mechanical engineering called for an "Internationally recognized curricula ... emphasizing the essential skills of a graduate engineer" (Hjalmered & Lumsden, 1994: 324). The duration and the costs which are needed to establish such-recognized curricula, and the lack of flexibility it imposes on the institutions involved tend to favour a more local approach. Alternatively, minimal requirements can be set, as it was done in an international (European) programme review (Vroeijenstijn, 1994). However, investigations of existing university programmes does not answer the question of the needs of society directly; rather, the investigations may reveal the needs which were taken into account at the most recent revision of the programmes. Therefor, it is of interest to identify the methods which are used in different countries to record the needs of society, in order to state objectivized needs, and to compare the methods and/or apply them in other countries.

When the needs of society have been established many other quality criteria apply, e.g. regarding the pedagogical methods used for presentation of material, the structuring and sequencing of material, and the application of educational technology. It goes without saying that the appropriate inclusion of recent research in the field is a quality criteria in its own right. Several of these aspects are treated by (Laurillard, 1993). These aspects are, however, not covered in the remainder of the paper which addresses methods for taking the changing needs of society into account (section 2), and the methods which were considered and used in an ongoing Phare/TEMPUS Joint European Project (section 3). The role of Mission Statements in the context of programme restructuring is discussed in section 4. A conclusion closes the paper.

2. Reflecting the Changing Needs of Society into the Study Programme

Technology changes, and so does the political attitudes, e.g. regarding the ownership of land, environmental protection, and instruments for regulation of economic activities. The relation between societal needs and university programmes has, therefor, to be reviewed every 5 - 10 years, or monitored on a regular basis. The following describes diverse methods, drawing largely from Danish experiences.

Methods related to the study programme

The study programme may by its internal structure support interaction between societal needs and educational content: *M.Sc. and Diploma work* generally relate recent research to societal needs, and/or earning opportunities. Whether these activities influence the study programme at large may depend on the circumstances. More effectively, however, *Student project work* based on student groups is likely to bring the needs of the changing society

more directly into the university education, because the students are motivated by their job opportunities to bring in new issues, and not bound to existing knowledge as much as the university staff. The organisation of students in groups is effective in this respect, as the students are telling their mates about literature they have read, mutually correcting draft papers, etc. and thus to a certain extent supplements the ordinary teaching. In this way the student groups makes a social force which complements the social forces of the teaching staff.

Institutional arrangements

A *Study Board* where students de facto has a say in the continuous revision of the study programme tend to keep the education up to date. A similar function is exercised by *industry liaison boards*, or a *council of external examiners*.

Enquiries

Besides such institutional arrangements the use of ad hoc or recurrent *enquiries* serve to identify a possible mismatch between societal needs and university teaching. Two Danish examples of enquiries are mentioned.

The *Faculty of Technology and Science of Aalborg University* in 1989 performed an enquiry regarding the Engineering programmes (Kjærdsdam, 1993: 83 f). A questionnaire was sent to all who graduated from the Faculty with a degree in Engineering. The response rate was 74% (N = 339). The task was to determine, on the basis of 3 - 4 years of experience as graduated engineer,

- which knowledge and experience from the studies were being used in practice
- whether the project-centred education provided the necessary knowledge and experience for the professional practise
- whether there were difficulties, arising from the project-centred education, in the employment, and
- whether the graduates and employers were satisfied with the Aalborg engineering education.

The enquiry showed a convincing identity between the composition of knowledge and experience which was achieved and used during the studies, and which was used by the graduate engineers in their professional practice. Knowledge fields was classified into: Theoretical science, Theoretical engineering, Experimental experience, Practical knowledge, Management, Economy, Work environment, Culture and society, Environment and resources, Foreign language, and Computing. The respondent indicated whether the knowledge and experience was used: Very often, Often, Seldom, and Very seldom at the university, and as professional engineers. The investigation exposed considerable differences between the knowledge profiles which was used in industry, as a consulting engineer, and in public administration, respectively. For further detail reference is made to (Jensen & Wagner, 1990).

The *Danish Association of Chartered Surveyors* and university staff have since the 1960s conducted enquiries into the time spent by occupationally active land surveyors on main professional activities, that is on Cadastral work, Surveying and mapping, Planning and land management, and Other, respectively. The surveys were conducted as of 1967, 1977, 1987, and a survey for 1997 is in preparation. The most recent survey revealed, among others, that many land surveyors supplemented their education by courses in business management (Stubkjær, 1993 with references).

This method addresses the long term changes. The experience so far is that changes in society were to a certain extent already reflected by changes in the education when the

enquiry was completed. However, the enquiry provided objectivized reasons to remove and to introduce study elements. For example, construction of roads and sewers in residential areas was removed, and business economics was introduced.

3. Methods discussed and applied in the Study Programme on Geodetic Engineering in Slovenia

The Phare/TEMPUS project: Improved education on environment and infrastructure, 1996 - '99, addresses the programme of geodetic engineering at the Faculty of Civil and Geodetic Engineering, University of Ljubljana, Slovenia. For a general description of the project, reference is made to (Sumrada, 1997).

The project was preceded by a two months visit to the university by the author. During this visit more than 10 interviews were made. A recurring issue which was raised at interviews and discussions was the relation between the study programme of the university and the needs of the society. Persons from governmental bodies, and from public and private companies were asked to express their view on the issue. More specifically, they were asked to comment on their perception of the knowledge profile which was provided by university teaching, compared to the knowledge profile which were considered relevant for their present job. For managers the question regarded the employees with a diploma in geodesy (Dipl.Ing.Geodet) (Stubkjær, 1995).

These interviews were of an explorative nature, and not structured. They established, however, firm evidence for the need of a more through investigation of the issue.

In the context of the TEMPUS project the following methods were considered for preparing an account of the needs of society:

Interviews and enquiries

The outcome of interviews is dependent on the selection of companies and authorities visited. More complete enquiries (in terms of population covered, and subject matters analysed) would provide for scientifically valid outcomes, but would be resource demanding as well.

Statements issued by main employers of geodetic engineers

An authority is in the position to balance the cost of further investigations against the expected benefit, and thus carry the risk of decisions made under uncertainty (Bedard, 1986). The Surveying and Mapping Authority of Slovenia (SMA) employs more than half of the total number of active surveyors and, furthermore, regulates the activities of further 10-20% of the total. A statement by this major employer must be attributed considerable weight.

Analysis of actual continuing education

The concept of continuing education may be derived from a federation in the USA, 'The Council on the Continuing Education Unit'. By 1979 the Council defined a Continuing Education Unit (CEU) as ten hours of participation in an organised continuing education experience under the responsible sponsorship, capable direction and qualified instruction (Rouch, 1993). The International Federation of Surveyors (FIG) prefer the term 'Continuing Professional Development' which does not restrict the educational activities to formal, off-the-job courses.

An analysis of actual participation in formal, off-the-job courses provides, however, for information on educational needs. This is because such further education demands substantial resources from the staff involved, and the selection of courses, schools, etc. ... is

likely to be made with considerable care. Therefore, the outcome of such analysis brings important indication of knowledge, etc. which is relevant for the job, but not covered by the university programme.

Analysis of staff development plans

Larger companies have staff development plans, recruitment plans, etc. Such plans could be applied as an input to the restructuring of courses. If staff development plans are not at hand, it would be worth while to prepare them, taking into consideration the importance of well skilled staff. Job descriptions, e.g. prepared in the context of drafting of cadastral law could be used as well.

Analysis of advertisements of new positions for geodetic engineers, etc.

Advertisements of new positions are genuine, public, and verifiable expressions of the needs of society. According to Slovene law, all positions have to be formally announced. However, some advertisements may be tailored to fit preferred persons. The selection of the subset of advertisements which are relevant relative to the geodetic education may be complicated. Also, the interpretation of the advertisements demands broad geodetic and didactic skills.

3.1 *Applied Methods and their Main Outcome*

The resources available for the present project restricted us to consider the three former of the methods which have been outlined above. It is assumed that they cover the core activities of present-day geodetic engineers quite well. However, potential tasks for geodetic engineers in private companies which apply GIS for technical and administrative tasks are probably not covered sufficiently. Also, potential tasks regarding real property management, appraisal, etc. have yet not materialised sufficiently to be taken into account.

The SMA, together with the 'Initiative of Chamber of Surveyors', issued a statement on the tasks of future geodetic engineers, and the knowledge they ought to possess (SMA, 1996; Stubkjær, 1997, Annex4). The statement anticipates three specialisations: About 60% of all surveyors are expected to work in national and communal administrative bodies, about 30% are 'operational surveyors' executing operational tasks related to cadastre, engineering surveys, and mapping, and finally, about 10% are expected to be 'specialists'. The latter refer to persons who are active in developing new methods, e.g. in remote sensing or other professional fields.

The statement further calls for new courses in law, and in public administration procedures, and - among others - calls for a new specialisation line in real estate management, and for more particularised knowledge regarding the land cadastre.

During interviews it was realised that a substantial number of graduates (Dipl.Ing.Geodet) completed their education through formal courses. As mentioned above, such continuing education identifies knowledge which is missing in the ordinary programme. A joint effort of the SMA and TEMPUS project resulted in an analysis of educational requirements of the geodetic branch (Drobne, et al. 1997). The analysis was based on a survey of about 586 SMA employees, of which 73 had attended further formal education at work. About the half studied at the Faculty of Civil and Geodetic Engineering to advance their level, e.g. from 'engineer' to 'Dipl.Ing.Geodet', but 32% (23 persons) studied at the School of Public Administration, 6 persons studied at the Faculty of Economy, and further 6 at the Faculty of Organisational Sciences.

Without going into detail this provides clear evidence that it is the social science disciplines which are under represented in the present study programme of geodetic engineering in . The investigation, also, provides for sufficient direction as to what subject matter needs to be treated more fully. Besides providing a firm and objectivized basis for restructuring of course

content the method has, furthermore, pointed to faculties who can assist in providing teaching materials, experiences, etc. in the new subject areas.

Summarising this section it appears that a main quality criteria for university programmes is their response to societal needs. Several methods exist to assess and review the correspondence between societal needs and study programmes. The methods may be institutional arrangements, enquiries, or emerge from the study programme itself. The relative benefit of different methods are provisionally assessed. A more definitive assessment may be of little value, as the circumstances will always demand a considerable creativity in selection and application of methods.

4. Mission Statements in the Context of Programme Restructuring

Quality, as described in section 1, does not refer to excellence but to that which is necessary and sufficient to meet the needs of the client. As the clients of universities, etc. are diverse and their needs may be contradicting the institution has to state in general terms what it conceives as the needs of the clients which it decides to serve, and what it intends to provide for the client. The preparation of such mission statements differs from the methods which were mentioned in the previous section by adding the visions, values and self interest of the institution to the more or less objective records of societal needs.

The statement of mission and strategy of an institution may be difficult to relate to current activities, because of the general expressions used. To be useful for quality assessment, etc. such statements are, generally, prepared for several levels, e.g. university, faculty/department, and study programme, respectively.

The preparation of mission statements by universities seems to develop with the implementation of quality management, see (Dale, 1993: 43) for an early example. The mentioned TEMPUS project did not propose the establishment of a formal quality management system for the faculty or department concerned. Such instruments were welcomed, if not requested by the TEMPUS tender documents, but as quality management is still an emerging university practice, a more pragmatic approach was taken: The first activity of the project plan called for "a development plan for the Faculty's resources in terms of staff positions, curricula, and teaching equipment", and "an implementation plan for the above development plan".

However, the idea and purpose of mission statement was well known, e.g. at interdisciplinary study circles at the University of Ljubljana (Ceh, 1997), and in fact it was proposed during the first seminar of the project in Ljubljana, November 1996. The idea was well received by all concerned. Only one month later the Board of the Geodetic Department in a formal meeting unanimously agreed and sustained a Mission Statement, and by February 1997 the statement was accepted and approved by the Faculty of Civil and Geodetic Engineering.

At the following seminar in June 1997 it appeared that the mission statement of the Department and proposed changes of study elements were only vaguely related. It was thus agreed to prepare mission statements for every sub-unit (cathedra) of the Geodetic Department.

Summing up, you may say that an institution or unit in a mission statement expresses its unique response to selected needs of society. The preparation of mission statements has appeared to be an excellent initial activity of a major programme restructuring activity.

5. Conclusion

The extent by which a university programme reflects the needs of society is a major quality criteria. The society is, in the narrower sense, the labour market or the professional fields where the graduates will find a job. The society in the wider sense includes the funding government, and the international research community. This position is supported by evidence drawn from scientific journals and proceedings. The position does not imply that university programmes shall reflect only demand of industry. The inclusion of recent research is an example of other quality criteria.

To review the correspondence between the knowledge profile which is needed by society and the knowledge profile which is provided by university, several methods are available: Some are based on the structure of the study programme, e.g. a project-centred education. Some relies on institutional arrangements, e.g. a commission of external examiners. Finally, enquiries may be conducted, ad hoc or regularly, and more or less formal. The recording of societal needs through such methods provide the basis for preparing a mission statement. The mission statement expresses how the institution intends to answer societal needs.

Experience from an ongoing project regarding the geodetic engineering study programme in Slovenia points to an investigation of the formal continuing education of graduates as a source for valid inferences on the needs and directions for restructuring of the study programme. The preparation of mission statements has been a successful activity within the restructuring process.

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