ECONOMIC ADVANTAGES

THE FINANCIAL position of ChE's is clearly enhanced by this control on numbers that we seek. ChE services are required, persons with such skills are few, and therefore the price for such services will be high. Professional licensing by the states could protect the public against imitators. A graduate in biology can read a few books on the physiology and diseases of dogs, but state licensing protects the public against this individual unilaterally declaring himself a veterinarian and opening a pet clinic. So it could be in ChE.

As is the case with most organizational structures, attitudes, philosophies, and ambitions, the major obstacle to this (or any other) more professional orientation is our desire to make the change. Many self-proclaimed leading departments will not be interested, for they mistakenly feel that they have nothing to gain. The sleepy departments will not be interested for concerns of self-preservation, for they would see themselves going out of business. Yet we are all the healthier—just as the NFL is healthier—if we maintain only as many teams as can be supported in first-class style and be maintained at more or less comparable strengths.

How might it be done, for departments are not likely to vote themselves out of business. Certainly the advantages to the individual faculty member of consolidating two or three departments could be made compelling. The combined department would be more attractive in terms of quality of faculty, quality of facilities, and numbers and quality of students. The economics of consolidation would be attractive to state legislatures and boards of trustees, and certainly the long-term economies of scale could be used to extract short-term incentives to promote and to initially capitalize this new epiphany of ChE education. Certainly those deans who lose their ChE department would breathe a sigh of relief, for the ChE's are widely recognized as the nemesis of all deans of engineering.

Perhaps the dismal science of economics may yet push us to this more professional status but curiously from the motivation of the happenstance corollary of cost effectiveness. That would be a very positive result, but it certainly would not reflect the wisdom of the ChE community. We seem to know so much about the economies of scale; it is curious that we continue to ignore those ideas in our own business. □

Can We Limit Enrollment By Professional Society Action?

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IT IS QUITE clear that the demand for engineering graduates is difficult if not impossible to predict. User surveys have not proven successful and it seems doubtful that we will ever be able to make forecasts adequate enough for individuals, universities, industrial and government sectors to do reliable planning. Some engineers think that the answer is to limit enrollment at some number below the most pessimistic forecast and thus assure that those accepted into the profession have an opportunity to practice it. There are two ways to limit enrollment:

- **limit number of accredited colleges**
- **limit number of studnts in accredited colleges.**

The Engineers Council on Professional Development already limits the number of colleges and any discussion of this issue must consider tighter criteria for accreditation. The question of limiting the number of students has not received as much attention and this problem is considered here.

ENROLLMENT LIMITING PROCESS

FIGURE 1 ILLUSTRATES the enrollment limiting process and shows what information is needed to consider the question. The capacity by discipline of each engineering college needs to be known and the number of graduates capable of being produced in each discipline in any one year must be known. This later information depends not only upon number of students which can be graduated, but also upon raw material supply of high school or transfer students. Demand forecasts for at least four years in the future must be available for each discipline. A comparison can then be made between supply and demand and action initiated (Figure 2).

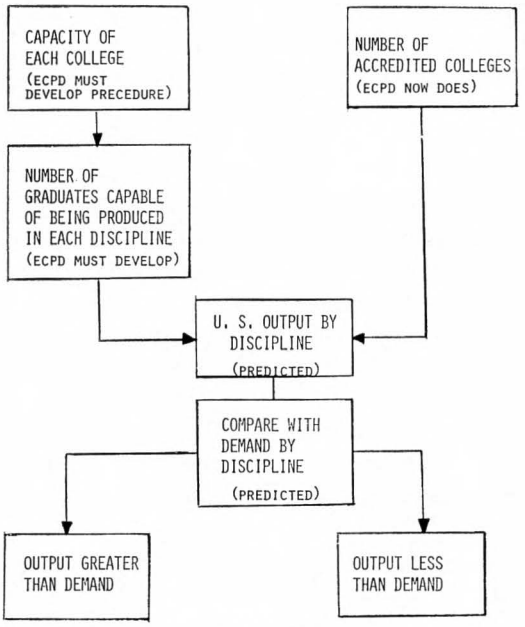

FIGURE 1.

When predicted output is greater than predicted demand and nothing is done, a cycle of over and under supply is created with very negative effects to the universities and to those employing engineers. To limit enrollment, departments or colleges must be eliminated or the number of graduating students in existing departments must be controlled.

Either course of action is difficult to carry out. There is a severe problem of time scale and it is essential to have adequate prediction at least four years in advance. This is simply not available at the present time with enough accuracy so that decisions of the sort needed can be made and enforced.

Furthermore, even if the predictions could be made with some degree of credibility, we must be able to predict the capacity of a college of engineering. This is a term used rather loosely. It is defined in different ways by different people using the word—the admissions office thinks of capacity in terms of Freshmen who can be admitted, the provost thinks of capacity in terms of the total number of students who are in the college, the dean thinks of capacity in terms of number of students in each year in each department, the professional society thinks in terms of number of graduates.

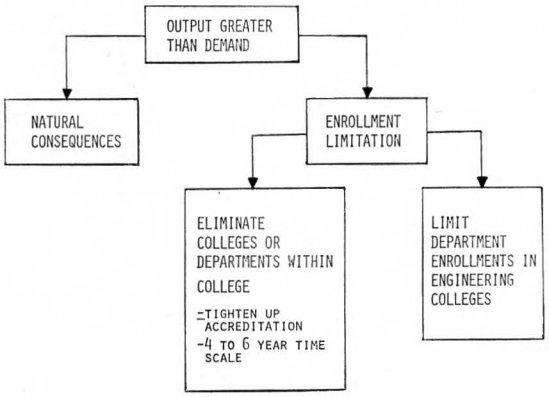

FIGURE 2.

A method of predicting department capacity for a given distribution of students by year has been proposed by Russell and Daugherty [1]. The main elements of their method are shown in Figure 3 and Table 1. It is a procedure which should assure educational quality. It first evaluates the faculty's efforts in research, curriculum development, professional society service and academic service to realistically determine the time which can be devoted to undergraduate teaching. (Faculty course capacity factor). Departments which are nationally ranked have values between 0.4 and 0.5. Departments which have values close to 1.0 are not devoting enough effort to other activities to keep their teaching up to date and effective. Using the faculty course capacity figure, the maximum number of student spaces can be computed if the negotiated work load, number of full time faculty, and number of students per course are known. The maximum number of student spaces is then modified for the inadequacies listed in Table 1. Capacity is determined in terms of distribution of students by year.

Some engineers think that the answer is to limit enrollment at some number below the most pessimistic forecast and thus assure that those accepted into the profession have an opportunity to practice it.

This capacity determination procedure has not been tested and modified by experience, a process which should take a minimum of two years. It is essential that this be done however, if the engineering profession is to consider the question of enrollment limitation.

If we suppose that adequate procedures are available to predict demand and predict capacity, the question of *how* to limit arises.

- **To limit number of departments, the ECPD must tighten accreditation standards in such a way that some number of schools will lose their accreditation. It is far from a**

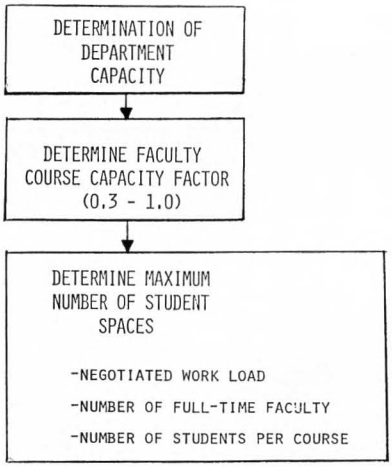

FIGURE 3.

trivial matter to decide how this should be done and almost impossible to control numbers within the time scales involved (6 and 4 year accreditations). Furthermore, what happens to those students enrolled in an institution which loses its accreditation? Many will continue and graduate.

- **To limit enrollments within departments, the ECPD must first determine capacity of each and every college it accredits. This is a task requiring a minimum of 6 to 8 years. Once capacity is known a means of prorating must be developed and each college informed of its "allowed" capacity. A means of so doing is not now available and even if this could be developed, the college or the university may not wish or may not be able to limit student numbers.**

It must be concluded that limitation of enrollment can not easily be carried out at the present time in any effective way.

WHAT SHOULD BE DONE

A means of determining capacity should be tested, modified and then formally accepted by the ECPD. This could be done by having ECPD inspection teams try out proposed procedures.

The capacity determination procedure should be made part of the ECPD inspection.

The U. S. capacity for producing engineers should be determined using the ECPD figures. This would then allow the engineering profession to better understand one part of the fundamental problem underlying over and under supply. □

TABLE 1

MODIFY MAXIMUM NUMBER OF STUDENT SPACES FOR DEFICIENCY IN

(1) Inadequate Laboratory Space
(2) Inadequate Numbers of Non-Academic Personnel
(3) Inadequate Numbers of Graduate Teaching Assistants
(4) Inadequate Capital Equipment Expenditures
(5) Inadequate Appropriations for Expenditure

Determine Capacity in Terms of Number of Students Per Year

REFERENCES

1. "Estimating Undergraduate Student Capacity of an Engineering Department", T. W. F. Russell, R. L. Daugherty and A. F. Graziano. (Submitted to Journal of Engineering Education).

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