APPENDIX H

THE ENGINEERS JOINT COUNCIL SURVEYS

AT THE end of this appendix we partially reproduce the 1953 questionnaire on demand for engineers, prepared by the Engineers Joint Council, and here discuss several important questions relating to the interpretation of the survey results.

The first major question involves the definition of the engineering universe. The EJC questionnaires are clearly intended to be restricted to forecast and realized employment, losses, and accessions of degree-holding engineers. Yet the EJC estimates of engineering employment in the United States, total and by industry, with which the engineering employment of the reporting firms and agencies is compared in order to indicate the degree of coverage of the reporting sample, clearly include nongraduate engineers. The summary of the 1952 survey estimates total engineering employment at 450,-000, and the 1953 summary estimates employment at 440,000. Although these estimates are somewhat inconsistent (more engineers were probably employed in 1953 than in 1952), they are substantially above estimates of employed college-trained engineers. Wolfle, for example, estimates the number of college graduates employed as engineers in 1953 at 361,000, 30,000 below the EJC engineering employment estimate for 1953 and 90,000 below the estimate for 1952.[1]

This uncertainty about the limits of the universe of engineers is related to the feeling on the part of the engineering societies and BLS that current estimates of the number of engineers based on 1950 census data are overstated by virtue of the inclusion of a large number of persons without engineering degrees who incorrectly claim to be engineers. An even more restricted view of the bounds of the engineering profession is implicit in the apparent assumption on the part of the EJC that new entrants to the profession are recruited solely from among new graduates. For the standard procedure in trying to assess the degree of "shortage" of engineers is to set the expected net increase in demand, derived from the EJC surveys (whose data are explicitly or implicitly expanded to cover all engineering employment), against the current number

[1] Dael Wolfle, *America's Resources of Specialized Talent*, Harper, 1954, p. 96.

of new graduates. Yet there is much evidence that even now substantial numbers enter the profession without acquiring engineering degrees (see Chapter IV). If this is true, then one clearly underestimates the current inflow of engineers by restricting the comparison to new graduates alone and overestimates any prospective "shortage" that the calculation may suggest.[2]

Another serious problem is the representativeness of the sample. The EJC summaries are concerned with this question and suggest that the respondents to the questionnaire "may have somewhat greater need for engineers than is typical in their respective industries." Any evaluation of the results of the survey is clearly dependent on this question of representativeness. It is not clear whether the Council's worries are concerned with the dominance of large companies in the sample or with the possibility that those firms which are rapidly expanding their employment of engineers are more likely to respond than firms with smaller increases in engineering staff. In any case, if the surveys are to be continued, and the substantial accuracy of the 1953 survey argues in favor of this decision, it would seem advisable to test directly the degree of representativeness of the kind of small sample the EJC typically obtains. Perhaps this could be accomplished by obtaining data on the previous year's experience alone for a larger sample of firms and government agencies and comparing growth in engineering

[2] In its report on its most recent demand study (conducted in late 1955 and early 1956) the EJC comments on this question as follows:

"In undertaking its survey of engineering demand shortly after World War II, the Special Surveys Committee of EJC decided that the most practicable basis for measuring such demand was the needs of the responding companies for engineering graduates rather than for individuals to fill engineering positions. This decision stems from the difficulty of defining engineering positions in a wide variety of organizations and the fact that in recent years individuals sought from outside an organization for work requiring engineering knowledge or skill had been very largely graduates, although comparable positions frequently are filled from within the organization by those developing such skills through experience.

"On this same basis, the responding organizations had been asked to indicate their . . . need for engineering graduates, regardless of expected assignment, recognizing that some may enter upon training for technical supervision or similar fields rather than strictly engineering work.

"The total population from which the survey sample is drawn, therefore, is the number of engineering graduates in the country, excluding those who are retired, which at the end of 1955 has been estimated as approximately 560,000 from data of the Commission on Human Resources and Advanced Training— as of 1953 and brought up to date. This compares with the total of about 675,000 individuals classified as engineers in industry, government and other activities as of the same date estimated from the 1950 census and subsequent additions and losses."

staffs for this larger group with the experience of the firms making up the EJC sample.

Finally, the meaning of the estimates of "required" increases in engineering staff is open to considerable question. It is not at all clear how the respondents interpreted the questions on "required" net accessions in the 1953 and 1954 surveys, despite the explanation in the questionnaires themselves. In view of the data shown in Table H-1, however, it appears that one of two things was happening during these years to companies' views of the "shortage" of engineers which the difference between "expected" and "required" net accessions was designed to measure. Either the deficits in required hirings were being made up rapidly, in which case the

TABLE H-1

Comparison of Expected, Required, and Realized Net Accessions of Engineers, 1952–1954

	1952		1953			1954	
	Expected	*Realized*	*Expected*	*Required*	*Realized*	*Expected*	*Required*
Constant group sample	8,118	3,416	3,085	—	3,137		
Larger sample used in detailed analysis			4,643	8,422	4,767	3,372	5,891

Source: Company and government agency reports, Engineers Joint Council surveys, 1952, 1953, and 1954.

current increase in demand for engineers was considerably smaller than was generally realized, or companies were taking a harder look at their needs for engineers and finding them substantially smaller than had been thought. The latter could have been due to more efficient use of engineers, or to conversion of nonengineering personnel to engineering work, or simply to decreasing uncertainty or concern about the "shortage" situation.[3]

Thus, the deficit in realized net hirings of engineers as compared with expected net hirings in 1952 for our constant group sample was 4,700, or about 7,000 when expanded to the size of our larger sample used in the detailed analysis of the 1953 returns. Yet the forecast deficiency in net hiring in 1953—i.e., the difference between required and expected net accessions—was only 3,800. And the difference between required net hirings and actual net hirings was only 3,600. In the next year (1954) the predicted deficiency,

[3] Ginzberg points out a similar phenomenon in 1951 and 1952 (*A Policy for Scientific and Professional Manpower,* National Manpower Council, 1953, p. 171).

i.e. the difference between expected and required net hirings, was again reduced, this time to 2,500.

In other words, either the original 1952 backlog was being reduced in 1953 and 1954 by a portion of actual hirings, in which case the current net increases in demand in these two years were smaller than would at first appear, or companies were continually revising downward their estimates of the degree of engineering shortage. Both developments probably took place.[4]

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[4] In its most recent demand study, the EJC comments:

"There is little indication . . . that engineering demand is accumulative over the years. Quite obviously, organizations have learned somehow to perform satisfactorily with undercomplements of engineering personnel. Nevertheless, and considering all factors, the data would seem to warrant the assertion that the situation would be considerably eased if the total number of engineering graduates this year were of an order of magnitude between 35,000 and 40,000.

"It should be emphasized that this situation does not necessarily have implications for the intermediate future. Looking ahead to the next three years when the size of the graduating class in engineering will average about 35,000 per year, it is pertinent to note that this increase in the size of graduating classes combined with a somewhat reduced technological momentum may have the effect of easing the present situation of extreme shortage. On the other hand, it is clear that given continuing technological activity with a growth factor similar to that of the recent past, there is very little to promise merely numerical relief during the next four years."

Please return one completed copy to: March 25, 1955
T. A. Marshall, Jr., Executive Secretary
Engineering Manpower Commission of EJC   *CONFIDENTIAL*

1953 SURVEY OF DEMAND FOR ENGINEERS

In order to obtain authoritative information concerning the needs of industry and government for engineering graduates, we would appreciate your help to the extent of furnishing the data requested below. Where exact data are not available please furnish us with your most reliable estimate. All replies will be kept strictly confidential.

QUESTIONNAIRE

I. *Requirements for Engineering Graduates*

	1952	1953
1. a. Total Number of engineering graduates in your company's employ on January 1st	_____	_____
b. Total Number of engineering graduates on military leave. (not included above)	XXXXX	_____

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	1953		
	(Actual)	(Expected)	(Required)
2. Total losses during the year through death, retirement, resignation, entry to military service, etc.	——	——	
3. Employment during the year: (See note 1)	——	——	XXXXX
a. From current classes:			
a. Bachelors	——	——	——
b. Masters	——	——	——
c. Ph. D.'s	——	——	——
Total	——	——	——
b. From earlier classes:	——	——	——
4. Number returning from Military Leave	——	——	XXXXX
5. Total net accessions (See Note 2)	——	——	——
6. Total engineering graduates in company's employ on December 31st	XXXXX	——	XXXXX

Note 1: The "Expected" and "Required" columns regarding employment are used in recognition of the apparent arbitrary downward adjustment some companies have made in recruiting goals—based on the anticipated shortage of engineering graduates. "Expected" refers to the number the company anticipates actually hiring. "Required" refers to the company needs to hire based on firm plans and commitments.

Note 2: If total net accessions for 1953 are expected to differ substantially from those of 1952, please explain briefly.