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ABSTRACT

Throughout the last decade, Ph.D. recipients were accustomed to a job market in which demand for their services far exceeded supply. During the same period, manpower experts predicted this situation would continue in the foreseeable future. However, when the 60's ended, the employment illusion had been rudely dispelled by frantic reports of a "glut" of Ph. D.'s, near hysteria at professional conventions, and anecdotal references to scientists and scholars reduced to hand-labor to earn a living. This paper presents analyses of the current situation, the causes of the current situation, and future prospects for Ph.D. candidates. (Author/HS)

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Ph.D.'s and the Marketplace *by James Harvey*

Throughout the last decade, Ph.D. recipients were accustomed to a job market in which demand for their services far exceeded supply. During the same period, manpower experts predicted this situation would continue in the foreseeable future; only Berelson [1] and Cartter [2] disputed the conventional wisdom about Ph.D. supply and demand. When the sixties ended, the employment illusion had been rudely dispelled by frantic reports of a "glut" of Ph.D.'s, near hysteria at professional conventions, and anecdotal references to scientists and scholars reduced to hand-labor to earn a living.

The Current Situation

There is no doubt that Ph.D.'s in all areas are facing the worst job market in decades. The National Science Foundation reported in July 1971 [3] that doctoral scientists were experiencing a 1.4 percent unemployment rate, compared to a 0.9 percent rate in 1970. For all scientists (including non-Ph.D.'s) the average length of unemployment was over 7 months. A similar report from the Foundation in September reported a 1.9 percent unemployment rate for doctoral engineers [4]. Citing 1970 NSF figures of Ph.D unemployment in the range of 1 percent, Falk [5, 6] notes that these rates are considerably below the national rate of unemployment, which had been in the area of 6 percent.

These averages do not indicate the problems of special groups in science. The National Research Council [7] in August reported that 1.6 percent of new Ph.D.'s in natural and social sciences, mathematics, and engineering were unemployed and that 1.2 were not using their graduate training in their employment. Postdoctoral holders leaving their positions showed higher unemployment: 2.2 percent were unemployed and 0.9 percent were not employed appropriately. An American Chemical Society study indicated that 6.1 percent of new Ph.D.'s in chemistry had not located employment shortly after receiving their degrees [8]. The NSF study [1] showed that scientists (all degrees) under 30 years of age reported an unemployment rate of 5.3 percent, and that this was the highest of any age group. Women doctorates and young Ph.D.'s may be experiencing the worst of the unemployment. Helen Astin [9] claimed that National Academy of Sciences figures demonstrated that women were being hurt more by the job shortage than men.

Nevertheless, commentators agree that the major problem with the employment picture for Ph.D.'s is not a great lack of jobs, but the fact that the available jobs do not meet the expectations of graduates, and that degree recipients have to accept virtually any job offered. Falk [5] notes that prestigious research positions are so coveted that developmental work or undergraduate teaching are regarded as demeaning. Moreover, since the scientific establishment has been accustomed to great demand for Ph.D.'s, the fact that supply has caught up with demand has produced a "trauma." Terman [10] notes that the inability of recent Ph.D. recipients to achieve their job expectations leads to disillusionment, which might be "greatest for those students who studied at the most prestigious schools, because their expectations were the highest."

Causes of Current Situation

The reasons for the job scarcity are financial: institutions of higher education have no money to hire new faculty; in the past few years federal research and development has not grown as it did in the previous decade; and industrial research programs have been cut back.

Universities, affected like other sectors of the economy by inflation, have not had the money to initiate new research programs or, in some cases, to properly maintain existing ones. It is estimated that inflation accounted for a 50 percent increase in the direct costs of academic research and development performed from 1961 to 1971 [11]. Although dollar expenditures for academic science increased in 1969 and 1970, if constant dollars, increased costs, and larger enrollments are considered, the net result is "a decline i effective support of academic science of bet rcent since fiscal year 1968." [12] The depa. most seriously affected by this net decrease were in the physical and life sciences, with physics and chemistry being particularly hard hit. The social sciences and engineering were not as seriously affected.

Adams [6] notes that when salary budgets in higher education are depressed, some disciplines that rely almost totally on academic employment are most hard pressed. In English, where well over 90 percent of the Ph.D.'s find employment at colleges and universities, the tight job market is a particular problem, according to Adams. In fact, he claims that the problems with Ph.D. employment stem *not* from overproduction of Ph.D.'s but from the inability of institutions of higher education to hire them due to financial problems:

> The real demand was there, and is there. The percentage of Ph.D.'s on the faculties of institutions of higher learning is less now than it was then; so if there was a shortage ten years ago, there is a greater shortage now. The crisis is budgetary, it's financial, and from that point of view it's quite real.

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Some support for Adams' view was provided last year by a National Association of State Universities and Land-Grant Colleges' survey indicating that the need for additional faculty was the most pressing problem [13].

Total federal research and development funds have not grown in recent years. These funds, concentrated in defense, space research and technology, and health, grew until 1968, and have actually decreased slightly since that time [14]. Since total GNP rose in this period, "relative to other types of Federal expenditures . . . research and development have experienced a significant reduction in emphasis since the mid-1960's." Again, if inflationary forces are considered, the ability to continue programs is jeopardized. This trend *may* be changing. The 1971-72 budget requests an 8 percent increase in current dollars for R&D funds; the request has yet to be acted upon and the actual constant dollar increase cannot be computed [15].

Industrial R&D spending dropped nearly 8 percent in constant dollars between 1969-70—due primarily to decreased federal expenditures—and the number of scientists and engineers employed in this sector (including non-Ph.D.'s) dropped as well [16].

T.L. Cairns [6] informed a Council of Graduate Schools' meeting that decreased industrial recruitment of new Ph.D.'s was only temporary. However, Deborah Shapley [17] felt that industrial laboratory reductions in 1971 might signal the beginning of an ominous trend of reductions of basic research in U.S. industry, since research—apparently nonproductive—would be the first area to suffer in an effort to enhance profits.

Future Prospects

There is a tendency to believe that the removal of the financial constraints in teaching and research will result in a better employment picture for Ph.D.'s. Overwhelmingly, however, with some disciplinary exceptions, the evidence does not suggest that demand for Ph.D.'s will return to the levels experienced in previous years.

The most optimistic estimates, consistently, are provided by the Bureau of Labor Statistics (BLS). BLS [18] estimates that 400,000 new doctoral degrees will be awarded between 1968 and 1980, or an average of 33,333 annually. Elsewhere in the same analysis the Bureau cites Office of Education statistics indicating that 515,000 earned doctorates will be awarded in that period:

> Despite alternative opportunities in industry and government, an increasing proportion of doctoral recipients have continued in college teaching in recent years. If trends continue, the number of new doctoral recipients entering full-time teaching would total about 275,000 between 1968 and 1980, compared with total projected needs of 205,000 and would, therefore, be adequate to meet manpower needs.

The Bureau apparently feels that the surplus Ph.D.'s will be employed in ensuring that all disciplines have adequate doctoral teaching manpower and in raising the percentages of doctorates in 4-year colleges, including predominantly Black colleges and universities.

National Science Foundation findings [19] for doctoral engineers and scientists (including the social sciences) are not so optimistic. They estimate between 315,000 to 336,000 doctoral scientists and engineers will be available in 1980, compared to between 270,000 and 297,000 positions. The most serious imbalance will be in engineering: the projected supply of doctoral engineers is 40 percent in excess of projected utilization. Lesser imbalances also exist in the other areas: the social sciences may have an oversupply of 20 percent; mathematics, 10 ent; life sciences, 9 percent; physical sciences, 8 percent. NSF warns that in each area disciplines "may differ markedly from each other as regards their supply-utilization relationship."

A number of interesting assumptions are built into the NSF study. Replacement requirements for death and retirement are based on standard Labor Department rates by age group. Ninety-five percent of new and replacement positions on graduate faculty and 62 percent of these positions on undergraduate faculties are expected to be doctorates. Doctorates employed in nonacademic R&D positions and in activities other than teaching or research are projected to increase. By 1980 R&D funding will be between 2.7 and 3.0 percent of the Gross National Product and will therefore increase in current dollars—assuming that GNP continues to grow.

> In short, about two-thirds of all science and engineering doctorates are now engaged in teaching and research in graduate schools, or are employed in nonacademic R&D positions. In contrast, slightly less than one-half of those doctorates entering employment in the 1969-80 period are projected to be in such positions. The other half are projected to be teachers of undergraduates or in non-R&D positions. . . .

Folger, Astin, and Bayer [20] see a declining need for college teachers during the 1970's, and the demand "will slow down even further in the period from 1980 to 1985 as the number of entering students declines slightly." They estimate that by 1975 fewer than one-fourth of the new doctorates would have to enter college teaching to maintain existing doctoral levels on faculties. Although more than one-fourth will be hired to improve the level of faculties, "sometime between 1975 and 1985 the demand for additional doctorates to upgrade college faculties will be satisfied in most fields, and at that point, the proportion of doctorates required for college teaching positions will decline sharply." They feel that the declining college market for faculty will be felt first in the sciences and last in the humanities.

In an excellent review of the projections for Ph.D. production, Wolfle and Kidd agree that fewer new doctorates will find teaching positions [21]. They believe that only 38 percent of the 1970-74 doctorates and 27 percent of the 1975-79 doctorates will find academic positions. "No reasonable change of assumptions predicts that the rule of thumb—50 percent of new doctorates become college and university teachers—will hold during the 1970's." Moreover, although some three-quarters of those engaged in nonacademic work have been employed in R&D, only 50 percent of these doctorates will be so engaged during the 1970's. They conclude:

> Projections of future utilization agree that the number of positions will also increase substantially during the 1970's, but not as rapidly as the number of degrees. Many new doctorates will enter nontraditional jobs and will do work that has not attracted many of their predecessors. Moreover, unless strong corrective actions are taken soon, new doctorates of the 1980's will face even bleaker prospects for jobs in the fields where they have traditionally been employed. . . . Few of them will be unemployed, but few will be employed in college and university teaching and research.

Cartter [22], one of the few analysts in the sixties who predicted the end of the college teacher shortage, expresses the most pessimism about the academic market for Ph.D.'s. He points out that during the 1980's the size of high school graduating classes will decrease in absolute numbers. The class of 1986 will be 25 percent smaller than the high school class graduating in 1979. "One need hardly emphasize . . . that a declining rate of growth for the total system implies a failing *absolute* demand for new teachers to meet the expanded enrollment." Like the preceding analysts, he concludes that employing 50 percent of new doctorates in academic positions will be impossible, and that the true figure during the 1970's will be in the area of 25 percent.

Nor is Cartter optimistic about the nonacademic job market for Ph.D.'s. He estimates that total R&D employment of scientists will grow about 5 percent annually during the 1970's. To employ surplus Ph.D.'s in nonacademic employment, he feels that a 9 percent annual growth rate would be necessary.

> Except for brief periods of time, and for some sub-specialties, we have never experienced such an overall growth rate for doctoral scientists and engineers in the past. My personal belief is that we are on a course which would result in about one-third too many Ph.D.'s produced in the latter part of this decade, and perhaps one-half too many in the 1980's, *for the types of employment we have known in the past.*

For total Ph.D.-scientist employment, Cartter predicts that a maximum of 255,000 new doctoral scientists would be required from 1970 to 1985. Noting that 1966 enrollment levels could adequately produce this many scientists, Cartter predicts Ph.D. scientist production of between 325,000 and 375,000 in the next 15 years.

> Even if all junior colleges were converted to 4-year colleges, every high school graduate went to college, and every new college teacher hired in the future possessed the Ph.D., by 1980 a smaller percentage of doctoral degree recipients would be likely to find academic positions than has been true for the preceding 25 years.

Office of Education projections [23] indicate some 500,000 Ph.D.'s being granted in the 1970-80 decade, or approximately 50,000 as an annual average. By 1977-78 the OE figures indicate that annual production will already total more than the 55,000 annually that BLS predicts for 1980. Mayhew's [24] poll of graduate institutions to determine their plans for future doctoral production indicates that by 1980 graduate departments may be producing between 60,000 to 70,000 Ph.D.'s annually, compared to 26,000 awarded in 1968-69. If such plans do become reality, it is likely that the problems with employment envisioned by these manpower analysts will increase dramatically.

Projections by Area

The greatest interest in projecting demand and utilization for Ph.D.'s has focused on the Ph.D. in science and engineering. Social sciences are occasionally included in science projections; humanities go virtually unnoticed. It is likely that this is due to the massive investment of money in technical areas and the fact that employment problems were first noticed in these areas. Very few of the projections are on a discipline-by-discipline basis; in fact, many of the studies indicate merely gross Ph.D. projections without even broadly separating the projections into areas, such as the biological or physical sciences. The existing evidence, although scant, is presented in the table below.

Potential Adjustments

Obviously no one can predict the future. The projections summarized in this review all *assume* certain rates of growth for undergraduate and graduate enrollments and levels of R&D funding. The assumptions might prove wrong; however, the overwhelming consensus is that in the decade of the seventies we will produce more Ph.D.'s than we can place in desirable jobs and the problem will grow worse in the 1980's.

Suggestions to alleviate the situation center around restricting the supply of Ph.D.'s, employment practices in higher education, and opening new employment possibilities.

Cartter [22] is most specific in terms of the supply of new Ph.D.'s. He suggests that the federal government identify perhaps 75 or 100 "national universities" and guarantee them minimum support levels for students and research. If it proves impossible to identify institutions, 50 or 75 departments in each discipline might receive such support.

Employment practices center around tenure and retirement ages. Cartter, noting that current tenure practices will hurt young faculty members most in the future, suggests that after 6 years of experience, two 3-year "moving tenure" periods be available, with a permanent position available after 12 years. He also notes that lowering the retirement age to 64 would open up new university positions at the rate of 15 percent annually.

The possibilities of opening up new fields of employment frequently mention needed research on environmental, transportation, and social problems. Terman [10] notes the obvious

Sources	Humanities	Social Science	Physical Sciences	Biological Science	Engineering	Mathematics
Bureau of Labor Statistics		Prospects in antropology, economics history are excellent; sociology, good; political science, very good; geography-favorable.	Chemists, physics, astronomers, good prospects. Good prospects for geology, geophysics, meteorology, oceanography.	Very favorable outlook for life scientists, biochemists (include medical research).		Favorable.
Folger, Astin, Bayer	1970-90 all available Ph.D's needed to fill teaching positions.	New sources of employment needed after 1975.	New sources of employment needed after 1975.	Including teaching in health professions, new sources needed between 1980-85.		Same as physical sciences.
Falk, National Science Foundation		20% excess of social science Ph.D's by 1980.	Projected excess of 8% by 1980.	Projected excess of 9 percent.	Excess of 40% by 1980.	Excess: 10%, 1980.
Cartter			Traditional jobs cannot employ supply of chemists and physicists during 70's. Worse in 80's.	Same trend as physical sciences but not as severe.		Same as biology.

difficulty with this opinion: "While there is much talk about the need [to solve social problems] such talk has not yet produced very much in the way of dollars for academic or industrial research. . . ."

There is also frequent discussion of increasing the number of Ph.D.'s on junior college faculties. However, Hansen [6] comments that junior colleges "might not want our Ph.D.'s unless they can have them at master's salaries. And they may not even want them then." Moreover, from the point of view of the current training and orientation of Ph.D.'s, junior college positions would not be desirable employment. This leads to frequent suggestions that Ph.D. training de-emphasize the attractiveness of academic and research and development positions.

Developing Institutions

One area of great concern to manpower forecasters lies in the number of institutions that began doctoral programs in the previous decade and their plans for the future. In surveying 156 universities, Mayhew found that while developed universities planned on moderate increases in graduate enrollment, developing institutions were planning substantial increases.

Other information also supports this view. *The Chronicle of Higher Education* reported that graduate applications were increasing at smaller state institutions [25]. A survey of the impact of changes in funding on colleges and universities [12] found that those institutions with less than $9 million to spend on academic science reported major increases in graduate student enrollment; those with over $10 million reported more decreases in graduate students; and those spending over $20 million consistently reported the largest decreases.

Conclusions

It is hard to argue with the overwhelming evidence that if current trends continue, too many Ph.D.'s will be produced. However, few analysts would agree that substantial unemployment of Ph.D.'s will result. Instead, it is expected that education requirements for various positions will be upgraded and the Ph.D.'s will "bump" people with master's degrees from their positions. However, if there will not be massive unemployment, the amount of underemployment—the use of Ph.D.'s in positions not allowing them to utilize their research skills—will increase. It is essential that graduate students, particularly at developing institutions, be informed of this outlook.

Ph.D. manpower is expensive to produce. To utilize it fully, federal policies to expand research and development funds in areas of pressing social concerns should be encouraged. Transportation, housing, environmental and medical problems could be investigated by using humanists, social, bio- and physical scientists, and engineers. The manpower is too valuable and the social needs too pressing to allow doctoral recipients to waste their talents in unsuitable positions.

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