The Scientist's Attitude Toward Government Employment[1]

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SHORTLY AFTER THE END OF WORLD WAR II, it became abundantly clear to most interested persons that the government would continue to be the largest single employer of scientists and engineers in the country. It was also becoming apparent at that time that an increasing problem would confront the government in recruiting and in retaining its share of the limited supply of first-rate scientists and engineers.

In part, this problem was created by the reentry of industrial research organizations, universities, and private research foundations into the employment market as strong competitors of government for scientific and technical employees. In part, also, this problem was rooted in the prevailing demobilization psychology. Many technical men wanted to turn their attention to investigations of a nonmilitary nature. Others, who had interrupted their formal education during the war, or who had given up teaching positions, wished to return to the universities. The government itself, in the abruptness of the transition to a peacetime economy, in many instances made the technical man feel that his position was insecure, or that the continuance of his particular technical work was uncertain.

Other factors, related to the unsatisfactory nature of the experience of technical people in the government, began to receive attention. The President's Scientific Research Board noted, as the result of a survey conducted among scientists and engineers throughout the country, early in 1947, that:[2]

> The generalization is widely accepted that the best research scientists are not to be found in the Government, and that it is difficult to recruit such men under the conditions prevailing in the Government service. The civil service system is criticized. It is alleged that scientific ability as such is not adequately recognized or rewarded. It is said that rewards rest on non-scientific considerations.
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> There is widespread belief that many fine scientific minds are "trapped in a blind alley" under present conditions of Government employment and advancement. It is charged that technical administrators are often promoted solely because of long service, and that this contributes to placing a premium on mediocrity. A great deal of misinformation contributes to these attitudes, but, nevertheless, they have some influence upon young scientists choosing among a variety of career opportunities.

In 1948 the Office of Naval Research, taking cognizance of the problems of recruiting able scientists and engineers, as well as of the seemingly high rate of turnover among such personnel in government laboratories, sponsored an inquiry into the attitudes of a large group who had voluntarily resigned from government laboratories. It was hoped to elicit information that would be of value to the Navy and to the government generally, both in the recruitment and retention of competent technical personnel. An additional purpose was to learn precise attitudes toward technical employment in government, so that methods for appraising morale might be devised. It was also hoped that such materials would indicate whether reactions to technical employment in Navy laboratories differed significantly from the reactions of former employees of nonmilitary government laboratories.

An eight-page questionnaire composed primarily of open-end questions dealing with both the technical and the nontechnical aspects of the individual's government employment experience was sent to a group of 673 professional scientists and engineers who had voluntarily left their government positions during the year 1948.[3] These individuals represented all the professional research men for whom addresses were available and who had resigned from seven of the largest Navy laboratories, seven of the largest nonmilitary government laboratories, and two of the larger Army laboratories. The laboratories were selected because of their size and on the basis of similarities in the types of technical persons employed, as well as for their geographic location in the field and in the Washington, D. C., area.

Of the recipients of the questionnaire 335, or 49.8 per cent, of the potential respondents made sufficiently complete and timely replies to permit their use. Considerable evidence suggests that a high degree of homogeneity existed in a number of important respects between the group that did not respond and the group

[1] A two-volume report on *Attitudes of Scientists and Engineers about their Government Employment* was prepared by the authors and released by the Maxwell Graduate School of Citizenship and Public Affairs, of Syracuse University. This research was supported by the Manpower Branch, Human Resources Division, Office of Naval Research. The material set forth in this article is based on the full report. The views expressed are the exclusive responsibility of the authors and do not represent the policies or opinions of the Navy Department.

[2] John R. Steelman. *Administration for Research,* Vol. III, of *Science and Public Policy.* Washington, D. C.: GPO, 143 (1947).

[3] The year 1948 was selected to avoid, insofar as possible, including within the study those who had entered government service during the war with no intention of remaining after the war was over.

that did, although it cannot be said conclusively that the response data are representative of the views of all 673 individuals.[4]

The respondents to the questionnaire were in the main engineers, physicists, chemists, and mathematicians. Most of them had occupied positions at grade P-5 or lower, and nearly three fourths of them were below thirty-five years of age. Practically all were college graduates, and over a third had M.S. or Ph.D. degrees. Somewhat fewer than half the respondents had had prior experience working in government laboratories before taking the positions from which they resigned in 1948. Almost a quarter of them had had prior experience working for industrial research organizations, and about an equal proportion had done professional work in university laboratories at some previous time.

Upon resigning from their government positions in 1948, 6 per cent left employment entirely; about 24 per cent returned to universities for the purpose of continuing their education; 34 per cent secured employment in private industry; and 36 per cent transferred to other government positions. If these percentages are indicative of the general situation, they suggest particularly that a third or more of the group, usually presumed to have been lost to public service, are in fact still working for the government, but in other positions.

Areas of Satisfaction and Dissatisfaction

In reply to the several questions that dealt with attitudes about their last government positions, the respondents expressed a variety of satisfactions and dissatisfactions which were found to be constantly recurrent. The repetitiveness of these elements is indicative of their major importance in the minds of the respondent scientists and engineers. The nine most frequently mentioned are discussed below in diminishing order of frequency of mention.

The nature of the questionnaire was such as purposely to bring to the fore a considerable amount of adverse criticism about government employment experience, and the remarks that follow tend to emphasize much of this. Accordingly, it is important to bear in mind that, in an evaluation of their government employment experience, 80 per cent of the respondents indicated they felt that experience had ranged from satisfactory to excellent. This suggested that for the group as a whole there was a decidedly favorable reaction to having worked in government laboratories.

Compensation and opportunities for economic advancement. The majority of respondents were dissatisfied with the compensation and the opportunities for economic advancement in their government positions. This type of dissatisfaction was most frequently cited as the principal reason for resigning. The sources of dissatisfaction were more often associated with the administration of pay schedules and the handling of promotions than with the adequacy of government pay scales. Where criticisms of the pay scales did occur, they involved the adequacy of these scales for top-level positions. One aspect of the compensation picture that received consistently favorable comment was that of the government's sick- and annual-leave policies.

A significantly larger number of individuals who had left positions in nonmilitary laboratories expressed dissatisfaction with the economic aspects of their government employment experience than did persons who left Navy laboratory jobs.[5]

Opportunities to do interesting, challenging, and important work and to have freedom in carrying on research. Most respondents were satisfied with this phase of their government employment. The criteria most often used in making an assessment of their opportunities to do interesting, challenging, and important work and to have freedom in their technical pursuits provide some insight into the nature of these concepts. The criteria may be summarized as follows:

a) The work made use of the respondent's training and job experience.

b) The work was within the field of the individual's principal interest.

c) The work was diversified and called for the use of a variety of skills and knowledge.

d) The work was considered to be important to the individual. The varied bases for assessing importance were:

1. Technical importance, meaning to the individual himself or to high-level technical personnel, or related to fundamental research or to new developmental problems.
2. Organizational utility and need.
3. Social usefulness.

e) There was a reasonable degree of individual freedom of research. This was shown most commonly to mean:

1. A role in the selection of assignments.
2. The right to initiate research proposals.
3. Responsibility for laying out technical work plans.
4. Responsibility to one's technical peers for the quality of one's technical work.

The administration of staff and service functions. Primarily included within the term "staff and service functions" were comments in respect to personnel policy and administration, supply and procurement, shop service, facilities, and space and equipment. The great majority of these comments, which, it may be added, occurred frequently, were unfavorable. For example, this was the most disliked aspect of the government positions which the respondents held in 1948. Poor administration of such activities was the reason most often cited as making government employment undesirable. As might be expected, because of their administrative responsibilities, respondents who had been in middle- and upper-grade positions were more critical of the handling of these matters.

The most consistently unfavorable comment was

[4] A lack both of time and of accurate data on the number of persons directly employed in research and development work made it impossible to develop a sample that would be representative of all scientists and engineers who voluntarily resigned from government laboratories during 1948. The attitudes reported are, however, representative of a sufficiently large and varied group to be highly suggestive of attitudes more generally held.

[5] Observed differences were tested for their significance, wherever the frequency of the data permitted, through use of the chi-square test at the 1 per cent level of significance.

directed at the slowness and inefficiency with which various personnel actions were accomplished in the laboratories. Individuals employed in the administration of personnel activities were criticized as being unimaginative, nonprofessional, and bureaucratic in their approach. Frequently mentioned were the failures to make any real effort to remove incompetent personnel and to discriminate between outstanding and highly productive technical employees and those described as of average ability.

Favorable comment about personnel policies and administration related to the absence of discrimination, particularly with regard to the employment of women, and to safeguards provided to avoid arbitrary dismissals.

Responses critical of supply and procurement activities generally referred to delays caused by the red tape involved in justifying selective procurement or to the restrictions placed on the authority of laboratory supply and procurement personnel. Employees engaged in administering supply and procurement activities were also criticized as lacking knowledge of scientific equipment and materials, or for being excessively concerned with standardizing equipment and sources of supply. They were also felt to be unwilling to make the effort necessary to meet scientific needs within the framework of rules and regulations covering federal supply and procurement activities.

The limited number of responses critical of the administration of technical service activities (such as are carried on in machine, instrument, carpentry, drafting shops, etc.) suggested that the majority were satisfied with the handling of these services. Facilities and equipment in government laboratories were nearly always spoken of in favorable terms.

The competence of supervisors and co-workers. A substantial majority of the respondents believed that the professional competence of their supervisors and co-workers was good, very good, or excellent. The attributes that were held to make a supervisor desirable were technical competence and actions that evidenced a concern with, and consideration for, subordinates. Qualities of friendliness, cooperativeness, and technical competence were also mentioned.

The minority who expressed dissatisfaction with supervisory personnel related this to technical and administrative incompetence, thoughtlessness, selfishness, arbitrariness, and a tendency to oversupervise. The dissatisfaction in respect to co-workers related to their technical incompetence, to their lack of adequate training, and to professional jealousies.

Conditions of professional atmosphere, morale, and working conditions. There was no clear-cut pattern of general satisfaction or dissatisfaction with these conditions. In assessing the circumstances that create positive feelings about the professional atmosphere, morale, and working conditions, the respondents emphasized the following:

a) A good scientific atmosphere, good working conditions, and high morale were frequently said to result from the presence of a staff of high quality.

b) The use of high standards in the review and approval of project proposals, and particularly in the appraisal of scientific work in lieu of commercial criteria, were said to contribute to good morale and a desirable atmosphere.

In describing the conditions that create negative feelings about the professional atmosphere, morale, and working conditions, these points were stressed:

a) A sense of apathy and inertia was felt to prevail in government. This was attributed to the lack of competitive motivation.

b) Congressional criticism of public employees, loyalty oaths, "witch hunts," and excessive security provisions were cited as disruptive of morale and the research atmosphere.

Opportunities for professional development and advancement. A large number of the responses suggested that professional advancement is viewed essentially as being the enhancement of one's prestige and status among one's professional colleagues. There was generally negative criticism of the opportunities to enhance one's reputation because of security restrictions on discussion and publication, as well as fund restrictions on travel, on attendance at professional meetings, and on technical publications. The mediocre nature of research programs, the poor reputation of the organization, and the absence of top-flight technical personnel were in some instances frequently cited as reasons for this opinion. Favorable responses were made, however, about formalized arrangements for on-the-job training and for joint training and work arrangements with colleges and universities.

Job security and retirement benefits. Most of the respondents expressed satisfaction with the job security aspects of their government employment. All the comments regarding the retirement system were of a favorable nature. Those who did not leave the public service more consistently expressed satisfaction with government provisions for job security and retirement. In a few instances, feelings of job insecurity were related to budget fluctuations, reorganizations, "temporary" classifications, and the tendency in some laboratories to replace staff members with other individuals possessing more extensive formal training.

Administration of the technical organization and program. A small majority of the respondents expressed the opinion that technical administration was less than satisfactory. These criticisms, which were voiced more frequently by those who had occupied high-level positions, covered all the processes of program planning and execution, including the participation in these activities of personnel at department, bureau, and laboratory levels. The bulk of the critical responses was directed to the departmental and bureau levels, and nearly all the favorable responses were related to the quality of technical administration at the laboratory level. This is interesting in view of the fact that the respondents' most immediate experience was in the laboratories, and presumably their most informed evaluation could be made about operations at this level.

TABLE 1

Conditions that make any technical position desirable	*Advantages of employment*		
	Government	University	Industrial
1. Opportunity to do interesting, challenging, or important work and to have more freedom in or responsibility for one's work	1. Job security	1. Freedom of research and opportunity to pursue research work of interest to the individual	1. Adequate compensation
2. Adequate compensation and economic advancement	2. Desirable leave policies	2. Desirable environment and professional atmosphere	2. Opportunity for advancement
3. Desirable working conditions with respect to equipment, plant facilities, and the handling of service functions	3. Opportunity to do interesting and important work, and to have freedom of action in research	3. Desirable working conditions	3. Good equipment and facilities
4. Opportunity to work with competent and congenial co-workers	4. Good physical facilities and equipment	4. Competent associates and co-workers	4. Desirable working conditions
5. Opportunity for professional development, advancement, and recognition	5. Compensation	5. Opportunity for professional development and advancement	5. Competent supervisors and co-workers
6. Opportunity to work for competent supervisors	*Disadvantages of employment*		
7. Matters of personal convenience and preference	Government	University	Industrial
8. Personal security	1. Poor general administration, including personnel administration	1. Inadequate compensation	1. Job insecurity
9. Opportunity for advancement based on merit	2. Poor compensation	2. Poor equipment and facilities	2. Production demands and pressures
10. Adequate number of competent assistants	3. Poor advancement opportunities	3. Excessive teaching load	3. Poor working conditions
	4. Lack of opportunity	4. Poor chance for advancement	4. Inadequate leave and vacations
	5. Lack of freedom of action and of challenging and interesting work	5. Poor working conditions	5. Lack of patent rights

A lack of stable, well-conceived, long-range plans was the most frequently mentioned criticism. The next largest group of responses made reference to inadequate coordination of the technical program or its poor direction. Finally, the technical leadership was held by many not to have measured up to its task of administering large-scale technical organizations and programs. The majority commented favorably on the competence of technical administration at laboratory levels.

Attitudes of professional colleagues and friends toward the work of the respondents' last government organization. Nearly three fourths of the respondents felt that their professional colleagues and friends held decidedly favorable views about the work of the government laboratories in which they were employed. This suggests that most of them did not feel that their prestige had suffered because of public employment, which might have contributed to their decision to leave government positions.

Advantages and Disadvantages of Employment in Government, University, and Industrial Research

The respondents were asked to set forth the professional and personal conditions which, *in general,* they felt make for a desirable position in their field. They were also requested to express opinions about the advantages and disadvantages of employment for persons of their profession in government, university, and industrial employment.

Table 1 lists in descending order of frequency of mention the ten categories of conditions which the respondents cited in answering the questions.[6] Also listed are the five most frequently mentioned categories of advantages and disadvantages felt by the respondents to characterize government, university, and industrial technical positions. As may be seen from the table, no clear-cut pattern of preference was revealed regarding the desirability of any one employment area over another, when it is measured against the abstract standard of conditions which, in general, seem to make a technical position desirable.

The respondents were also asked to indicate which of the three employment areas, government, university, or industry, would, in their opinion, constitute the most desirable working situation for competent young and competent mature technical personnel. Forty-seven per cent selected private industry as being most

[6] This ordering of categories was based on the responses to this specific question. The earlier ordering of categories was made on the basis of the total number of responses given to questions designed to elicit favorable, as well as unfavorable, comments with respect to various aspects of government employment.

desirable for young scientists and engineers, 26 per cent selected government, and 15 per cent universities. The distribution of responses in regard to the most desirable employment area for mature persons closely followed this breakdown.

In view of the fact that private industry was most frequently characterized as being advantageous in respect to compensation, it may be suggested that, in evaluating the comparative desirability of the various employment areas, the matter of compensation appears to have been considered most important by many respondents. This finding further suggests that, as between jobs offering advantages in respect to compensation as compared with advantages in respect to opportunities to do interesting and challenging work, more of the respondents would tend to favor the former than the latter.

General Conclusions

The findings did not support a conclusion that the majority of these scientists and engineers left their government positions because of deep-seated dissatisfactions with their employment experience. Indeed, the over-all reaction to that experience was favorable, although there were numerous matters about which dissatisfactions were expressed. This conclusion is further borne out by the fact that most of the respondents were at age and experience levels where there tends to be a high degree of employment mobility, and most of those who transferred to other government jobs or outside employment did so at a promotion.

Since 36 per cent of the respondent group, all of whom had voluntarily resigned, went to other government positions, it may be inferred that the government, viewed as a single employer, is actually losing fewer technical persons than is commonly supposed. Accurate judgments of the actual losses to the public service by voluntary resignations of technical personnel are precluded by inadequate statistical data. It may be suggested that the opportunities to transfer within the public service are advantageous to the scientist in giving him a means of broadening his experience and of finding the types of positions most suitable to his needs and interests. Likewise, the government's provisions for job security and retirement appear to be positive forces tending to influence individuals in their decision to remain in the service. On the other hand, there is an economic and a technical cost involved in intragovernment transfers that should not be ignored, as seems currently to be the case.

No marked distinction in the patterns of attitudes of respondents from Navy laboratories and of respondents from nonmilitary government laboratories was revealed. This seems to belie the view that employment in Navy laboratories is less desirable than employment in nonmilitary government laboratories. On the other hand, there was little indication that employment in Navy laboratories was considered preferable.

The criticisms of the administration of the technical program suggested essentially that a lack of adequate program planning characterizes technical administration at the organizational levels above the laboratory. Scarcely any respondents suggested the prevalence of too much planning or of overly rigid and inflexible programming.

Furthermore, the loss of freedom in research endeavor was more often said to be the result of inadequate programming at higher echelons than of excessive programming. Freedom was defined as the opportunity to initiate ideas with a reasonable expectation of obtaining support, to participate in the selection of one's work assignments, and to assume responsibility for laying out one's technical work plans. Where bureau and department levels were believed to be poorly organized to permit such opportunities and responsibilities in the laboratories, or were felt to be actively frustrating them, the consequence was a feeling of lack of freedom.

Adverse criticisms of compensation, administration of pay scales, handling of promotions and other personnel policies and practices reflected a major source of dissatisfactions. This suggests the need for modification and improvement of personnel policies and practices, and the quality of the staffs handling such activities. There were also indications of need for a more complete understanding on the part of technical people themselves that a personnel system designed to achieve merit and equity necessarily involves the imposition of some restraints and controls. In addition, it appeared from the response data that scientists and engineers working in the government do not always recognize that certain of the administrative tasks they are required to perform are both legitimate and inevitable in large-scale organizations and under a democratic form of government.

Both the competence of technical administration and the efficiency with which staff and service functions are handled emerged as the elements of primary importance in the maintenance of high morale and desirable working conditions. This suggests that efforts designed to achieve improved organizational morale, which concentrate solely on staff and service problems, may, in many situations, fail to produce the desired objective.

The major attitudes revealed by the study indicate that these scientist and engineer respondents were not unique in their employment requirements and demands. They share with almost all types of workers a concern about pay, employment location, their chances of getting ahead, working conditions, and the congeniality and competence of associates and supervisors.

It is perhaps less apparent that those needs and interests which center around the scientist's concern with the conduct of his technical projects and program are also shared by nonscientific workers. The uniqueness of the problems of the research man is frequently pointed to, especially as it relates to his desire to be creative, his need for freedom of activity, and his wish to be free from nontechnical responsibilities. The concepts of freedom and creativity that emerged from the study

suggest that scientists and engineers do not differ in these respects from other workers. Indeed, industrial studies made in mass-production environments have indicated that the industrial worker, too, desires to share in program development, to make suggestions about his work and the work of his shop, and to have adequate responsibility and authority to do his job.[7] Apparently the characteristics that are commonly supposed to distinguish scientific personnel from all other types of individuals are, in fact, simply variations of degree, rather than differences of kind.

One final observation should be made in respect to the differences in attitude patterns that apparently characterized the respondents from some laboratories as compared with those from others. These differences were not presented in the formal report for a number of reasons, one of which was that in several instances there were too few respondents to permit valid statistical comparisons to be made. Nonetheless, it was evident that the quality of morale among respondents from the several participating laboratories did differ, with some laboratories having seemingly engendered more favorable attitudes. This suggests that there is need for the development of attitude-measuring instruments that can be used on a repetitive basis to appraise morale in individual government laboratories. Such devices should materially assist in the location of trouble spots and would represent a necessary first step in the development of improved morale.

[7] Fritz Roethlisberger. *Management and Morale.* Cambridge, Mass.: Harvard Univ. Press (1941); Elton Mayo. *Social Problems of an Industrial Civilization.* Cambridge: Harvard Univ. Press (1945).

Technical Papers

Recovery from Radiation Injury[1]

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The LD_{50}[2] for intact young adult mice[3] has been shown to be in the neighborhood of 550 r, whereas the LD_{50} for mice with lead-shielding of the exteriorized spleen during exposure to total-body x-radiation is about 1,025 r (*1, 2*). In contrast to the hematopoietic changes seen after the same exposure without spleen-shielding, no anemia, and only a transient leucopenia, appeared in spleen-shielded mice exposed to 1,025 r. This was attributed to the fact that ectopic blood formation was intensified in the shielded spleen within 48 hr after the exposure, and recovery of other hematopoietic tissue occurred within 8 days. In the animals without spleen-shielding, no recovery of hematopoietic tissue occurred before death. This brief report attempts to clarify some of the factors involved in this observation.

The techniques employed in these experiments are essentially similar to those reported previously (*2*). Tissues were encased in ¼-in. thick lead shields. The x-radiation was generated in a 250-kvp machine operating at 15 ma. The target distance was 59 cm. All animals were anesthetized with Nembutal (0.072 mg/g) during irradiation.

As is shown in Table 1, lead-shielding of part of the exteriorized liver, the exteriorized intestine, the entire head, or one hind leg, including the thigh, enhances survival of mice exposed to 1,025 r total-body x-radiation. Survival under these circumstances is considerably less than for spleen, shielding. Shielding one exteriorized kidney does not enhance survival. Recovery of the irradiated hematopoietic system and of the gastrointestinal tract, as judged by histopathologic study, is essentially complete within 8 days in spleen-

TABLE 1

SURVIVAL OF MICE EXPOSED TO 1,025 r X-RADIATION WITH LEAD PROTECTION OF VARIOUS TISSUES

No. animals	Tissue lead-shielded	Survival (%)	Hematopoietic recovery (8 days)
135	Exteriorized spleen (0.1 g)	77.7	Complete (++++)
93	None	0	0
15	Exteriorized lobe of liver (0.8 g)	33	Nearly complete (+++)
15	None	0	0
15	Exteriorized intestine (2.5 g)	26.6	Nearly complete (+++)
15	None	0	0
18	Head (3.0 g)	27.7	Only partial (+)
12	None	0	0
15	Right hind limb, including thigh (1.5 g)	13	Not studied
28	Exteriorized right kidney (0.19 g)	0	0
8	None	0	0

[1] This investigation was supported (in part) by a research grant from the National Cancer Institute, U. S. Public Health Service, and by a grant from the Armour Laboratories.

[2] Dosage required to kill 50% of animals in 28 days.

[3] CF-1. Raised by Carworth Farms—homozygous for recessive genes aa, bb, cc.