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HUMAN ASPECTS OF SCIENTIFIC RESEARCH

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CONSPICUOUS throughout the world of to-day is the great diversity of science, which has been accomplished by the wide extension of the frontiers of knowledge of man and nature by the application of research. This research may be looked upon as the scientific quest for the possible. More precisely, it finds, observes, defines and applies positive facts by experimental methods and inductive logic. Research has characterized the life of the universities, which are primarily responsible for its existence. Having comprehended the spirit and power of research from the universities, the industries have utilized its methods in their own affairs with most beneficial results.

It seems that wherever research is alive it grows. The past thirty-five years have seen the number of industrial research laboratories in this country increase from a few to more than 3,000. But, without the evolution of scientific investigation in the universities, these industrial laboratories might never have been established. In addition to the very idea of research the universities have supplied the industries with men and women possessing knowledge not only of the underlying scientific facts and theories but of the methods and techniques of investigation. From the universities also has come much of the basic knowledge of science on which modern technology has been erected and will build in the future. The practical uses of science may be regarded as the dividends declared every once in a while by pure research and research education. When such research and education are hindered these dividends

must often be paid out of surplus and in a disaster such as war they may have to be taken from capital.

During the past several years the loss of science students and teachers and the assignment of remaining scientific personnel to wartime tasks have all but stopped pure research in our universities. The situation resulting from this expenditure of basic resources is so very serious that years of zealous effort in and for our research training schools will be required to provide an adequate supply of scientists and to put pure investigation on a prewar level. The Federal Government and our industries have been amply notified by the interested professions that pure research has waned and must be revived, that almost a generation of scientists has already been lost, that there will be a shortage of research personnel in the afterwar period, and that capable science teachers and fundamental research specialists should be returned to the universities. Let us trust there shall never again be a lapse in the continuity of pure research and research education. We must retrace our impressions of them upon the ground of hope for a long peace.

Reconstruction by Science

Researchful scientists in general perceive the importance to them of those considerations of the presuppositions of knowledge or of the general features of reality that are within the domain of philosophy. For that reason the philosophical principles of management have been infused into advanced research administration. There is wanting, however, a present-day view of science as a totality and there has been slow advance toward a philosophy of science which would bring about such a systematic whole.

Scientific education and investigation, with unavoidable increasing subdivision, would become more satisfactory as means of human progress by linkage with a broad survey of very complex science in its entirety. Some day there may be evolved a working philosophy to enrich the study of the past and present of science for the sake of the future, to illuminate scientific knowledge and its application to human problems. Then scientists could be successful in composing a synthesis in which all the sciences would be put in correct relation to one another, so that the field in which each research man is located would appear to him, not as an isolated region, but as a part of an aggregate, the general outlines and interconnections of which would be clear to every scientific worker and student. A layman could thereby grasp the ample implications and effects of a science, and hence the synthesis would facilitate the helpful absorption of fundamental scientific axioms in the wider domain of life. In applied science, service should be expressible in terms of sociologic and economic forecasting. The policies, conditions and methods conducing to communal well-being should be appraisable by scientific measurement. The demands for scientific research in bettering human relations in general will be discussed in the last section of this article following the consideration of basic phases of research management.

We are looking forward to a reconstructive world, in which scientific investigation will give scope to the energizing impulse and to the shaping imagination. The value of research lies in its productive contributions to society. As the basis of solid managemental activity, it is fundamental to intelligent prediction, necessary to the verification of prevision. In investigational undertakings the scientific mind stays open and keeps eager: the scientist sinks himself in his problem, which becomes his essential life; his movement of self is from within outward, toward engrossment in an objective of human value. Such a scientist is engaged in doing something of societal utility that is the source of pride in his project; he is responsible to humanity being served. Research no less than education salvages potential human waste.

Philosophy of Research Management

Satisfying research management has for its goal the transformation of relations in ways that the finest and most effectual powers are evoked. Like all management of good substance it is never impersonal. It prevents loss of talent; it discovers just where persons best fit; it finds out how individuals can be better adapted to the work they do; it respects and protects professional freedom; it gives proper recognition.

Research management is concerned with precision and economy; its actions correspond to the facts sought. This management gives scientists opportunities to make their interests felt; it is therefore conservative of such interests. These scientists adhere to a functional unity of which they are a part, to which they are contributing. The functional laboratory organization renders supervision more easy by reconciling it with individual autonomy. The best organizer of arrangements for handling administrative matters on their proper levels is a generalist who knows how to use specialists and to keep them happy. Research is an adventure in cooperation by scientists who are always in earnest, and effective teamwork is facilitated by good-will, companionability and understanding of objective and parts to be played. The relations in research must rest upon mutuality and equality of privilege. Taking a common interest in the same things leads to united efforts. Response is both observed and anticipated, and it is developed by nurturing contented attitudes.

Persons who are kept in a state of good morale do not readily lose interest in what they are doing. A research man may be a small part of a laboratory; but if he has the right qualities, the right direction, the right environment, the laboratory will be a great part of him. Morale is personal in origin, operating from the top down. Only enlightened friendly and honest leadership in action can generate and sustain the esprit de corps that distinguishes the happy, brisk, continuously advancing organization. The betterment of employee relations should be the joint work of all executives, and management should constantly point up every group activity until it actually promotes comity. Substantial change in personnel, especially when suddenly effected, has often been seen to affect morale and particularly to damage nicely balanced working arrangements within an organization.

A practical philosophy is the conception on our part of what is basically demanded of us. That philosophy is discoverable in the animating idea of an enterprise, in the unity of doctrine and spirit in terms of which all functions are performed, all details organized—the principles that set the pace and direction. In reaching a philosophy every organization must be perfectly straight and clear about its guiding concepts. After trial and success the true managemental pattern becomes known and the philosophy is definable. Science uncovers facts through investigation and then describes them. Philosophical research management desires that its knowledge have useful meaning, that the significance and worth of factual information be found out. This management which thus requires perspective and valuation, expects discoveries that have relation to the organization, its purposes and boundaries. An integrative research philosophy has regard for the logic of events, emotions and sentiments; it communicates bent of mind; it conduces to personal as well as organizational advancement.

Public and Professional Relations of a Research Institution

The health of a research institution depends upon the maintenance of a correct balance among four components: staff life, systematic pursuit of new knowledge, teaching of high professional ideals and provision of support for the activities, both internal and external. Where such an organization has purposes not involving pecuniary profit, societally valuable results are always planned to accrue. The kernel of non-profit is proportionality—nothing in excess in motives, everything in the right connection, properly balanced for public benefit. The aim is not to make money, only to give as excellent professional service as possible.

Having gained respect through managemental and investigational accomplishments, a research institution can extend its scientific activities into other fields. It can aid in showing the high importance of depending upon facts. It can assist in popularizing scientific research by demonstrating its usefulness through the media of addresses, press releases and literature. It can help in planning for peacetime public and professional satisfaction. It can exalt pure research. The public as well as the industries will have faith in the utility of the scientific method when that value is proved again and again. A cardinal principle is that a research institution should concentrate on long-range basic problems, on preventive and constructive programs that do not displace projects of other kinds of organization. A research institution should supplement other establishments in its field and should have a part in stimulating scientific effort everywhere in that province. The increasing growth of research puts a high premium on the improvement of professional relations among institutions, consultants and commercial laboratories.

A research institution often receives appeals for counsel from companies that want technical assistance. Most of these requests relate to scientific or managemental questions that generally can be either answered at once or referred to consulting firms. By this channel an institution can cooperate with other research establishments or professional practitioners. Sometimes, however, it will be learned that manufacturers need research specialists in their organizations; therefore they can be encouraged and assisted in finding properly qualified persons.

Coming Changes in Research Relations

In the afterwar period there will be new problems in regard to research workers. Scientists and engineers who are in the armed services or who have left laboratories to assume some other class of temporary civilian employment will have adjustments to make when they return, and both they and many persons who have been in essential research through the war period are wondering about where and how they will fit into the future. Numerous young men of science and engineering have gained mental development, have shown new abilities in military duties. The shift from the stage of wartime pressures and tensions to a transitional or peacetime era will surely require mutation in attitudes as well as in formal managemental policies and organization.

History has repeated itself, and procedures employed in military personnel activities are being proposed for use in peace. Indeed industrial management is studying war agency applications of psychology in the selection and classification of per-

sonnel, in the influence and measurement of attitudes and in intramural and extramural relations. In war there is occasion for the intense application of science to urgent problems; research is stripped of wishful thinking. It is therefore to be hoped the valuable methods and techniques will be adapted with discrimination. Both management and labor will have an attitude more favorable than in the prewar period for the use of scientific research and tools. The postwar period will likewise be entered with greater emphasis on the importance of human relations than we have known. There will be a rich heritage of information gained from science and from the application of research findings. During wartime, as has been brought out, research knowledge is used chiefly in pressing short-time studies. In peace long-range fundamental research has exhilarating surroundings it can not locate in the interruptions of conflict.

Industrial reconversion and re-employment are under way and will be accelerated as time goes on. Communities as well as companies are trying to find how they can gage the impact of the war, how they can get ready for shifts of production to peacetime requirements. The urgent necessity for reviving business in the postwar period is spurring many manufacturers, some of them for the first time, to improve their practices. Changes will be in the postwar air, and alert organizations are preparing for them. It seems certain that the strategy and tactics of industrial research and their bearing on national welfare will be much more essential several years hence from what they are to-day, that researches of wide scope will be in motion throughout the industries. The experience of the war will enlarge points of view, will expand responsibilities. Scientists and engineers from the martial services will become strong elements in reorganization and reconstruction after their return because of their knowledge of personnel relations, executive work and other military activities. They will be willing to face and to cope with arduous problems and will be sympathetic to intellectual adventure. They will help to make encouraging the outlook for satisfactory employment. We should not neglect searches for science talent in the armed forces, to facilitate the subsequent recruitment of promising personnel.

Professional societies, universities and research institutions can be of advisory aid to scientists and engineers, such as veterans, in coping with their readjustment and placement problems—in securing professional positions, temporary or part-time employment, retraining or graduate or post-doctoral grants. They can also give suggestive guidance to persons now or formerly in research who are unfitted for careers therein. Research personnel problems that lie ahead should be studied from all approaches and corners. We must find out how and where we can best use men and women to their highest potential in assuring the maximum of employment, production and well-being.

Special Training for Research Service

As the accomplishments of men of research grow more and more prominent in every sphere of life, the security of society makes most important the sage and full utilization of their unusual assortment of qualities and skills. The administration of research ability will therefore increase in essentiality, as will the obligation of developing new research executives. We should constantly strive to encourage the desire for responsibility and to furnish training bases for scientists possessing evident fundamental qualifications for managerial posts. The moulding and enlivening of any executive development program require sound judgment and the managemental guidance that has all-out concurrence—leadership possessing familiarity with the intricacies of human nature. We have under examination a set of tests for selecting research executives. If adequately validated later on, the procedure will be reported.

In particular we should give more and more attention to the branch of management that treats of the personal and official duties of researchists, in distinction from the much better known subject of systematic research, which deals with literature studies and experimental methods. We should intensify the personal factor in all such professional work as we have ample evidence that this action contributes to individual and organizational happiness and success and to friendships in and for science and its investigation. Research management should therefore endeavor to unfold and widen the interests of employees, to make easy their perception of the over-all significance of their life and obligations and of the value of personal audits at regular intervals, to encourage relations and activities necessary in bringing about symmetrical personalities. In the personal enrichment of a scientist's life there is above all involved the attainment of a liberal attitude, a sympathy with human living, an understanding of the aspirations of others. Thus there can be cultivated those special kinds of discernment called senses of humor, judgment and proportion.

Laboratory personnel management has a weighty place in developing young men for commercial and public service, mainly because it can impart useful information, largely gleaned from the experience of industrial research administration, that is not acquired in scientific courses in the universities. Research

staff members can be educated in managemental procedures in general, in the minutiae of professional ethics and relations, in the differentiation of people and things, of personnel and materiel and their connections, in economic principles and trade knowledge, and in the psychology of the industrial mind. Relative emphasis accorded to the last-mentioned subject will gradually enable a young scientist of correct attitude to appreciate the commercial standpoint. It will teach him to convey to the industrial or business executive the ideas of science and the results of research in a manner and language that can be easily understood. Informed genial conversation is one of the best features of well-rounded professional life. In industrial research, especially in practical associations with company officers, the art of making and keeping contact and of promoting polite, tactful and friendly relations is of constant utility. It is of great aid in gaining essential cooperation and in securing the confidence that springs primarily from research accomplishment and technical merit. All successful industrial research as well as all successful professional and public relations are built upon trust. Among the foremost agencies for advancing research and its votaries are the scientific societies with their coordination, conventions and publications.

RESEARCH DEMANDS IN HUMAN RELATIONS

Scientific research has manifold societal and personal facts. In industry, for example, it is confronted with problems relating to workers as representatives of complex society as well as with problems involving interactions of workers and managers as individuals. In another type of problem study is being given to the recognition of the limit, if one can be found, beyond which production and distribution are likely to disturb the areas of industrial management and communal life. Applied physical science has been a very revolutionary and constructive factor in the industries, but to economists and sociologists concerned with the stability of communities it is of perturbing influence. Natural scientists could be of much aid to them in investigating that variation broadly along with other dynamic problems of improving human relations.

If after the readvent of peace we could produce and market goods at the same rate as in wartime, we should have the highest standard of living ever experienced, provided we could rightly solve our human relations enigmas. Of necessity in attacking these difficult questions is the correct and full use of scientific methods. We also need faith as well as facts and therefore psychological and ethical standards must be determined. To cite an instance, let us take the objective of personnel management research, which is the improvement of the understanding of people, of quality of judgment, of employee effectiveness and contentment and of corresponding techniques. Just as research is essential to all technologic progress, so is it indispensable to the advancement of personnel relations.

Many studies have been made on human problems of the industries, embracing sectors of their labor and public relationships, and discoveries in natural science have been stimulating in influence in all portions of the work; but much investigation remains to be performed to bring satisfactory results. It must be borne in mind that the activities in human relations have been too largely casual, the knowledge and experimentation too inadequate, to be comparable with the facts and methods of natural science. What needs to be done is apparent in general; how it shall be accomplished requires elaborate attention. We do know, however, that progress in human relations is dependent upon sufficient and efficient research on the value of what we have taken for granted, on the tendency and usefulness of change, and on new means to meet advantageously the real conditions of living and working to-day and to-morrow. This research must be conducted and its results utilized wisely if we are to pass the bounds, the numerous unsolved human problems, that hedge about us, little affected by ready measures of control. With science as the afterwar societal architect we could gain an economy and accompanying standards of human relations that would encourage the good life and thereby help importantly in preserving peace.

The United Nations organization has the unprecedented opportunity to foster research on defining the cogent relations among state and human interests and the facts of current reality, with the objective of evolving scientific means for bettering national and worldwide human relationships. Such a powerful action would stimulate the revival of fundamental investigation and also education in the universities, would inspire the improvement of public, institutional and technologic life in the postwar era. It would help to prevent the adaptation of science to adverse social philosophy; it would instead encourage an intelligent demand for science in the societal field and the development of a generally acceptable philosophy of science; it would thereby strengthen the realizable usefulness of scientific research. The United Nations could thus extend the versatility and creativeness of science and research to their own peacetime administration and promotion of progress, so as to invigorate and safeguard all that rightfully belongs to them as political bodies and to man as man.