The productivity of scientists

SCIENTISTS IN ORGANIZATIONS. By Donald C. Peltz, Frank M. Andrews. 318 pp. Wiley, New York, 1966. $10.00

by George Auman

In attempting to comment on this formidable presentation the reviewer finds himself pulled in a number of directions. An evaluation of *Scientists in Organizations* could vary considerably depending on which of several possible groups of readers one envisions. Certainly an understanding reading of this volume will require more motivation than a curious passing interest.

The authors say, "This book is addressed to scientists and engineers, to administrators of research and development, and to all others who are concerned about the effects of organization upon the work of their members." An additional, differently motivated audience for whom this book might be of value is persons interested in evaluating and determining the relative emphasis and level of support that should be given the various sciences, particularly the social sciences. I say this because the book itself constitutes an excellent case example of the present state-of-the-art in respect to methodology, interpretation and potential usefulness of an important segment of social-science research.

Identifying the effects of individual factors frequently involves specific assumptions or special treatment of the data to hold constant the effects of other variables. Getting meaningful comparisons of productivity for a variety of employers and technical groups involves a number of combinations and adjustments of performance measures. The rationale and techniques used are spelled out in the appendixes. The reader's assessment of the validity of the end result is what makes this book an interesting case example of the present state-of-the-art of this part of the social sciences.

The authors claim that, "This book describes one of the first major attempts to apply rigorous methods of research to the administration of R&D laboratories." Information about technical performance, working relationships and motivations was collected from 1311 scientists and engineers located in five industrial laboratories, five government laboratories, and seven departments of a midwestern university. Conclusions were not derived from opinions alone, but from data analyzed to determine what conditions—either in the environment or in the individual's orientation toward it—actually accompanied a high or low level of performance. The findings are illustrated and discussed in detail, including, by rough count, 101 charts, 32 tables, and 35 examples of questions used. To this are added 48 pages of explanatory appendixes.

While it is admittedly difficult (some might say impossible) to identify many generally applicable consistent principles about groups of human beings and the effects of their interactions with various environmental features, it does nothing to help prospective users of social research when social scientists respond to all questions about application of their data with a "What do you think?" or "Sorry, but you will have to interpret the data in light of your own situation." The authors of *Scientists in Organizations* offer a refreshing change in their straightforward attempt to interpret the findings. Each chapter ends with a "Summary and Implications" section, usually in the form of dialog, which attempts to translate the findings into practical steps for the R&D manager.

The authors frame a number of questions and suggested answers that have interesting implications for individual scientists and engineers as well as managers of R&D. For example:

> "How much of his working day should the scientist or engineer spend on strictly technical tasks, and how much (if any) on administration, teaching or communication? For that matter, is there an optimal total length to his working day? How many projects can a man work on profitably at one time?"

Partial comment:

Reviewed in This Issue

In development-oriented laboratories "It appeared that those PhD's who spent essentially full time in technical work, and therefore little if any time on administration, were less effective than those who spent about three-quarters time." In research-oriented labs, PhD's ". . . spending only half or three-quarters of their time on strictly research activities were more productive scientifically than those who spent full time."

In general the data seemed to indicate that the scientists performed best when they utilized two or three different skills, and faced both scientific and applied problems in their work. It did not matter whether the work was organized around one or several projects, so long as it called for a mix of activities.

"In almost all groups, the scientists performed less well if they worked only a standard eight-hour day or less. But it did not follow that the longer the hours the better the job done. Generally a nine- or ten-hour day, on the average, gave better results than an 11-hour day. . . ."

Some examples of other interesting questions considered in this book are:

How much actual freedom (in contrast to desire for freedom) goes with high performance? And how do the answers vary in different kinds of labs or for different levels of scientific personnel?

What is the connection, if any, between satisfaction and performance? Are the effective scientists happy? Unhappy? Neither?

Does the scientist's creative potential fall off after reaching its peak in his late 30's? Are there certain conditions under which scientists continue a creative career throughout their life span?

Answers or implications related to such questions as the foregoing are found deeply imbedded in a plethora of charts, tables, and statements of methodology, rationalizations and interrelationships throughout the text. For purposes of analysis the authors have classified respondents into five "primary analysis groups" and established four separate measures of performance. These are charted, correlated and analyzed in combination with individual personal and environmental variables. The resulting narrative requires the careful, full time attention of the reader. A good memory for connecting related factors discussed in other chapters is necessary to properly understand the limits and ramifications of many text discussions.

At this point a proper question would be "Should *I* read the book?" The answer, as indicated at the beginning of this review, depends on the reader and his motivation. If as an individual you are seriously interested in identifying some of the general behavior patterns that seem to characterize the more productive scientists and engineers, parts of this book are well worth reading. If, as a manager of R&D, you are interested in doing something about organizational patterns and practices associated with high productivity by scientists and engineers, parts of this book that provide a number of possibilities for specific management policies and action will be worthwhile. If you are concerned with whether the social sciences are getting the amount of support they should, you might want to evaluate many of the assumptions and practices described in this book as to their apparent validity and potential for refinement and improvement.

The amount of detailed information and discussion in *Scientists in Organizations* could not possibly be assimilated in its entirety without a large amount of time and effort. In terms of interest and importance (from the viewpoint of affecting performance), the subject matter of the various chapters is of uneven value. Putting these two facts together, an obvious approach is to read this book in a selective manner, tailored to a specific interest. This approach seems to have been anticipated by the authors who state, "Chapter 1 sets the context for the study. . . . The remaining twelve chapters are reasonably self-contained descriptions of research results. The reader is encouraged to pick and choose among them as he pleases."

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Excursion into the history of the nature of heat

MEN OF PHYSICS: BENJAMIN THOMPSON—COUNT RUMFORD. (Reprint collection). By Sanborn C. Brown. 207 pp. Pergamon Press, Oxford, 1967. Paper $5.50

by R. Bruce Lindsay

No American interested in the history of science can help being fascinated by the career and accomplishments of Count Rumford. He and Benjamin Franklin are justly considered to have been the most noteworthy American contributors to the development of 18th-century physics. In the light of Benjamin Thompson's achievements in science, we have long since forgiven him his loyalty to the Crown during the War for Independence. Another look at Rumford with special emphasis on his contributions to our understanding of the nature of heat is very welcome, particularly since it comes from the pen of Sanborn Brown, one of the world's leading authorities on the life and work of Rumford.

This book is another in the series *Selected Readings in Physics*, a part of the Commonwealth and International Library, intended to provide brief reviews of the scientific work of great physicists, both past and present. Prefaced by a short biographical sketch of Rumford, the bulk of the volume is devoted to selections from his writings on heat, with helpful and engagingly written commentaries by

COUNT RUMFORD, 1753–1814