

Pelz D C & Andrews F M. *Scientists in organizations: productive climates for research and development.* New York: Wiley, 1966. 318 p.

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In 11 R&D settings in industry, government, and academia, the technical performance of scientists and engineers was related to the nature of their interactions with colleagues and superiors, type of work, autonomy, influence, and motivations. [The *Science Citation Index*® (SCI)® and the *Social Sciences Citation Index*® (SSCI)® indicate that this book has been cited in over 435 publications since 1966.]

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"This book grew out of a project commissioned by the National Institutes of Health (NIH) in the early 1950s. NIH was expanding rapidly and had added a clinical center, and its directors wanted to assess staff morale and productivity. Of particular interest were results on technical performance of intramural scientists as judged by panels of peers. Would similar factors relate to performance in university and industrial laboratories? F.M. Andrews joined me in the late 1950s for a study of 11 organizations—5 industrial and 5 government labs, and several departments of a university—resulting in the 1966 book.

"Many parallels appeared for basic and developmental laboratories, and for PhDs and non-PhDs. When I sought to extract some basic principles for an article in *Science*¹ (which became the introduction for a revised version of the book 10 years later²), technical performance appeared to flourish in the presence of conditions that seemed antithetical—hence the concept of 'creative tensions' or 'creative contradictions.' Effective scientists and engineers needed both some source of 'security' or *protection* from external disruption and some source of 'challenge' or *exposure* to external demands. Security could be provided by autonomy, influence, or specialization; challenge by frequent communication, multiple R&D functions, or colleague diversity. I was reminded of a passage in Emerson's essay on 'Self-Reli-

ance' a century earlier: 'It is easy in the world to live after the world's opinion; it is easy in solitude to live after our own; but the great man [read: effective scientist] is he who in the midst of the crowd keeps with perfect sweetness the independence of solitude.'

"Why has the book been frequently cited? In part, we suspect, because of its timing. It pioneered in the postwar and post-Sputnik wave of concern for the management of research and development. We like to think, too, that the format helped. The book presented a complex matrix of factors in a clear and readable manner, with meaningful charts and simple tables, and concluded each chapter with a dialogue between the authors and a hypothetical reader on practical implications.

"The book has been translated into Japanese and Russian, and, we are told, it has been widely read in both areas. In the early 1970s, it stimulated a cross-national study of research teams under UNESCO auspices. Andrews served as technical adviser for the first round in six European countries—Austria, Belgium, Finland, Hungary, Poland, and Sweden—and edited a book.³ In second and third rounds, the methodology was extended to South America, Africa, Asia, and Russia—a total of 16 countries, including some repeats. The series will be the subject of a conference in January 1985 in Rio de Janeiro. Andrews found keen interest in the research results among an audience of several hundred in a 1983 visit to Beijing.

"The UNESCO studies have sustained many of the findings from the American data, even though the UNESCO studies focus on performance of R&D teams rather than on individuals as in the initial study. The UNESCO data found performance to be higher under conditions of strong personal dedication, diversity in several factors (number of roles, projects, skill areas, funding sources, and disciplines), and frequent communication with many colleagues. Groups were more effective when their members had high influence but moderate autonomy, and were comprised of four to six people who had worked together about 7 to 10 years. In short: conditions governing technical contribution appear to transcend cultural boundaries and political systems."

1. Pelz D C. Creative tensions in the research and development climate. *Science* 157:160-5, 1967. (Cited 30 times.)
2. Pelz D C & Andrews F M. *Scientists in organizations: productive climates for research and development.* Ann Arbor, MI: Institute for Social Research, 1976. 401 p. (Cited 55 times.)
3. Andrews F M, ed. *Scientific productivity, the effectiveness of research groups in six countries.* Cambridge, England: Cambridge University Press, 1979. 469 p.