

Managing Creativity in Science and Hi-Tech

Ronald Kay

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Second Edition



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*To Renate, whose insight
and commitment has given
balance to our joint ventures*

Preface

This new edition was motivated by the realization that the issues addressed have become more significant and more widespread. The importance of Scientific and Hi-Tech enterprise has increased the world over. The need for people with scientific and technical competence has become ubiquitous, including the highest levels of management in industry, education, and government. Today, this need extends to every organization which depends upon information and communication technology, that is, not only to science and high tech but also to banking, finance and insurance, marketing, and the energy industry.

During the past 20 years, Hi-Tech enterprises have become the most dynamic segment of the world's economy. Information processing and communication technology in particular have changed the world we live in. Very likely, Bio-Hi-Tech will become an equally significant factor in the course of the twenty-first century.

Industrial research facilities have played a dominant part, by accepting (sometimes reluctantly) the role of advance troops to the development army which turns invention into innovation. University departments which address the issues germane to high technology have made major contributions and have found effective ways of interacting with industry.

This is hardly surprising given the magnitude of the effort. Worldwide R&D expenditures in 2011 were in excess of \$1,000 billion ($\10^{12}).

Much of that R&D effort has assumed international dimensions. Large companies like Siemens, NEC, Novartis, IBM, and Microsoft have laboratories all over the world. The cost of introducing new technologies has motivated companies to find joint venture partners in every part of the world. The complexity and scope of management issues which have accompanied this development is making new demands upon people whose formal education has been largely concentrated upon science and engineering.

There has not been a commensurate advance in the training of engineers and scientists to prepare for management responsibility.

Higher education has only begun to meet this need. An advanced scientific or technical education still leaves little time to prepare the most capable for management responsibility which they are sure to face.

To fill the need at the top, it is essential to motivate and help scientists and engineers meet management challenges at every stage of their career.

This new edition includes a look at the international aspects of the evolving environment. This is a matter of particular urgency.

Europe, Japan, and the USA will face competition from China and India in the immediate future. The latter have invested heavily in the education of potentially creative individuals. They have the benefit of people who have experienced the best training that Europe and the US have to offer.

These new Asian leaders in Science and Hi-Tech have an advantage which is hard to overstate: They have come to accept, that there is another way of doing things, the hallmark of creativity. They have had the experience of adapting to another culture and selecting that which promises to serve *their future* needs.

This new edition also considers the role of technology itself upon the challenges and opportunities faced by managers of Science and Hi-Tech.

It has been reassuring that recent studies of the effectiveness of management in science and high-tech have borne out the continuing relevance of what has been put forth in the earlier edition. Google's Project Oxygen (2011), a data driven survey of employee views of management effectiveness, is an especially relevant validation.

San Francisco, California
February 2012

Ronald Kay

Acknowledgments

It has been my good fortune to be able to call upon people who have played significant roles in the advancement of the management of Science and Hi-Tech since the publication of the earlier edition.

Of the many people consulted, I am especially indebted to those who have been so generous with their views and their time.

Clemens Szyperski, who has made the journey from successful Hi-Tech entrepreneur in Switzerland to Academia in Australia, advanced the science and practice of software engineering and is a manager and leading software architect at Microsoft in Redmond, Washington.

Donald Shapero, Director, Board on Physics and Astronomy of the US National Academy in Washington, DC, with a lifetime in national science policy.

Evgeny Zaytsev of Helix Ventures who made the journey from managing a major Russian biomedical program in Siberia to starting a Venture Capital firm in Palo Alto, California.

Frank Mayadas, who has held executive positions at IBM and with the Alfred P. Sloan Foundation, New York, spend a lifetime in Science and Hi-Tech management and was instrumental in the advancement of E-Learning.

Hans Danielmeyer, Stuttgart, Germany, whom I first met at a Management Workshop for young physicists. He has since been involved with every aspect of Science and Hi-Tech management as founding President of a Graduate Technical University, as Board Member of Siemens, and as member of German and European Commissions

Hervé Bourlard, Founding Director of the IDIAP Research Institute in Martigny, Switzerland, singled out for Entrepreneurship and recognized for his contributions to the field of Speech Processing and Artificial Neural Networks.

Moidin Mohiuddin, Associate Director of the IBM Research Laboratory in Almaden, California, who helped me put some of the changes over the past 20 years in perspective.

Norbert Szyperski, University of Cologne and Sylter Runde, who has held CEO positions in public and private Hi-Tech organizations in Germany and has played a leading role in establishing and in making the case for Hi-Tech start-ups in Europe.

Thomas Huber, Switzerland, could draw upon his unique experience, going from the University of Zurich Biochemistry Department directly into a management job with the Novartis Pharma Research Lab.

Uwe Thomas, Friedrich-Ebert Stiftung, Germany, as director at the Federal Ministry for Research and Technology played a decisive role in creating the conditions for Germany's re-emergence in Science and Hi-Tech.

Wolfgang Wahlster, Director of the DFKI, Artificial Intelligence Centers in Germany and advisor to government and industry in various parts of the world has a comprehensive view of the challenges facing Science and Hi-Tech management.

Preface to the First Edition

The growing role of science and technology has generated a need for unique management skills on the part of scientists and engineers. While this need is widely recognized, there is little agreement on the most appropriate way in which it should be satisfied.

By and large, the general literature on management does not recognize problems that are unique to science and high technology. This lack is also reflected in the considerable variety of formal management training. More often than not it has missed its mark, at least when judged by the response of participating scientists and engineers.

The principle motivation for this book has been my own experience and teaching graduate students and practicing scientists and engineers about those aspects of management that are likely to be most relevant to their future endeavors.

The book reflects some of what I have learned from that experience and has been further encouraged by the convictions that

1. The distribution of management potential among engineers and scientists is no different from that of other groups with comparable academic achievement.
2. Successfully managed scientific and technical organizations provide the most useful source of learning.
3. The process of learning is facilitated by referring to the experience that has proven effective in creating an environment in which creative scientific and technical enterprise has flourished.

I have found such flourishing enterprise in universities, in government laboratories, and in Hi-Tech industry, the world over.

Creativity plays a special role in such enterprise. It is the recognition of that special role which makes unique demands upon those who assume management responsibility. Management principles that have been applied successfully to administration, finance, marketing, and production need modification when applied to creative scientific and technical effort.

Every time an individual scientist or engineer selects a problem to be tackled or an approach to its solution, she or he assumes personal risk, often with

long-term implications. This readiness to assume risk is a necessary, if not sufficient, condition for creativity to flourish. Hence, the environment for creative endeavor must be conducive to risk taking.

Besides bringing relevant experience to bear upon the topic of managing creativity, this book is also intended to convey some of the challenge and excitement which awaits those willing to assume responsibility.

October 1989

Ronald Kay

Acknowledgments to the First Edition

It has been my good fortune to have had close association with a number of very effective managers, and to have spent a good part of my professional life with the International Business Machines Corporation. IBM is a company which places a premium upon creativity and works hard at the task of developing managers.

For many years, daily discussions of my wife's experiences, managing a class of 30 ten-year-olds, has helped me put management in perspective: To help people develop their potential.

From my children, I have learned to recognize the limitations of age-induced one-upmanship.

In life, one owes a lot to those who have put up with one's failings, a most valuable source of learning. To all of them, my sincere gratitude; in particular, to Angela Lahee, my most effective editor at Springer-Verlag.

Contents

1	Introduction	1
2	Outline	5
2.1	A Word About Getting the Most Out of This Book	7
3	Is the Management of Creative People Desirable?	9
3.1	Does Management Understand Creative People?	9
3.2	Creative People Do Not Need Management!	10
3.3	Characteristics of a Creative Hi-Tech Professional	12
3.3.1	Recognition as a Prime Motivator	12
3.3.2	Achievement for Its Own Sake	12
3.3.3	Achievement Versus Relationships	13
3.4	Managing Creative People: Our Hypothesis	14
3.5	Creative Team Effort	14
3.6	Individual Creative Effort	16
3.7	Summary	16
4	Managing Your Own Work	19
4.1	Objectives, Activities, and Results	19
4.1.1	The Basis for Decision Making	19
4.1.2	Our Intuitive Management Style	20
4.2	Efficiency and Effectiveness	21
4.3	Dealing with the “Incompetent” Project Leader	21
4.4	Work Habits of the Successful	22
4.5	Publications	23
4.6	Managing the Use of Time	23
4.7	Supporting Decisions	24
4.8	Summary	25
5	Desired Qualifications of Managers	27
5.1	Picking the “Best” Available	27
5.2	Qualifications of Project Manager	28
5.3	Qualifications of Department Manager	30

5.4	Qualifications of the Top-Level Manager	31
5.5	Leadership: To Lead or to Mislead	33
5.6	Summary	36
6	Managing a Project	37
6.1	The Expectations of the Project Members	37
6.2	Management Initiative	39
6.3	The Role of Estimates and Schedules	40
6.4	Communication Within the Project	41
6.5	Communication with Those Outside the Project	42
6.6	Formal Project-Tracking Schemes	42
6.7	Report Writing	43
6.8	Patents	45
6.9	Summary	46
7	Some Aspects of Managing a Department or Small Enterprise	47
7.1	Developing a Strategy	47
7.2	Elements of a Strategy	48
7.2.1	Environment	49
7.2.2	Mission	49
7.2.3	Potential Impact	50
7.2.4	Usefulness of Strategy	50
7.3	Developing an Operating Plan	52
7.4	The Financial Plan	54
7.5	Summary	55
8	Managing Creative People in the Hi-Tech Environment	57
8.1	Recruiting	57
8.1.1	Recruiting: The Applicant's Position	57
8.1.2	What Management Potential?	58
8.1.3	The On-Site Interview	59
8.1.4	The Recruiter's Position	59
8.2	Performance Evaluation	62
8.2.1	Why Performance Evaluation?	62
8.2.2	The Evaluation Process	63
8.2.3	Observations About the Evaluation Process	64
8.2.4	Consequences of Evaluation: Wanted and Unwanted	69
8.2.5	Opinion Surveys	72
8.3	Compensation	73
8.3.1	The Hybrid "Experience – Merit" Approach	73
8.3.2	The "Merit Only" Approach	75
8.3.3	Ranking Criteria	75
8.3.4	Ranking: Public or Private?	77
8.3.5	Nonmonetary Compensation	78

- 8.4 Management Style..... 81
 - 8.4.1 Is There “A Way” of Managing People? 81
 - 8.4.2 Guidelines Versus Rules..... 83
 - 8.4.3 Management Style: Perceived Positively 83
 - 8.4.4 Management Style: Perceived Negatively 83
 - 8.4.5 Summary: Managing People 84
- 9 Evaluation of Research and Development 85**
 - 9.1 Evaluation at the Project Level 85
 - 9.2 Evaluation at the Department Level 86
 - 9.3 Evaluation at the Top Level 87
 - 9.4 The Importance of Under-the-Table Projects 89
 - 9.5 General Observations About Project Evaluation..... 89
 - 9.6 The Evaluation Process 90
 - 9.7 Evaluation of Proposals 92
 - 9.7.1 Evaluation Criteria for a New Project 95
 - 9.8 Evaluation of the R&D Function 96
 - 9.8.1 How to Approach the Evaluation of an R&D Function... 97
 - 9.8.2 What Are We Getting for Our Investment?..... 99
 - 9.8.3 What Is the Appropriate Amount of R&D? 101
 - 9.8.4 Setting Priorities 103
 - 9.9 Conclusions..... 104
 - 9.10 Summary..... 104
- 10 Administrative Skills 107**
 - 10.1 The Art of Making Presentations 107
 - 10.1.1 Know Your Audience..... 107
 - 10.1.2 Presentations: Structure and Technique 108
 - 10.1.3 Visual Aids..... 110
 - 10.1.4 The Art of (Not) Listening 111
 - 10.1.5 Summary 111
 - 10.2 The Art of Conducting Meetings 111
 - 10.2.1 General Guidelines 112
 - 10.2.2 Sample Meeting Agenda 112
 - 10.2.3 Methods for Conducting Group Meetings..... 113
 - 10.2.4 Selection of Method 115
 - 10.2.5 Tips for One-on-One Meetings 116
 - 10.2.6 Summary 117
- 11 Starting a New Enterprise 119**
 - 11.1 Profile of the Entrepreneur 119
 - 11.2 The New Enterprise 121
 - 11.3 The Business Plan 122
 - 11.3.1 Executive Summary of Business Plan 122
 - 11.4 Financial Controls 125
 - 11.5 Summary..... 129

- 12 Financing Creativity** 131
 - 12.1 The Venture Capital Industry 131
 - 12.1.1 Who Are the Venture Capitalists? 131
 - 12.1.2 The Venture Capital Network 132
 - 12.1.3 The Risk and Reward of Venture Capital 132
 - 12.1.4 Accessibility of Experienced Management..... 133
 - 12.1.5 The Related Infrastructure 134
 - 12.1.6 Evaluation of Proposals 135
 - 12.1.7 The Relative Size of Venture Capital Investment 137
 - 12.1.8 Summary: Venture Capital 138
 - 12.2 The Role of Foundations 138
 - 12.3 Government Sponsored R&D..... 140
 - 12.4 Conclusions..... 140
 - 12.5 Summary: Financing Creativity 142
- 13 Organizational Culture** 143
 - 13.1 The Matter of Trust..... 145
 - 13.2 Intellectual Property: Whose? 146
 - 13.3 Expense Accounts: Judgment or Integrity? 147
 - 13.4 Bureaucracy: A Positive Asset? 148
 - 13.5 Cultural Values 150
 - 13.6 Respect for the Individual..... 151
 - 13.7 Relevance to Creative Effort 152
 - 13.8 Summary..... 153
- 14 The Impact of Globalization and Technology** 155
 - 14.1 Globalization 155
 - 14.1.1 Management Implications..... 156
 - 14.1.2 National Differences: Changing Perceptions 157
 - 14.2 Impact of Technology 160
 - 14.3 The Future 162
 - 14.4 Summary..... 163
- 15 What the Behavioral Sciences Have to Offer** 165
 - 15.1 Douglas Mcgregor: Theory X and Theory Y 165
 - 15.2 Abraham Maslow: Hierarchy of Needs 167
 - 15.3 Frederick Herzberg: Motivation-Hygiene Theory 168
 - 15.4 Rensis Likert: Four Management Styles 169
 - 15.5 Summary..... 170
- 16 Management Training Opportunities for Engineers and Scientists** 173
 - 16.1 Short Programs 173
 - 16.2 Basis for Selection 174
 - 16.3 Career Development Workshops 174
 - 16.4 Full-Time Academic Training Programs 176
 - 16.4.1 General MBA Programs..... 177
 - 16.4.2 E-Learning Programs 177

16.5	Task Force Participation	177
16.6	Summary.....	178
Recommended Further Reading	179
Appendix	183
A.1	Management Initiative	183
A.2	Ranking Criteria for an R&D Function	183
A.3	New Venture Staffing Plan.....	185
References	187
Index	191