

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 (\$10¹²).

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.

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