

TECHNIQUES FOR MANAGING TECHNOLOGICAL INNOVATION

Overcoming Process Barriers

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CAROL WALCOFF

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PREFACE

This book presents a study that investigates management techniques used by U.S. industry and government to facilitate the technological innovation process. The study discusses how selected management techniques can help overcome technical, organizational, governmental, financial and marketing barriers in the innovation process. Descriptions of 21 management techniques are included.

Management techniques and candidate organizations using these techniques are presented with information on their relative abilities to stimulate development and commercialization of new technological markets. The management techniques selected for presentation are currently employed as a means of managing technological innovation. The processes are defined by which industry generates new and improved products and methods of production.

Activities are included that range from idea generation, research, development and commercialization to diffusion through the economy. This book should be useful to engineers and scientists involved in production, product and management functions, as well as managers, executives, sales personnel and all those who are part of their organization's decision-making process. Technological innovation—bringing new products and processes into the marketplace—is made up of many small steps, from the thought of a new concept to its final sale and use.

In addition to the rationale and background involved in the management techniques for technological innovation, this book presents "case histories" of major organizations, covering a broad spectrum of styles and approaches. The reader will find these presentations valuable for study and reference. The approach here is not one of the traditional "cook-book," but, we hope, a text the reader can apply in the thought process toward his or her own business activities.

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Carol Walcoff
Robert P. Ouellette
Paul N. Cheremisinoff

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CHAPTER 1

INTRODUCTION

This book presents a review of the applications of management techniques currently being used by U.S. industry and government to encourage or facilitate technological innovation. Management techniques and candidate organizations using the techniques were identified during the first phase of the study. In the second phase, users of the management techniques were interviewed to obtain information regarding the relative effectiveness of the management techniques to stimulate the development and commercialization of new technological products and processes. The group of management techniques included do not necessarily represent the most successful means of managing technological innovation but were selected because they are in current use. Further, information regarding their application was accessible to investigation at this time.

Technological innovation has been defined as "the process by which industry generates new and improved products and production processes. It includes activities ranging from the generation of an idea, research, development and commercialization to the diffusion throughout the economy of new and improved products, processes and services" [1]. Innovation in the academic sense generally refers to the process of creating a new product or process; however, for this report, that definition is extended to include those existing products and processes for which new users or markets may be defined. Technological innovation occurs as a result of either technology push or market pull. Technology push for innovation happens when innovators seek commercially viable uses for new or existing technology. With market pull, innovation results from the recognition of an existing problem or need by the innovator, as well as the application of technical and capital resources to develop alternative technological solutions.

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The process of technological innovation—bringing new products and processes into the market place—actually consists of many small steps from “thinking” of a new concept to “selling” it. The steps do not always follow in a consecutive stepwise fashion for all industries, nor are all steps necessarily required in all cases. A diagram of some of the major steps in the technological innovation process is presented in Figure 1. These steps have been grouped into three major phases. Elements of this innovation process model were drawn from the literature [2,3] and are used in this study to describe the applications of the management techniques. The first phase consists of setting broad goals regarding innovation policy, identifying the general types of new products and processes to be developed, developing innovative ideas, selecting innovation projects and conducting preliminary project planning. The second phase includes research and development (R&D) on both production methods and the products. The third phase consists of marketing or diffusion of the new product or process.

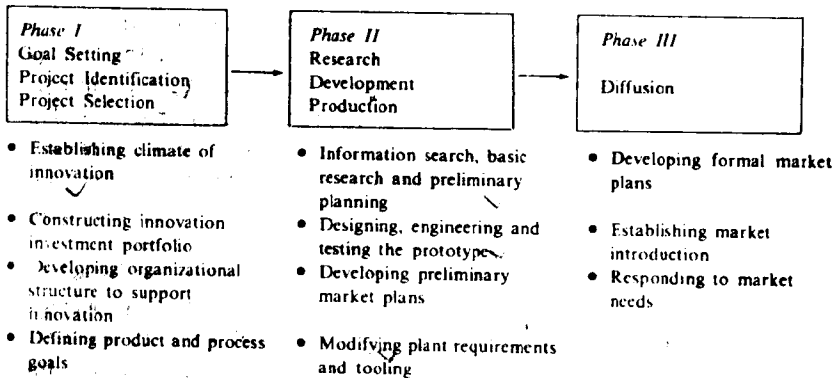


Figure 1. Three phases of the innovation process.

Corporate decision-makers elect to invest in R&D supporting technological innovation for several reasons. They may wish to identify new products or processes that will permit the firm to remain competitive by providing new ways to reduce costs and improve quality, or they may wish to expand existing market areas. Businesses that tend to support ongoing investment in innovation also believe it may be advantageous to maintain an R&D effort as a resource for production-related problem-solving.

There are, however, a number of barriers within the innovation process that inhibit the development of new products and processes.⁷ These barriers may be manifested in the lack of technical or financial resources required to support innovation or may be defined as structural deficiencies within an organization inhibiting the flow of innovative ideas. These barriers can retard or stop the technological innovation process within an organization. Recognizing these barriers as impediments to the innovation process, business managers in U.S. industry and government have developed management techniques to overcome them and increase the probability that the development of new products and processes will result in commercial success.

This book provides a summary of 21 management techniques selected for review and used to effect innovation process barriers. A brief description of each technique is presented in Table I. Although these techniques address problems that occur during the innovation process, they were not necessarily developed solely for that function. For example, some address general management problems associated with personnel, finance, facilities, etc. The information gathered during interviews with users of the management techniques is summarized in Chapter 3. A series of tables are presented in that chapter to assist the reader in analyzing problems associated with managing the innovation process and to identify keys to potential solutions based on the experience of other organizations and industries.

Table I. Brief Descriptions of the Management Technique

Management Technique	Description
1. Idea Generation	New product and process ideas are generated through both structured and unstructured discussions involving technical staff and management.
2. Innovation Incentives	A financial reward and recognition program is established to encourage technical professionals to stay within the firm and to increase the rate and level of innovation through the development of alternative career ladders designed to maintain professional interest and challenges.
3. Innovation Training	Employees throughout the organization participate in organizational development programs that encourage greater receptivity in nurturing innovative ideas, particularly through group dynamics.
4. Internal Venture Management	Organizations isolate the financial risks and rewards associated with management of the innovation process, establishing a profit center along process lines.

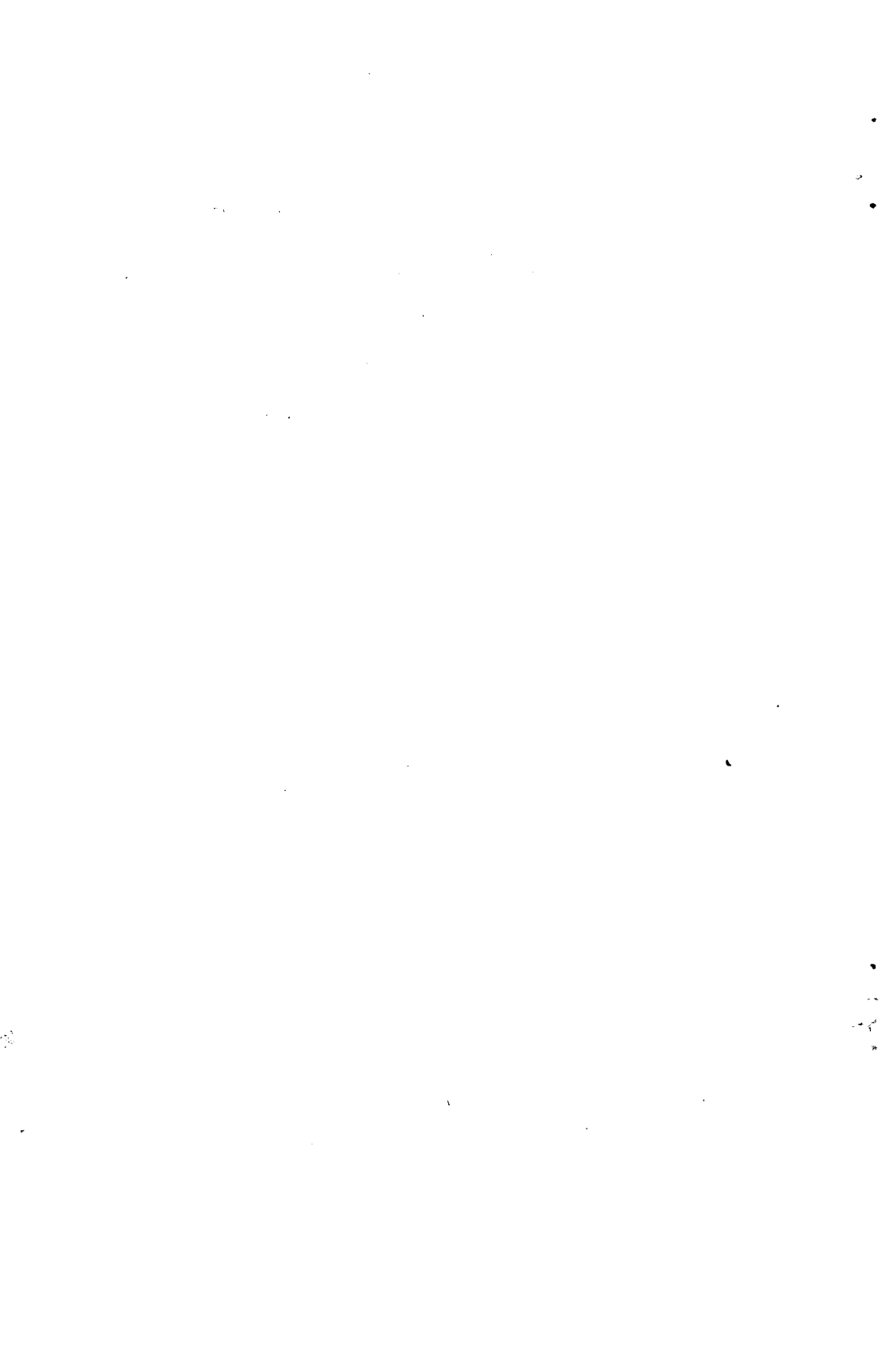
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Table 1, continued

Management Technique	Description
5. Production Champion	An individual is identified to act as political surrogate and manager responsible for the development of a new product or process.
6. Project Performance Measurement	Guidelines are established by innovation project management and staff to evaluate the effectiveness of project activities and their outcomes.
7. Quality Circles	Voluntarily formed groups of nontechnical and technical staff meet to identify problems within the organization's operation that require innovative solutions.
8. Research Planning Frame	A structured corporate research planning process is utilized to ensure participation of experts in the long-term identification of product/process goals.
9. Temporary Groups	Individuals representing several levels of management form committees as a temporary work assignment to apply problem-solving techniques to develop new product/process ideas.
10. External Venture Management	Intensive capital, marketing and management resources outside the organization are utilized to initiate new product development or to assist in mature firm development and growth.
11. Franchising	A legal relationship is established between a corporation and distributors of its products and services to facilitate the transfer of innovative product/processes.
12. Licensing	The developer of an innovative product or process permits its use and further development but maintains legal control and receives payment for these license privileges.
13. Middleman Broker	Universities' services and resources are matched with industry's technical innovation needs through the coordinating efforts of a not-for-profit technical organization.
14. Personnel Transfers	Technical staff are encouraged to transfer both within the organization as well as among organizations to stimulate the transfer of technological innovation.
15. University-Industry Linkages	Business management services are provided to small business owners and operators and individual inventors to assist in the development of strategies for managing new product development.
16. Industrial Applications Centers	Technical personnel and information resources have been organized in a center to assist in the public dissemination of new technology developed for space research.
17. Innovation Centers	University-based centers provide startup funding and technical and management support to assist individual inventors and innovators in new products/process development.
18. National Technology Foundation	Dispersed professional, engineering and other technical resources are consolidated under federal direction to address national problems potentially requiring technological solutions.
19. Regulations	Federal legislation and guidelines may stimulate the dis-

Table I, continued

Management Technique	Description
20. Technology Transfer from Laboratories	semination and use of new products and processes by creating an incentives structures for the users. Industry representatives are involved in the development of new products and processes at government laboratories to ensure full understanding of the innovation concept and effective commercialization.
21. Subsidies	Federal funding of industries involved in technological innovation requiring high R&D investments ensures technological advancement and reduction of risk borne by the innovators.



CHAPTER 2

METHODOLOGY

STUDY APPROACH

The goal of this study is to identify and describe management techniques used to facilitate the innovation process and the exploitation of new products and processes. The study objectives defined to achieve this goal are (1) to identify and characterize the aspects of management techniques that facilitate the diffusion of innovation; (2) to gain a better understanding of the barriers to the diffusion of innovation through the analysis of management techniques applied in different stages of the innovation process; and (3) to obtain information regarding the successful or unsuccessful use of management techniques.

Three major tasks were pursued. The first was to identify potentially useful management techniques and candidate organizations to be included in the study. The second was to obtain additional information from individuals in government and business who use the selected management techniques. The third objective was to review the information collection and prepare a summary and analysis of the interview results.

SELECTION OF MANAGEMENT TECHNIQUES AND CANDIDATE ORGANIZATIONS

The management techniques were selected by reviewing the literature (1975-1981) to identify a group of techniques that would address major barriers to the innovation process. The information search consisted of a formal literature search and interviews with individuals involved in the