

INTERNATIONAL CENTER FOR GROWTH-ORIENTED ENTREPRENEURSHIP

Research and Developments: Comparative Management Studies

DEFINITION AND SCOPE OF TECHNOLOGY MANAGEMENT

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December 9, 2013

Abstract

In order for the comparative study of technology management to be meaningful and understandable it is necessary to reach some agreement on the definition of basic terms and concepts including “technology” and “technology management. This report describes various attempts to define technology management and the key issues relating to technology management that confront countries and firms.

In order for the comparative study of technology management to be meaningful and understandable it is necessary to reach some agreement on the definition of basic terms and concepts. The task begins with the term “technology” which, not surprisingly, has been defined in a number of different ways. At its roots the term refers to the skills associated with application of proper techniques² or the practical application of knowledge. The following useful definition was supplied by Burgelman et al.: “technology refers to theoretical and practical knowledge, skills and artifacts that can be used to develop products and services as well as their production and delivery systems. Technology can be embodied in people, materials, cognitive and physical processes, plant, equipment, and tools.”³

Like the definition of “technology”, the meaning of the term “technology management” has also been debated. In a report issued in 1987 the National Research Council defined the management of technology as linking “engineering, science, and management disciplines to plan, develop, and implement technological capabilities to shape and accomplish the strategic and operational objectives of an organization.” White and Bruton were critical of this definition, arguing that it failed to include attention to the evaluation and control that they believed was necessary for a strategic approach to technology management, and suggested that a better definition would be the following: “The management of technology is the linking of different disciplines to plan, develop,

¹ The material in this report is derived from material appearing in *Business Counselor’s Guide to Organizational Management* by Dr. Alan S. Gutterman and is presented with permission of Thomson Reuters/Westlaw. Copyright 2013 Thomson Reuters/Westlaw. For more information or to order call 1-800-762-5272. Dr. Gutterman is the Director of the International Center for Growth-Oriented Entrepreneurship [www.growthentrepreneurship.org], which supports the Comparative Management Studies Blog [www.comparativemanagementstudies.org]. Inquiries about this report should be addressed to Dr. Gutterman at agutterman@alangutterman.com.

² K. Hakkarainen, *Strategic Management of Technology - from Creative Destruction to Superior Resilience* (2006).

³ R. Burgelman, A. Maidique and S. Wheelright, *Strategic Management of Technology and Innovation* 4 (2001).

implement, monitor, and control technological capabilities to shape and accomplish the strategic objectives of an organization.”⁴

Chanaron and Grange offered the following comprehensive definition and accompanying explanation of technology management: “Technology management is the management of innovation, whether it be a product, a process or an organization, from its conception to its diffusion, and therefore to its implementation within the company, including the consequences, advantages and disadvantages for all of the variable and actors involved in running the company. Innovation is seen as any change produced by technology in an organization towards the satisfaction of its economic goals, i.e., providing an economic advantage. Technological management is then the management of change, i.e., the management of technology. But it also involves management by and through technology or, in other words, how technology is used to run the company, then the management of the appropriation of technology by the organization. It is a set of tools that creates value by generating new markets and opportunities and/or by reducing production and transaction costs.”⁵

In general, technology management concerns itself with the creation or acquisition of technology, particularly the process of transforming basic knowledge, or science, into products that have practical and commercial utility in the marketplace or in internal business activities. In other words, technology management implies managing what adds value to products and services on the market to create wealth; it is therefore managing the application of knowledge and know-how in order to create value.⁶ This process is also often referred to as “innovation” and has been the subject of analysis and commentary by a wide range of academics and business consultants, particularly as to those industries that are grounded in continuous advances in scientific knowledge. Technology management also includes the steps that need to be taken to protect the technology of the firm, including the development and maintenance of an intellectual property rights portfolio, and the formulation and implementation of strategies for commercial exploitation of the company’s technological assets.

Given the uncertainties associated with the development and commercialization of emerging technologies, which are defined and discussed below, as well as the pervasive impact that all forms of technology have on the way in which organization conduct their activities, it is not surprising that technology management has become a recognized strategic and professional discipline. In addition to the general areas of interested mentioned above, technology management requires attention to a wide range of difficult specific issues, including the following:

- What procedures can be identified and implemented for identifying and evaluating technologies worthy of investment in situations where the risk associated with the development of the technologies are extremely high and the outcome of the development activities is uncertain?
- What strategies should be adopted to access the technologies needed by the company to pursue its goals and objectives, including internal development, licensing or more extensive strategic alliances with outside partners?

⁴ M. White and G. Bruton, *The Management of Technology and Innovation: A Strategic Approach* 18 (2007).

⁵ J. Chanaron and T. Grange, *Towards a Re-Definition of Technology Management* (2006).

⁶ J. Chanaron and T. Grange, *Towards a Re-Definition of Technology Management* (2006).

- How can the company identify markets that are suitable for products and services based on its emerging technologies given that the uncertainty and newness of the technology will necessarily make it difficult to gauge customer requirements, competition and the potential size of the market?
- What organizational structure should be created in order to manage the development of new technologies and their associated products and services?
- What steps need to be taken in order to perfect and maintain the optimal level of intellectual property protection for the company's technology assets, particularly in situations where patent offices have little or no experience with the technology?
- Is it possible to make an educated guess regarding the direction that new industries based on emerging technologies will take over the company's planning period?

The results of a survey conducted in the mid-1980s among academics and industrial managers from 17 countries revealed that strategic planning of technology products was clearly the highest priority with respect to technology management. Other issues, in descending order of importance, included project selection methods and criteria, methods and tools for organizational learning, identification and development of key competencies, reducing the length of the product development life cycle, creating an "ad hoc" organizational culture, coordinating and managing new product development teams, analyzing and understanding technological trends and shifts and, finally, orchestrating more involvement from marketing teams.⁷ For their part, Khalil and Bayraktar suggested that technology management requires consideration of the following fundamental questions⁸:

- How should technology be integrated into the objectives of corporate strategy?
- How can technologies be released and accessed more quickly and efficiently?
- How can technology be assessed more efficiently?
- How can the transfer of technology be optimized?
- How does one reduce the development time of a new product, process or organization?
- How should major, interdisciplinary and inter-organizational projects or complex systems be managed?
- How should the internal usage of technology within the organization be managed?
- How can the efficiency of technical personnel be improved?

Chanaron and Grange argued that strategic management of innovations and technology covers a broad range of research issue and managerial practices such as the following⁹:

- Strategic reflection on the role of technology in attaining the objectives of corporate strategy: What role and what priority should be given to innovation and technology? What are the technologies of the future? What are the mainstream trends liable to impact on the emergence and rate of diffusion? Which key technological competencies should be maintained, developed, abandoned and at what rate? What are the markets of the future?
- Strategic reflection on internal organization and industrial relations with corporate partners: Undertake, acquire or delegate technological development? Acquire, merge or develop

⁷ J. Chanaron and T. Grange, *Towards a Re-Definition of Technology Management* (2006) (citing G. Scott, *Top Priority Management Concerns About New Product Development*, 13(3) *The Academy of Management Executive* 77 (1999)).

⁸ T. Khalil and B. Bayraktar, *Management of Technology: The Key to Global Competitiveness* (1990).

⁹ J. Chanaron and T. Grange, *Towards a Re-Definition of Technology Management* (2006).

technological alliances? Which human and financial resources? Which systems should be used to assess the performances of the organization and piloting?

- Operational management of the innovation process: Management of R&D and design; management of knowledge and know-how; management of the specific competencies of technical personnel; management of R&D and design personnel; management of technological acquisitions, partnerships, alliances and contracts; management of budgets allocated to research, technological scanning and innovation marketing; management of market release
- Management of the technological value chain and innovation process: Industrial management of scientific and technical projects; management of interfaces between research and industry; management of budget allocations to research, technological scanning and innovation marketing; management of the localization of knowledge production activities, especially poles of excellence; and management of market release
- Management of innovative product marketing: Understanding the determinants of new product performance; strategies for managing competitive reactions; management and composition of new product development teams; methods for forecasting sales of new products; methods for setting prices of innovative products; management of the life of new products, including the launch agenda; and management of communication, especially the pre-announcement

It was noted that while SMEs face all or most of the problems listed above areas of particular interest for those types of firms appear to be tools and methods; scientific and technical partnership, alliances of a technological nature; funding; and marketing of innovative products and services.