Chapter 4.7

Information and Knowledge Perspectives in Systems Engineering and Management for Innovation and Productivity through Enterprise Resource Planning

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ABSTRACT

This chapter provides an overview of perspectives associated with information and knowledge resource management in systems engineering and systems management in accomplishing enterprise resource planning for enhanced innovation and productivity. Accordingly, we discuss economic concepts involving information and knowledge, and the important role of network effects and path dependencies in influencing enterprise transformation through enterprise resource planning.

INTRODUCTION

Many have been concerned with the role of information and knowledge and the role of this in enhancing systems engineering and management (Sage, 1995; Sage & Rouse, 1999) principles, practices, and perspectives. Major contemporary attention is being paid to enterprise transformation (Rouse, 2005, 2006) through these efforts. The purpose of this work is to discuss many of these efforts and their role in supporting the definition, development, and deployment of an enterprise resource plan (ERP) that will enhance transformation of existing enterprises and development of new and innovative enterprises.

Economic Concepts Involving Information and Knowledge

Much recent research has been conducted in the general area of information networks and the new economy. Professors Hal R. Varian and Carl Shapiro have published many papers and a seminal text, addressing new economic concepts as they apply to contemporary information networks. These efforts generally illustrate how new economic concepts challenge the traditional model, prevalent during the Industrial Revolution and taught throughout industry and academia over the years. In particular, the book *Information Rules* (Shapiro & Varian, 1999) provides a comprehensive overview of the new economic principles as they relate to today's information and network economy. The book addresses the following key principles:

- Recognizing and exploiting the dynamics of positive feedback
- Understanding the strategic implications of lock-in and switching costs
- Evaluating compatibility choices and standardization efforts
- Developing value-maximizing pricing strategies
- Planning product lines of information goods
- Managing intellectual property rights
- Factoring government policy and regulation into strategy

These concepts have proven their effectiveness in the new information economy and have been fundamental to the success of many information technology enterprises introducing new ideas and innovations into the marketplace. Paramount to an enterprise's success in reaching critical mass for its new product offering is the understanding and implementation of these new economic concepts.

Economides (1996) has also been much concerned with the economics of networks. He and Himmelberg (1994) describe conditions under which a critical mass point exists for a network good. They characterize the existence of critical mass points under various market structures for both durable and non-durable goods. They illustrate how, in the presence of network externalities and high marginal costs, the size of the network is zero until costs eventually decrease sufficiently, thereby causing the network size to increase abruptly. Initially, the network increases to a positive and significant size, and thereafter it continues to increase gradually as costs continue to decline. Odlyzko (2001) expands on the concept of critical mass and describes both the current and future growth rate of the Internet and how proper planning, network budgeting, and engineering are each required. He emphasizes the need for accurate forecasting, since poor planning can lead to poor choices in technology and unnecessary costs.

Economides and White (1996) introduce important concepts with respect to networks and compatibility. They distinguish between direct and indirect externalities, and explore the implications of networks and compatibility for antitrust and regulatory policy in three areas: mergers, joint ventures, and vertical restraints. They also discuss how compatibility and complementarity are linked to provide a framework for analyzing antitrust issues. Strong arguments are made for the beneficial nature of most compatibility and network arrangements, with respect to vertical relationships, and policies are set forth to curb anti-competitive practices and arrangement. Farrell and Katz (2001) introduce concepts of policy formulation in preventing anti-competitive practices and, in addition, explore the logic of predation and rules designed to prevent this in markets that are subject to network effects. This work discusses how the imposition of the leading proposals for rules against predatory pricing may lower or raise consumer welfare, depending on conditions that may be difficult to identify in practice.

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