Chapter VII
# A Diffusion Model for Communication Standards in Supply Networks

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## ABSTRACT

*This chapter presents a simulation framework that analyzes the diffusion of communication standards in different supply networks. We show that agents' decisions depend on potential cost reduction, pressure from members of their communication network, and implementation costs of their communication standards. Besides focusing on process-specific market power distributions, the impact of relationship stability and process connectivity are analyzed as determinants of the diffusion of communication standards within different supply network topologies. In this context, two real-world scenarios, from the automotive and paper and publishing industries, are used as examples for different network topologies. The results support the thesis that increasing relationship dynamics and process connectivity lead to decreasing competition of communication standards. In certain circumstances, local communication clusters appear along the value chain, enabling these clusters to preserve their globally inferior standardization decision.*

## INTRODUCTION

During the last decade, the importance of communication standards has increased due to an intensification of the relationships between supply chain companies. The ensuing demand for intra-organizational process integration and advanced communication technologies in a broad range of software and hardware, for example, XML (extensible markup language) interfaces in standard software, Web electronic data interchange (WebEDI), and so forth, has made the standardiza-

tion of communication protocols a crucial task. As a result, a discipline within standardization research has emerged that is dedicated to analyzing the impact of network topology on the diffusion of communication standards and to improving the understanding of diffusion processes in generic topological structures (Economides & Salop, 1992; Weitzel, Wendt, Westarp, & König, 2003). The objective of the work presented here is to analyze how the underlying process topology determines the dynamics of the communication infrastructure within supply networks. Based on Weitzel et al., our central hypothesis states that network topology and market power strongly influence the diffusion process of communication standards in supply networks. In particular, we pose the following questions.[1]

1.  Does market power influence the diffusion of communication standards along the value chain?
2.  How does relationship stability between supply network organizations affect the diffusion process?
3.  What effect does connectivity between the particular value chains have on the tendency toward the concentration of standards in supply networks?
4.  How do communication standards propagate along value chains and what are the consequences for the diffusion within the whole network?

This chapter introduces a simulation framework for the diffusion of communication standards in supply networks, focusing on the impact of the underlying topologies. On the assumption that the communication relationships result from supply network structures, we employ empirical data sets to model industry-specific supply networks. These topologies are the basis for simulations that analyze diffusion dynamics in supply chain settings under varying levels of flexibility, market power, and interconnectivity. However, how will

the results of this analysis help when struggling to determine the right communication standard? This chapter shows what impact different topologies and process structures in supply networks have on the diffusion of communication standards. Decision makers should not only consider the installed base[2] and the cost of standards, but should also carefully take into account the following aspects.

*   How flexible is the choice of suppliers in the value chain?
*   How connected are the value chains within the supply network?
*   Who are the central players?
*   How is the market power distributed?

In the following sections, we proceed as follows. First we provide an overview of the three most relevant areas of research concerning communication standard application; next we systematically identify relevant determinants of diffusion processes within supply networks. Based on these determinants, we then explain the simulation model and its implementation. After describing the supply web scenarios from two specific industries to analyze the diffusion of communication standards, we present and analyze the results of the simulations. Finally, we conclude with an evaluation of our findings.

## LITERATURE REVIEW

### Network Effects

The adoption of standards could create positive and/or negative network externalities called network effects (NEs) in macroeconomics. Katz and Shapiro (1985, p. 424) provide the following definition of a positive NE: "[A NE occurs in a situation where] the utility that a given user derives from the good depends upon the number of users who are in the same 'network' as he or

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