

## Chapter 2.1

# A Diffusion Model for Communication Standards in Supply Networks

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### ABSTRACT

This article 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 is 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/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 among supply chain companies. Intraorganizational process integration has resulted in a high demand for advanced communication technology, for example, XML interfaces in standard software and WebEDI. In turn, this development has made the standardization of communication protocols a crucial task. As a result, a discipline within standardization research has emerged, which 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. (2003), our central hypothesis states that network topology and market power strongly influences the diffusion process of communication standards in supply networks. In particular, we pose the following questions<sup>1</sup>:

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 has connectivity between the particular value chains 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 article introduces a simulation framework for the diffusion of communication standards in supply networks and focuses 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. But how will the results of this analysis help when struggling to determine the right communication standard? This article shows what impact different topologies and process structures in supply networks have on the diffusion of communication standards. Decision makers not only should consider the installed base<sup>2</sup> and the cost of standards but also should 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 in order 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.

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