

Chapter 14

A Stochastic Model for Improving Information Security in Supply Chain Systems

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ABSTRACT

This article presents a probabilistic security model for supply chain management systems (SCM) in which the basic goals of security (including confidentiality, integrity, availability and accountability, CIAA) are modeled and analyzed. Consequently, the weak points in system security are identified. A stochastic model using measurable values to describe the information system security of a SCM is introduced. Information security is a crucial and integral part of the network of supply chains. Each chain or driver requires a different security level according to the services it contributes to the overall SCM system. Different probabilistic weights are assigned to the four goals CIAA of security depending on the SCM driver's mission. A Semi-Markov chain model is used to describe the probabilistic nature of different security levels for each driver in the system. A comparison of the steady-state security for a multi-driver model with different levels of attack is performed, and the results analyzed. Enhanced supply chain security could be achieved by identifying the effects of attacks on the security goals of an organization. The use of this model helps to identify weak points in supply chain system security, and offers hints on how to strengthen them. The model is tested by considering intrusion scenarios representing different levels of attack on the SCM system. An analysis of the results is performed using an interactive application.

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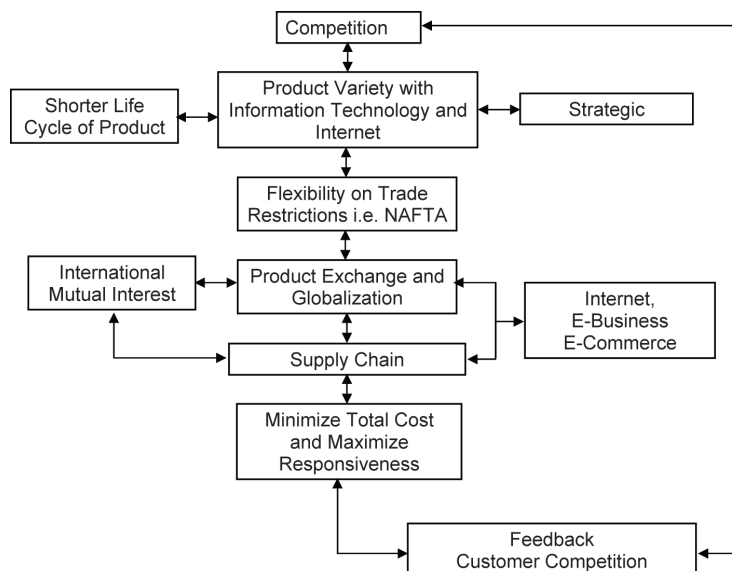
INTRODUCTION

At the present time, leaders of business and industry frequently use the acronyms of globalization, security of information technology, and supply chain management (SCM). These terms have together grown to become powerful tools for business and industry expansion. Toyota, Dell, and Wal-Mart were among the first companies to succeed in the implementation of SCM tools in their specialized industries. These tools have developed over the last two decades as a result of competitor growth and mutual international interests; which has led to the development of a variety of products. Product variety (enhanced by IT) has pressured international business to reduce the restrictions placed on global trade. Consequently, accurate information technology is a crucial part of proper integration to all parties involved in globalization and has enhanced the success of international business. Growing competition has forced companies to generate high quality, lower cost products, and maintain quick responsiveness in the delivery of products and services (Chopra & Meindl, 2004). Figure

1 shows the integration process of supply chain and globalization, as developed by the authors.

The supply chain is a complex network of facilities dispersed over a large geographical area may be across the globe. The supply chain system is a dynamic system that evolves over time due to changes in customer demand. The key issues in SCM system are a wide spectrum of corporate activities from strategic to tactical and operational levels. IT and its security are essential for the integration of the chain of SCM and securing the success. Today, business growth is enhanced by rapid development of information concerning internet-based technologies and services. Information available on the internet has provided organizations with new and creative ways to improve business processes, drive revenue growth, reduce costs and improve customer satisfaction; and consequently, facilitates the implementation of SCM systems. The evolving information systems require that the information resources need to be shared securely among customers, employees, business partners and financial institutions. With this, however, come serious security threats (Al Nunu, 2006).

Figure 1. Integration of IT into supply chain and globalization



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