

# Chapter 12

## An Empirical Investigation on the Use of Buffers and Incentives in Non- Hierarchical Networks

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### ABSTRACT

*Delivery reliability has shifted from being an order winner to being an order qualifier in many industrial and service sectors. Thus, companies are forced to take into consideration all the aspects that might impact on such an indicator. This paper focuses on the European machinery and equipment industry, an important instance of the non-hierarchical network concept, to investigate the relationships existing among supply-side uncertainty, delivery reliability to the final market and the adoption of possible leverages to mitigate problems, namely buffers and incentives. The authors formulate the research hypotheses and test them against a set of collected data in 3 European countries. The final discussion about the results provides insights about the real effectiveness of buffer and incentive based approaches, as well as some directions for future research.*

### INTRODUCTION

Since time-based competition has been widely accepted as a key to success, the on-time delivery of products and services is today recognized as a pillar of competition for many manufacturing and

service firms (Stalk & Hout, 1990; Gunasekaran *et al.*, 2001).

In many sectors, delivery reliability (providing customers the product or service on the agreed date) has shifted from being an order winner – a characteristic that will win the customer's purchase

DOI: 10.4018/978-1-4666-2773-4.ch012

– to being an order qualifier – that is, a criterion that a company must meet just to be considered as a possible supplier (Hill, 2000). With the advent of just-in-time manufacturing and quick response distribution, delivery reliability is nowadays a critical key component of order fulfillment, as well as a primary concern for many companies (Urban, 2009). However, several factors jeopardize delivery reliability such as for example:

1. Supply-side problems, due to delays in the supply process or non-conformity issues in the delivered quantities that lead to a delay in the final delivery to the market.
2. Internal problems, both in the production stage (i.e., machine breakdown, lack of human resources, workforce absenteeism) and in the planning processes (i.e., error in the planning and scheduling decisions), leading to shortages of final products and impossibility to fulfill market demand.
3. Delivery problems, comprising a vast array of issues related to transportation such as truck driver strikes, road traffic, non-optimized routing and dispatching, loss and theft, problems with custom declarations and so forth.

To tackle the above-mentioned problems, different approaches have been proposed and developed by both academics and practitioners, aiming at providing high delivery reliability levels to the market. For example, to lessen supply-side problems, a possible response is to take advantage of competition between suppliers, adopting on-time delivery as key performance indicator in the supplier selection phase. As noted by Grout (1996) about substitutive products, “historically, many U.S. firms have used competitive pressure to influence suppliers. Buyers have allocated portions of their purchases of an item to multiple suppliers. The timeliness, quality, and price of the goods from suppliers are used to determine what proportion of the purchases is allocated to each supplier”. Considering non-substitutive products,

a possibility to stimulate timely delivery from suppliers is the use of delivery time guarantees, a form of incentive contracts that allows a supplier to charge a price premium for on-time delivery, whereas when the guarantee is not met the supplier incurs a substantial penalty cost, either through direct payment to the customer, additional expediting costs, and/or through loss of reputation/goodwill and lost future demand (Urban, 2009). Considering internal problems, a possibility consists in using buffers (i.e., inventory, capacity and time) to mitigate delay impacts (Caputo, 1996; Hung & Chang, 1999; Lapide, 2008; Zsidisin *et al.*, 2000; Steckel & Kumar, 2009). Alternatively, another way discussed in literature is to adopt a robust, formal and simple mechanism to quote reliable due-dates taking into account possible internal problems (Sridharan & Li, 2008), even though this approach can be viewed as a form of time buffer, to some extent.

Due to the prominence of supply uncertainty issue in today economical environment (Aberdeen, 2005; Boonyathan & Power, 2007; O'Marah, 2009; Thun & Hoenig, 2009) and the increasing importance of delivery reliability in almost all kinds of supply chain, this study focuses on supply delivery problems with particular reference to the European machine and equipment manufacturers industry. This industry can be effectively described as a generally complex and highly volatile non-hierarchical network (NHN) composed by SMEs collaborating outside the traditional hierarchical patterns, where large companies drive all the decisions in the network viewing SMEs as merely subcontracted suppliers. The prominence of the machinery and equipment industry is testified by the fact that it represents 178 billion euro of added value (10.9% of value added in European manufacturing) employing about 3.5 million people (Eurostat, 2010). Furthermore, according to Schuh *et al.* (2010) the delivery reliability within machinery and equipment industry is really a concern, being usually estimated below 65%.

Thus, considering this industry, we investigate the relationships among supply-side issues, de-

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