Chapter 1
Exploring a Downstream Demand Inference Strategy in a Decentralized Two-Level Supply Chain

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ABSTRACT

A coordination approach for forecast operations, known as downstream demand inference, enables an upstream actor to infer the demand information at his formal downstream actor without the need for information sharing. This approach was validated if the downstream actor uses the simple moving average (SMA) forecasting method. To answer an investigative question through other forecasting methods, the authors use the weighted moving average (WMA) method, whose weights are determined in this work thanks to the Newton's optimization of the upstream average inventory level. Starting from a two-level supply chain, the simulation results confirm the ability of the approach to reduce the mean squared error and the average inventory level, compared to a decentralized approach. However, the bullwhip effect is only improved after a certain threshold of the parameter of the forecasting method. Still within the framework of the investigation, they carry out a comparison study between the adoption of the SMA method and the WMA method. Finally, they generalize their results for a multi-level supply chain.

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1. INTRODUCTION

The optimal supply chain performance requires the realization of numerous actions. Regrettably, those actions are not always in the best interest of the actors of the same supply chain. The supply chain actors are mainly focused on achieving their own objectives and that self-serving focus often leads to poor performance. However, enhanced performance is achievable if the companies coordinate their operations such that each company's objectives become aligned with the supply chain's performance. Supply chain management (SCM) is one of the most important research areas that aims to improve the overall supply chain performance.

The information sharing policy presents one of the most common managerial solutions in the SCM field. In recent years, numerous studies have highlighted the importance of information sharing within the supply chain (Lambert and Cooper, 2000; La Londe and Ginter, 2003; Trkman et al., 2006). Information-sharing contracts between economic actors in a supply chain can lead to important benefits, such as increased productivity, better policy-making and integrated services. A series of papers have argued that information sharing can reduce inventory levels and associated costs for upstream actors (Cachon and Fisher, 2000; Yu et al., 2001; Sahin and Robinson, 2005). Li (2013) has explored new ways to reduce operational costs in supply chain systems that face uncertainty about shared information. Adopting simulation, the author concluded that information sharing is essential to reduce fluctuations in stock replenishment, thereby improving supply chain performance. The replenishment of companies' inventories depends on customer demand information. To avoid the accumulation of cost-intensive and obsolete inventories, demand information must be frequently updated and shared with transparency and credibility. Trapero et al (2012) studied the impact of information sharing on supplier forecasting performance. The authors concluded that information sharing improves demand forecasting performance. Croson et al. (2014) argued that coordination through information sharing reduces the risk of a very strong demand distortion. In particular, several researchers have shown that sharing end-customer demand information reduces the bullwhip effect and lowers the average inventory level (Chen et al., 2000b; Lee et al., 2000; Cheng and Wu, 2005).

End-customer demand presents crucial information that must be well considered by all actors in the supply chain (Ciancimino et al., 2012; Asgari et al., 2016). Moreover, several researchers have devoted a high importance to customer behavioral studies (Arnould and Thompson, 2005; Badot et al., 2009; Lemoine, 2003). These studies have shown that this demand is fully shaped by consumers' ethnological and environmental components (such as the pleasure felt by the customer in the store, the state of excitement in the store, the time spent at the point of sale, the amount of purchases made, etc.).