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Introduction

Over the past two decades, competition has shifted from individual firms to whole supply chains (Lambert & Cooper, 2000; Li et al., 2006; Ballou, 2007; Christopher & Holweg, 2011). Accordingly, the scope of some of the key debates in operations management has been extended beyond a single manufacturing system to include supply chain (SC) partners and their interactions. One example of such an extension is the recent topic of supply chain flexibility (SCF) (Vickery et al., 1999; Lummus et al., 2003; Sawhney, 2006; Winkler, 2008; Stevenson & Spring, 2009), which broadens the existing debate on manufacturing flexibility (Slack, 1987; Sethi & Sethi, 1990; Gerwin, 1993) by “looking at those components that make an organization flexible and [extending] them beyond the organization’s boundaries to other nodes in the SC ” (Lummus et al., 2003, p. 3). In this context, SCF aims to promote the flexibility dimensions required by all the participants in the SC to successfully meet customer demand (Duclos et al. 2003, Coronado & Lyons 2007; Yi et al. 2011), targeting to achieve competitive advantage (Stalk, 1988; De Meyer et al., 1989; Kekre & Srinivasan, 1990; Wagner, 2010).

As SCs have become the competitiveness focus, more participants become involved in the competition environment and the relationships among them are becoming increasingly complicated, resulting in more sources of uncertainty to be dealt with (Zsidisin et al., 2005; Verbano & Venturini, 2011; Thun et al., 2011; Sofyalıoğlu & Kartal, 2012). This reinforces the growing necessity of managing risks in SCs, highlighting why supply chain risk management (SCRM) has become a recently popular topic (Autry & Bobbitt, 2008; Thun & Hoenig, 2011; Tang & Musa, 2011; Hachicha & Elmsalmi, 2013; Elleuch et al., 2014). Firms and their respective SCs are facing increasing exposure to risk (Christopher & Towill, 2002). Market globalization, reduced product lifecycles, complex international networks of industrial partners, unpredictable demands, uncertain

supply, cost pressures, the necessity of being lean and agile, increasing use of outsourcing and off-shoring, and reliance on suppliers are only some of the factors that contribute to this risk exposure (Lavastre et al., 2012; Hachicha & Elmsalmi, 2013). SCRM aims to develop approaches for identifying, assessing, analyzing, and treating areas of vulnerability and risk in SCs (Nieger et al., 2009), which increases the resilience of the SC (Pujawan & Geraldin, 2009) in addition to increasing the understanding of risk management in the current contexts of SCs.

Both SCF and SCRM have received considerable attention by academics and practitioners recently and are considered among the main relevant Supply Chain Management (SCM) topics. However, the current debate on both fields is still in their infancy and there is still a need for empirical research in SCF (Vickery et al., 1999; Sánchez & Pérez, 2005; Yi et al., 2011) and SCRM (Thun & Hoenig, 2011; Lavastre et al., 2012). One major limitation of the literature is that most of the previous studies in SCF and SCRM have been conducted within the confines of a single firm, thereby neglecting other important aspects of a SC (Moon et al., 2012; Hachicha & Elmsalmi, 2013). Various avenues exist for future research, as there is a lack of empirical multi-tier studies capable of investigating the inter-organizational components of SCF and SCRM (Stevenson & Spring, 2007; Chandra & Grabis, 2009; Fatemi, 2010; Hachicha & Elmsalmi, 2013). The need for multi-tier studies involving the analysis of not only the first-tier SC members (customers or suppliers) of the focal firm but also second-tier members (e.g., the suppliers' suppliers) is highlighted by Trkman & McCormack (2009).

Within this context, this thesis develops a multi-tier study in three SCs of the Brazilian automotive industry in order to respond to the following question: which are the main factors of flexibility and risk that affect the SC ability to deliver product to the end-customer?

To answer to this research question, this thesis has the twofold goals: (i) to exam the main restrictions at various tiers that limit the SCs' abilities to provide flexibility to the end-customers, offering an overview of existing flexibilities restrictions and (ii) to identify the main risks by investigating their manifestation in these SCs offering an initial risk profile for the Brazilian automotive industry.

The multi-tier approach adopted broadens the representativeness of the findings by embracing different interconnected SC members' perspectives, from car dealers to auto-parts suppliers. In the effort to study connected systems (rather

than individual companies and dyads), this research adopted an approach similar to previous multi-tier case studies (see for example Holweg & Pil, 2008), aiming for representation of many tiers rather than a comprehensive picture of any one tier.

In addition to advancing the academic debate on flexibility and risk at a SC level by investigating the inter-organizational components of SCF and SCRM, the research goals are particularly relevant to practitioners. An understanding of how SCs can be managed to increase their overall level of flexibility and to mitigate risk effects and of how uncertainties within and between the individual SC partners may restrict this flexibility and generate risks are crucial for SC managers across many industries. Additionally, the attempt to develop a risk profile for the Brazilian automotive industry that could serve as a guide for practitioners to start the SCRM process is needed as the few empirical findings available reveal that SCRM practices within this industry are still in their infancy (Blos et al., 2009; Thun & Hoening, 2011) and that the identification of risks can be viewed as the trigger for SCRM (Kern et al., 2012).

This thesis is organized into eight chapters, being this first one the introduction one. The second and third chapters offer a literature review on SCF and SCRM (respectively) providing a theoretical background for the case studies. Chapter 4 describes the research method adopted in the Thesis. Chapters 5 and 6 present the empirical studies on SCF and SCRM (respectively). The main discussions are embraced in Chapter 7 and the conclusion is given in Chapter 8 together with suggestions for future research.