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Internal lean practices and performance: The role of technological turbulence

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ABSTRACT

Drawing upon resource dependence theory, this study investigates the linkages from supplier partnership and customer relationship to internal lean practices. Furthermore, this study investigates the linkages from internal lean practices (ILP) to operational performance and organizational performance, and assesses the contingency perspective of these relationships with respect to technological turbulence. The study is based on a questionnaire sent to 228 manufacturing companies in the Republic of Ireland, and the relationships proposed analyzed with structural equation modeling and OLS regression. The results reveal the importance of supply chain relationships, in particular through supplier partnership and customer relationship, in that they are positively associated with ILP. Further, the study finds that ILP are positively associated with both operational and organizational performance. This study also adds to the understanding of the circumstances under which ILP impact performance in that technological turbulence was found to negatively moderate the linkages between ILP and operational performance and ILP and organizational performance. While lean practices can stimulate improved operational and organizational performance, this relationship is not monotonic and is timely to consider the rate of technological change at the time of implementing lean manufacturing.

1. Introduction

Since the publication of 'Japanese Manufacturing Techniques' (Schonberger, 1982) lean manufacturing has spread remarkably as companies such as Toyota and Boing succeeded and other companies follow their leadership (Jayaram et al., 2008; Shook, 2008). Internal lean practices (ILP) refers to the implementation of manufacturing practices focused on reduction of waste and non-value added activities, e.g. overproduction, inventory, or any other factor that can disrupt the swift even flow of goods through the supply chain, from a firm's internal manufacturing operations (Li et al., 2005; Yang et al., 2011). To capture the perceived benefits of ILP, companies have promulgated its adoption through supply chain relationships (Jayaram et al., 2008; Perez et al., 2010). In particular, buyers have sought to leverage supplier capabilities in efforts to improve performance (Stuart, 1993). They have done so by bringing suppliers closer by engaging them in planning and problem solving (Li et al., 2006; Swink et al., 2007) and even in the design and development of products (Liker and Sobek II, 1996). As such, there has been an emphasis of focus in the literature on upstream relationships (e.g. So and Sun, 2010). However, recent research has revealed the importance of downstream relationships (Droge et al., 2012), which have been overlooked within the lean literature (Martínez-Jurado and Moyano-Fuentes, 2014). It thus seems pertinent to consider supply chain relationships, both upstream and downstream, and their impact on ILP.

Herein we have adopted resource dependence theory (RDT) to explain the association between supply chain relationships and ILP. RDT posits that critical resources for organizations can be obtained from external sources (Pfeffer and Salancik, 1978). So to

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achieve reliable delivery performance of frequent small batches, practices which are central for lean, implicit forms of behavior such as information sharing and cooperation between trading partners is central (Handfield, 1993; Buvik and Halskau, 2001). Accordingly, RDT suggests that close interaction between buyers and suppliers will enable ILP.

ILP has been associated positively with operational performance (Shah and Ward, 2003); however, empirical work has not been unified in its findings (e.g. Sakakibara et al., 1997; Callen et al., 2000; Swink et al., 2005). Similarly, while lean operations have been generally shown to be associated with improved organizational performance (i.e. market-and financial oriented performance) (Fullerton et al., 2003; Eroglu and Hoffer, 2011), there are still studies offering mixed results (e.g. Balakrishnan et al., 1996; Fullerton et al., 2003; Kannan and Tan, 2005, Jayaram et al., 2008, Cannon, 2008). It has been suggested that inconsistent findings may be attributed to the complexity of the manufacturing practices-performance link, which is often regarded as self-evident and demands further understanding (Swink et al., 2005). A potential explanation for the inconsistency in the results lies in contingency theory (CT), which suggests that no universal set of strategies applies to every business situation (Lawrence and Lorsch, 1967; Ginsberg and Venkatraman, 1985) and that no single strategy is successful in every context. While the contingency view is not new in the lean literature, studies are either exploratory (e.g. Dean and Snell, 1996; Shah and Ward, 2003; Browning and Heath, 2009), or have used internal characteristics of the firm (e.g. plant characteristics) as contextual variables (e.g. Lowe et al., 1997; White et al., 1999; Cua et al., 2001; Shah and Ward, 2003; Crute et al., 2003). However, the role of external variables such as environmental dynamism remains comparatively unexplored (Shah and Ward, 2003). Environmental dynamism has been described in the literature as a multi-dimensional construct (e.g. Lawrence and Lorsch, 1967; Miller and Friesen, 1983); however, technological turbulence (TT), as one main dimension, has been under-researched in the lean literature (e.g. Chavez et al., 2013; Azadegan et al., 2013). TT refers to the rate of technological change over time within an industry (Slater and Narver, 1994; Trkman and McCormack, 2009), which arises from fast technological change in products and breakthroughs in manufacturing processes (Hsu and Chen, 2004; Song et al., 2005; Kandemir et al., 2006). Accordingly, this research extends the lean literature by investigating the ILP-performance link contingent upon TT.

Thus this research adds to the SCM and lean manufacturing bodies of knowledge by addressing three research questions: (1) To what extent do up and downstream supply chain relationships impact ILP, (2) To what extent does ILP impact performance, and (3) To what extent does TT affect the ILP and performance relationship. This study contributes to the building the RDT perspective to explain SCM and lean manufacturing phenomena (Handfield, 1993; Paulraj and Chen, 2007). By investigating the relationship between ILP and performance, in particular by considering the role of TT, this study will clarify current understanding of the topic. Importantly, this study will explore the role of external variables such as TT in impacting performance related to ILP.

2. Theoretical background and hypotheses development

2.1. Resource dependence theory

RDT suggests that organizations rely upon other entities (e.g. trading partners) to obtain resources critical to their continuing existence (Pfeffer and Salancik, 1978). The need to obtain resources creates interdependence between organizations (Barringer and Harrison, 2000). However, since this interdependence is not necessarily symmetric or balanced environmental uncertainty is created (Pfeffer and Salancik, 1978). Two strategies have been put forward to manage interdependence, and thus reduce uncertainty. One states that organizations should acquire control of critical resources – absorbing the environment – thereby decreasing dependence on other organizations. However, this strategy tends to create positions of strength, which can be exploited at the expense of weaker trading partners. Alternatively, firms can participate in inter-firm relationships and coordination efforts – negotiating the environment – in order to obtain access to critical resources and increase their power relative to competitors (Handfield, 1993; Barringer and Harrison, 2000). This study focuses on the latter form of reducing uncertainty: negotiating the environment.

RDT represents an important theoretical perspective for conducting empirical research in SCM as supply chains rely on sequential interdependence, which benefits from coordination (Paulraj and Chen, 2007). For instance, buyers can cause their suppliers to become over-dependent on them, potentially creating dissonance between both parties. According to Ketchen and Hult (2007), this strategy describes traditional supply chains wherein trading partners take advantage of resource dependence. Conversely, describing best value supply chains, interdependence and collective actions should be used to create trust rather than opportunistic behavior (Ketchen and Hult, 2007). In this research, RDT is used to emphasize how supply chain relationships are a viable mechanism for managing interdependence, thus reducing uncertainties and increasing predictability and stability of demand and supply (Paulraj and Chen, 2007).

With regard to the lean perspective, it has been argued that lean manufacturing depends on predictability and coordination, which are associated directly with supply chain relationships (Simpson and Power, 2005). Specifically, in accordance with RDT, it has been argued that buyer-supplier cooperation and coordination are associated with "implicit" forms of behavior such as suppliers reduction, information sharing, the creation of channels of communications for information sharing, and the commitment of support between the parties involved, which are a preliminary step for lean manufacturing practices such as JIT (Handfield, 1993; Buvik and Halskau, 2001). For example, Handfield (1993) explains that in this type of cooperative supply chain contexts suppliers can obtain more and better information to manage deliveries to their JIT customers, while buyers can provide more accurate schedules of requirements to suppliers so this latter can plan better their capacity more efficiently. Also in line with RDT, Buvik and Halskau (2001) argue that JIT practices imply significant structural changes towards long-term and stable buyer-supplier relationship compared to more traditional buyer-supplier relationships. These relationships provide, in turn, the necessary grounds to share insight about manufacturing process, demand patterns and quality assurance, which are key issues for lean manufacturing (Buvik and Halskau, 2001). Accordingly, RDT and, specifically, the concept of negotiating the environment provide a useful theoretical context to explain lean phenomena (Handfield, 1993), and thus we expect that close interaction between buyers and suppliers will translate into implicit benefits such as cooperative behavior and information sharing, which are necessary to reduce uncertainty and regarded as a preliminary steps in the direction of ILP (Handfield, 1993).

2.2. Supplier partnership, customer relationship and ILP

Supplier partnerships are mutually beneficial relationships between suppliers and buyers designed to leverage their individual resources and capabilities with the objective of improving

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