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Exploring the impact of innovation implementation on supply chain configuration

Yasmine Sabri^{a,*}, Guido J.L. Micheli^a, Cali Nuur^b^a Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Milan, Italy^b Department of Industrial Economics and Management, Royal Institute of Technology, Stockholm, Sweden

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ABSTRACT

Considering the foreseen digital transformation and rapid dissemination of technological innovations, this paper investigates what happens along the supply chain (SC) when process and product innovation practices are implemented. The research examines the SC strategy and configuration of four product families; it considers the configuration to incorporate the whole range of SC functions and relationships.

The paper addresses the little attention paid to the process innovation dimension in SC literature, and develops a framework capturing the dynamics between innovation implementation and configuration decisions and settings. The provided analyses guide practitioners on better management of innovation implementation along the supply chain.

1. Introduction

In the era of digital transformation, supply chains will have to accommodate an expected rapid dissemination of technological innovations (Goldsby and Zinn, 2016; MacCarthy et al., 2016). The recent technological developments can alter the landscape of the supply chain and its configuration; as such, the design of the physical, financial and information flows is expected to be revolutionised (Kearney and WHU, 2015).

Innovation is addressed extensively in the supply chain domain (e.g. Bellamy et al., 2014; Zimmermann et al., 2016); however, further attention is still needed to examine the challenges that span the whole supply chain when firms implement innovation—that is, to investigate the entire supply chain configuration, as well as the relationships among the supply chain members (Arlbjørn et al., 2011; Arlbjørn and Paulraj, 2013). The extant literature indicates that most businesses do not change the configuration of their supply chains when they start to implement innovation practices (Arlbjørn et al., 2011), which signals a misfit between the configuration of supply chains and their environment and strategy (i.e. environment-structure-strategy misfit). A better understanding of the impact of innovation implementation, from a holistic perspective, is therefore needed. By doing so, it will be possible to mitigate any risks that might propagate along the supply chain. Furthermore, such a holistic perspective will provide a more realistic analysis of the tangible impact of innovation implementation, which can lead to better management of innovation along the different phases of the supply chain.

The process innovation dimension is emerging as an interesting research topic due to the increased diffusion of digitalisation and an expected surge in process innovation (e.g. additive manufacturing, Industry 4.0 tools and AGV-managed warehouses) (Kearney and WHU, 2015; GCI and Capgemini, 2016). There is a substantial number of scholarly publications on the interplay between the

* Corresponding author at: Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Via Raffaele Lambruschini, 4/B, 20156 Milano, Italy.

E-mail address: yaminesabri.hassan@polimi.it (Y. Sabri).

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various aspects of innovation and the supply chain (Lo and Power, 2010; Pero et al., 2010; Stavroulaki and Davis, 2010; Ülkü and Schmidt, 2011; Pashaei and Olhager, 2015); however, these studies mostly address the product dimension (i.e. new product development/launch, product characteristics and design). So far, the process innovation and its implications for the supply chain have been under-researched.

The relationship between innovation implementation and supply chain configuration can be better interpreted by embracing the concepts of contingency theory, which suggest that the peculiarities of a firm's internal and external contextual environments need to be considered in its design, so as to improve its performance (i.e. to establish environment-structure-strategy fit) (Drazin and Van de Ven, 1985). This paper considers the implementation of process and product innovation practices as contextual factors, whose impact on the configuration and performance is investigated. The present research examines what happens along the supply chain when a firm decides to implement an innovation, through investigating the interplay between innovation practices' implementation and supply chain configuration—that is, investigating the aspects related to operations, supplier selection, supply and distribution network design, transportation mode, facility globalisation/localisation, sourcing decisions, and collaboration and information sharing (Chandra and Grabis, 2007; Chopra and Meindl, 2007; Farahani et al., 2014; Melynk et al., 2014).

2. Theoretical background

2.1. Definitions of innovation

Innovation is regarded as a “*complex and multi-dimensional phenomenon*” (Adams, 2003, p. 4), and its literature involves various research disciplines and definitions largely based on the classical definition of Schumpeter (1939)—i.e. that innovation entails developing new products and new forms of organisational structure, opening up new markets, creating new production functions and finding new sources of raw material. Drucker (1985) argues that innovation is the main function of entrepreneurship, whether by using new resources or developing existing knowledge resources to create what he describes as wealth at the industrial or national levels. Rogers (1998) defines innovation as the activities and changes performed to produce new or improved products or processes within a firm to improve its performance. The notion of disruptive innovation was introduced by Christensen (1997) and is related to igniting growth and creating new markets.

The conceptualisation of innovation is investigated in a number of studies—for example, the innovation typology developed in Garcia and Calantone (2002). Further categorisation can be performed depending on the range or influence of innovation activities. Classical innovation taxonomies are related to the application context—for example, product vs. process innovation (Blaug, 1963), or are based on the novelty of the innovation—for example, radical vs. incremental, technical vs. administrative (Gopalakrishnan and Damanpour, 1997). Innovation can also be considered as architectural, niche, regular, revolutionary (Abernathy and Clark, 1985), or as sustaining, evolutionary, disruptive (Christensen, 1997). The outlined discussion reveals that the innovation field of study is

Table 1

The innovation practices, context, scope and novelty addressed in the literature.

| Innovation Practices | Context | | Scope | Innovation Novelty | Source |
|--|---------|-----|--|---|-------------------------------------|
| | Prd | Prc | | | |
| - Developing new products - New forms of organisational structure - Opening up new markets - New production functions - Finding new sources of raw material supply | ✓ | ✓ | To advance industrial competitiveness | <ul style="list-style-type: none"> ● Radical ● Incremental ● Competence enhancing | Schumpeter (1939) |
| - Using new resources - Developing existing knowledge resources - Investment in machinery, marketing and training expenditures, | ✓ | ✓ | To create national wealth | <ul style="list-style-type: none"> ● Radical ● Incremental | Drucker (1985) |
| - Developing firms' intellectual property - Technology that leads to new or improved product or process - Innovative processes that ignites growth | ✓ | ✓ | To enhance firm's performance | | Rogers (1998) |
| - Introducing new products to the market | ✓ | ✓ | Creating new markets | <ul style="list-style-type: none"> ● Disruptive ● Revolutionary ● Evolutionary ● Architectural ● Niche ● Regular ● Revolutionary | Christensen (1997) |
| - New idea, process, product | ✓ | ✓ | Industrial development and productivity growth | <ul style="list-style-type: none"> ● Radical ● Incremental ● Technical ● Administrative | Abernathy and Clark (1985) |
| | | | Nurturing national economy Enhancing firm performance | | Gopalakrishnan and Damanpour (1997) |

Prd: Product innovation, **Prc:** Process innovation.

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