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Knowledge Push Curve (KPC) in retailing: Evidence from patented innovations analysis affecting retailers' competitiveness

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ABSTRACT

Previous studies have demonstrated the extent to which an analysis of patent growth can be used to study the innovation level of a certain industry, national competitiveness in terms of technological innovation, and the inventive capacity in a specific domain etc. In terms of the retail industry, there is a propensity for patenting and an increasing consumer demand for technological innovation. In fact, integrating innovative technologies, including innovative systems for conducting product searches and comparisons, and for paying, are one of the most efficient ways to create value for businesses. Building on a historical series of patents from 1990 to 2015, this paper explores the trends in the sector, analysing the increasing number of patents. Secondly it develops a predictive curve, a technology-push curve (TPC) for making some predictions about the future directions in the retail industry that might affect retailers' competitiveness and subsequent innovation management strategies.

1. Introduction

In recent years, integrating innovative technologies, including innovative systems for product search and comparison, payments, etc., has emerged as one of the most effective ways of engaging potential and existing customers and creating value (Pantano and Priporas, 2016; Pantano et al., 2017). These technological innovations involve new shopping experiences and enrich retail services by incorporating convenience, leisure and entertainment into the retail experience (Demirkan and Spohrer, 2014; Poncin and Mimoun, 2014; Hristov and Reynolds, 2015; Johnson et al., 2015; Pantano and Priporas, 2016). As a result, the available hardware and software-related innovations stimulate the retail industry to search for newer and more efficient applications in order to advance the consumer experience (interaction with retailers), improve retail management (Couteau, 2014; Hagberg et al., 2016; Pantano et al., 2017) and stimulate economic performance (Hristov and Reynolds, 2015). Choosing the technological innovation that best fits a company's strategy is difficult, due to increasingly rapid technological developments, technological complexity, the shorter technology lifecycle (Sternitzke, 2013; Han and Shin, 2014), and the time required (Pantano, 2016). Although consumers experience can be positively affected by means of technological innovation, and through process innovation (Sorescu et al., 2011), or sensory stimuli (D'Ippolito and Timpano, 2016), that not necessarily tap on technological advances, the present manuscript deals exclusively with the technological side of retail innovation. Thus, when we refer to shopping experience, only the technological side of shopping experience is involved.

The literature has indicated that leverage of the innovative forces shaping the retail sector could be fruitful for organizations and managers in their efforts to better plan investments and future strategies (Altuntas et al., 2015). Despite this, only a few preliminary research studies have attempted to examine the effects of innovative forces on the retail industry by providing empirical evidence distinguishing between high innovation and low innovation sectors (Sorace et al., 2015; Pantano et al., 2017). While these studies have partially provided an understanding of the factors driving consumers' adoption of technological innovation in retail settings and the actual innovation trends and relevant implications, the crucial issues affecting progress in the sector and the future directions still require further investigation. Moreover, the need to constantly track the technological changes so as to maintain business profitability pushes companies to seek and manage a large amount of data regarding the complexity and availability of

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technological innovations.

Literature indicates that empirical studies in various sectors (i.e. nano-technology, telecommunications, etc.) (Noh et al., 2016; Joung and Kim, 2017) have employed patent analysis to assess the key developments in innovation and technology in the sectors under investigation (Abraham and Moitra, 2001; Encaoua et al., 2006; Alfano et al., 2011; Han and Shin, 2014; Nelson et al., 2014; Tsai et al., 2016). Drawing on the current and predicted number of new patents in a given economic sector, managers may better evaluate the technological evolution in the sector. This could potentially help managers and respective organizations to create sustainable competitive advantages by being the first to identify and put in use breakthrough innovations.

Although existing studies focus their analysis on estimating the number of patents and evaluating their applicability and their changes over a particular time period (e.g. Hicks et al., 2001; Cecere et al., 2014), still they do not relate to applications in retailing and, thus, corresponding research in the particular area is scarce.

Taken together and building upon a historical series of European patents submitted from 1990 to 2015 with respect to the retail industry, the aim of this paper is to explore the trends in the sector, analysing the increasing number of patents and attempting to predict the release of new patents in the years to come through the foundation of a technology-push curve in predicting how retailing will be affected. In doing so, we implement a time-series model drawing on data provided by the European Patent Office. Given that there is a dearth of studies regarding the development of patents to be applied in retail, this study makes some predictions for the future directions in the sector, by developing a predictive model describing the future innovations in retailing.

The current study contributes to the limited body of studies in retailing in the following ways. First, it addresses the gap in the retailing literature by offering empirical findings on key areas for innovation in the sector under research based on patent analysis. Hristov and Reynolds (2015, p.128) point out that innovation literature in retailing is relatively new and fragmented. This is one of the few studies in retailing (Sorace at al, 2015; Pantano et al., 2017) that employs patent analysis. Second, it utilizes bibliometric and patent analytical methods to examine the forces affecting retailing (Daim et al., 2006; Chang, 2012; Pantano et al., 2017), it advocates that the sector is becoming a steadily innovation-oriented one. From a theoretical viewpoint, the current findings can enable an examination of the evolution of innovation and the distinct technologies that could offer a pattern on how to exploit future opportunities and increase business profits. At a practical level, retailers could use our findings to prioritize investment in technological innovation by identifying some key areas in order to gain a competitive advantage. James et al. (2015) suggest that patent data analysis could lead to helpful discoveries (i.e. trends in innovation, forecasting new technologies).

The remainder of the article is organized as follows. Next, we give a brief overview of the retailing changes that have emerged due to technology progression, and the measures utilized to evaluate levels of technological innovation based on patent analysis. Thereafter, we analyse the historical series of patents in retailing so as to detect the most critical areas and propose a technology-push curve (TPC) for the sector. Finally, we discuss the outcomes and offer suggestions for both academics and practitioners on how these insights could be used to design novel retailing management strategies.

2. Innovation protection, patent propensity and motives

2.1. Innovation in retailing

Several studies have highlighted the emerging demand for innovation in retail settings (Demirkan and Spohrer, 2014; Pantano, 2014; Hristov and Reynolds, 2015) and have focused on consumers' desire to have more pleasant shopping experiences. As a result, consumers expect that technology-based innovations will offer them both utilitarian value (support) and hedonic value (entertainment) during their shopping activities online and offline.

The potential to innovate successfully by engaging consumers is a requirement of continuous technological progression, which offers many and various innovative and interactive systems with different financial costs, risks and benefits (Pantano et al., 2013). For example, topics such as augmented reality, haptic technologies, social networks, mobile technologies and multichannel environments are considered emerging and avant-garde for research in marketing (Kushwaha and Shankar, 2013; Demirkan and Spohrer, 2014; Hagberg et al., 2016; Willems et al., 2016). Moreover, the positive impact of this technology on retailing practices emerges as another important driver of innovation in the particular sector (Hagberg et al., 2016; Inman and Nikolova, 2017; Pantano, 2014; Priporas et al., 2017). However, the heterogeneity of the potential new innovative solutions creates new opportunities and challenges for retailers, who in turn have to identify the most efficient one, so that they can deliver new stimuli and provide innovative sensorial experiences that can communicate and promote products, services, and brands (Renko and Druzijanic, 2014). Therefore, emerging technologies are dramatically changing the marketplace where companies perform. As a consequence, retailers need to develop and manage a particular technological innovation to meet consumers' expectations and organizational goals, which are important for business profitability and marketing strategy success (Grewal et al., 2017; Inman and Nikolova, 2017). On the one hand, the contemporary viewpoint in retailing centres on creating new, more cost effective, experiences for customers, and on designing direct and highly customized marketing campaigns, while handling more channels synchronously in a consumer-centered view (Cao, 2014; Cao and Li, 2015; Demirkan and Spohrer, 2014; Herhausen et al., 2015; Leeflang et al., 2014). On the other hand, prior literature on technological innovation in retailing settings mainly investigated consumers' willingness to accept these innovations, while the emerging focus has started acknowledging an innovation management approach in the sector (Cao, 2014; Demirkan and Spohrer, 2014; Hristov and Reynolds, 2015; Pantano, 2014, 2016; Willems et al., 2016).

2.2. Patents and patents growth

The introduction and gradual diffusion of emerging technologies is mainly based on the successful combination of innovations in different technological areas, e.g. digital technology and cognitive science. This creative process serves as a means of identifying new business opportunities and designing new products that could potentially help organizations create a competitive edge or maintain their competitive advantage (Lee et al., 2011). To achieve this goal, individuals and organizations standardize the outcomes of research and development via corresponding published patents. This may help the protection and beneficial exploitation of intellectual property and any new methods and tools related to technological progress in specific fields of study (Choi and Hwang, 2014; Jun, 2014; Lapple et al., 2015; Lee et al., 2011; Venugopalan and Rai, 2015; Yoon and Park, 2004).

In this vein, a number of academics have acknowledged the value of studying technological innovation and introduction of inventions via patents analysis, and some of them have also articulated the need to examine patent growth using special dedicated measures (Archibugi and Pianta, 1996; Basberg, 1987; Kim et al., 2015). For example, some indices have been proposed to measure the advancement of technology and the introduction of innovative systems in terms of patent quantity (Daim et al., 2006). This is due to patents' unique trait of effectively reflecting innovation and echoing the evolution of technology at a certain area of interest (be it geographical areas, specific sectors/industries, or countries) (Basberg, 1987). In fact, Park et al. (2005) suggest that patent documentation is a "source of technical and commercial knowledge about technical progress and innovative activity" (p. 473). Specifically, patents inform interested parties about technological foundations, including