Patenting Behaviour of Hotel Firms

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Abstract: The characteristics of the hotel industry have led to the belief that hotel innovation happens through incremental service improvement, which is hardly patentable. In addition, there is a belief that technological development occurs only by incorporating innovation from other industries. Therefore, most research on innovation in the industry excludes the patenting behaviour of hotel companies, which might be a significant gap in the literature.. This paper is set up to address this gap using secondary data regarding the patents registered by hotel firms and variables concerning the characteristics and performance of those firms. Two hundred twenty-two patents (222) from 72 hotel firms in 14 countries were analysed and categorised using a mixed approach, qualitative and quantitative. A cluster analysis generated two profiles of firms according to their characteristics and patenting behaviour. The results suggest that hotel firms tend to patent inventions useful for innovating their processes or products and applicable in other industries (*e.g.*, types of beds; flavoured beers; baskets for dishwashers). This result questions the approach of hotel firms as exclusive innovation adopters. Some hotel firms have an impressive track record of patent applications, with firms that have submitted dozens of applications each. The study has relevant implications for theory and practice, bringing a fresh approach to the study of innovation in the industry and revealing that patenting has been a growing industry trend.

Keywords: Innovation, Patent, Hotel, Hospitality, Services

1. Introduction

Globalised competition has led firms' competitiveness to depend more on developing new products and offers (Marais, du Plessis, and Saayman, 2017). This effort is also true for the hotel sector (Gomezelj, 2016) because of the constant consumer demand and preference changes. Innovation in tourism and hospitality (T&H) positively impacts business performance and regional growth (Chen et al., 2017; Randhawa, Kim, and Cichy, 2017; Tugores and Valle, 2016). Notwithstanding, one may find some contradictory results regarding how innovative these companies are. Some scholars argue that the industry is highly innovative (Backman, Klaesson and Öner, 2017; Krizaj, Brodnik, and Bukovec, 2014; Martínez-Román et al., 2015). Others argue that the degree of innovation in hotel firms is below the average in the services sector and even less when compared to nonservices industries (Baum and Ingram, 1998; Guisado-González et al., 2013). We agree with Kofler et al. (2018) that it is necessary to better understand the particular characteristics of innovation in T&H before labelling it either as highly innovative or the inverse.

Studies concerning innovation in the hospitality sector are relatively scarce (Jacob and Groizard, 2007; Orfila-Sintes and Mattsson, 2009), but the most significant gap concerns knowledge of the patenting behaviour of hotel firms. Indeed, patents cannot protect this sector's common products and services, which are easily copied and imitated by competitors (Hsu and Wang, 2015). This characteristic has led researchers in the T&H field to assume that because there are no technical components in what they sell, these firms do not usually register patents (Kofler et al., 2018) and that patenting is an irrelevant phenomenon in T&H.

Although patent analysis can help understand an innovative phenomenon (Archibugi and Pianta, 1996), patenting behaviour in T&H has received little attention in the literature, and very few scholars have addressed the topic. The exceptions are Sucurro and Boffa (2018) and Pantano and Stylidis (2021). Notwithstanding, these recent studies have a particular focus (specific country, in one case; specific technology, in another), which leaves unanswered the following questions: "*What types of patent applications do hotel firms submit?*" and "*What characterises the hotel firms that submit patent applications*?" Thus, we answer the recent call for more research on the patenting behaviour of T&H firms and its relation to innovation made by de Larrea et al. (2021).

This study's results question the approach of hotel firms as exclusively innovation adopters. The study has relevant implications for theory, trailing a fresh stream of research in T&H literature – that of patenting behaviour. Relevant implications for practitioners are also drawn by revealing that patenting has been a growing trend in the sector. To achieve competitive advantages, hotel managers should explore avenues for knowledge creation, patenting and innovation, in-house or in partnership.

2. Innovation and Patents in T&H

Innovation in T&H can take many forms due to the sector's characteristics; intangibility, inseparability, variability, and perishability. These characteristics have led to the belief that hotel innovation happens through incremental service improvement (Tajeddini et al., 2020), which is hardly patentable and, therefore, easy to imitate (Sundbo et al., 2007; Tang et al., 2015). The same characteristics also make securing legal protection of intellectual property and measuring innovation in this sector difficult (Malik et al., 2020). Additionally, it has been argued that T&H innovations are primarily imported from other sectors. In their study of innovative hotel firms in Spain, Guisado-González et al. (2013) found that the most common innovation strategy used is to acquire new technology through the purchase of machinery and equipment, followed by training the staff involved in innovation activities. Some scholars argue that the modest innovativeness of T&H firms is associated with the sector's fragmented nature, which is mainly constituted by small businesses. However, others account for highly innovative small tourist firms (Pivcevic and Petric, 2011).

Innovation in T&H -does not rely as much on technology as on human and consumer values (Orfila-Sintes, Crespicladera, and Martinez-Ros, 2005). Najda-Janoszka and Kopera (2014, p.194) compiled the specific features of innovations introduced in T&H: the dominance of non-technological innovations; hybrid innovations; innovation highly susceptible to imitation; focus on incremental innovation; supply-driven technological changes; high customer involvement; weak linkages to research and development (R&D); lack of innovation management procedures.

The propensity of firms to use patents (i.e., 'patent propensity') has been researched by several scholars, even though patents are not the only way to appropriate knowledge. Other means are secrecy, acquisition and exploitation of complementary assets (e.g., marketing and production capabilities), and time to market (first-mover advantages) (Hughes and Mina, 2010). Although some authors argue that patents have limited applicability to T&H (Janoszka and Kopera, 2014), one should not assume that hotel firms do not register patents. Other scholars (e.g., Martinez-Román et al., 2015; Pantano and Stylidis, 2021; Sucurro and Boffa, 2018;) suggest that patents on T&H may play an essential role in protecting the investment made in technologies developed to solve sector problems.

In the mainstream literature, patent analysis has proved useful for analysing technology and innovation dynamics (Dirnberger, 2016; Grimaldi, Cricelli, and Rogo, 2018). When firms invest in R&D, they generate new technologies (Wolfram, Agarwal, and Brem 2018) and then wish to protect their investment by filing a patent (Bessen and Meurer 2007). The propensity to patenting by firms depends on core technology, R&D human capital, the autonomy of R&D, and R&D collaborations with universities and competitors (Huang and Cheng (2015).

According to Oltra et al. (2010), a patent holder can set higher prices than its competitors, which allows the recovery of innovation costs. Patents grant a temporary monopoly on exploiting the knowledge created but are insufficient for translating an invention into successful innovation in the market. Notwithstanding, patenting is common among innovative organisations (Abbas, Zhang, and Khan, 2014; Ardito, D'Adda, and Messeni Petruzzelli, 2016). Patents may be beneficial for innovation because they provide an incentive to invest in R&D (Hughes and Mina, 2010), even though the role of patents varies significantly from sector to sector of the economy.

Patents are not appropriate for deducing how technology is used by a user (Kim, Kim, and Kim, 2018), but they are a common proxy of innovation activity. The number of patent grants and applications is commonly used to measure the output of the R&D stage (Ma et al., 2021). However, there has been little interest from T&H academics to use patents as an innovation proxy (Pantano and Stylidis, 2021), maybe because of the criticism of service innovation researchers that studying innovation through patents creates a bias towards the manufacturing sector, technology, and large firms (Storey et al., 2016). However, the growing trend in the patenting behaviour of T&H firms (Succurro and Boffa, 2018) suggests that this may be changing. For instance, Pantano and Stylidis (2021) found that tourism audio-visual patents registered from 2010 to 2014 had the second highest growth rate after micro-structural and nano-technology.

In their study of Italian hotel firms, Sucurro and Boffa (2018) also find evidence of patenting behaviour in the sector. The scholars categorised the patents registered by hotel firms into five categories: (1) hospitality services (*e.g.*, door security system, bathroom aspirator); (2) food and beverage services (*e.g.*, water and ice dispenser, gas deep-fryer); (3) internal organisation (*e.g.*, automated shift scheduling for employees, personal identification card); (4) tourism management/e-marketing (*e.g.*, data protection system, a device for the management of

editorial products and brochures); and (5) patents with no relation with tourism (*e.g.,* apparatus for removing hair and/or atrophying hair follicles; method and system for manufacturing a packaging unit). Sucurro and Boffa (2018) also found that patent behaviour is positively associated with measures of firm performance. Despite not directly affecting profit, it has a positive and significant association with turnover growth (measured as the yearly average change in turnover) and profitability (measured by Earnings Before Interest Taxes Depreciation and Amortisation - EBITDA).

3. Methodology

This study follows both an exploratory and a descriptive research approach. While exploring a topic now emerging in the extant literature, we will also attempt to describe the types of patents submitted by hotel firms and what characterises these firms. We will achieve this by analysing the patents filled by European hotel firms from 2000 to 2019. We chose Europe since it is the leading tourist destination worldwide. The period was considered suitable to provide an overview of patent development by hotel firms over 20 years.

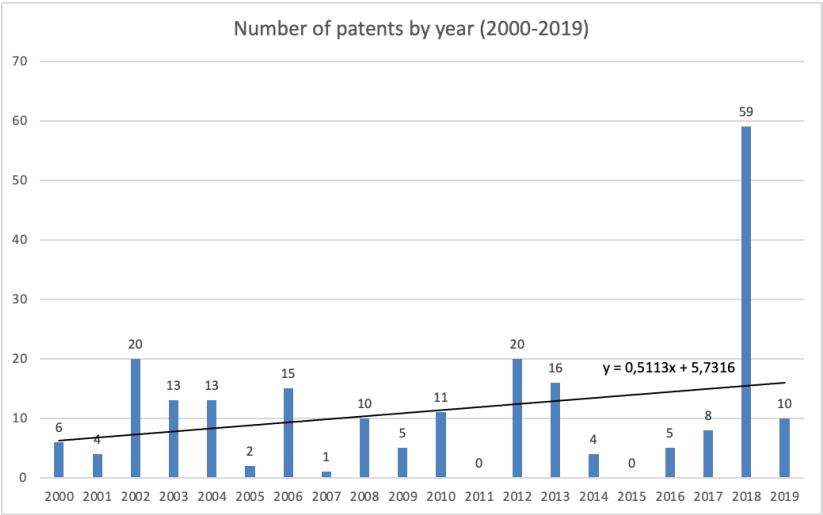
Patents are longitudinal public documents organised in standardised formats, freely available (Lee et al., 2009) regarding technical and commercial knowledge. Patents describe the technical features of an invention, criteria of originality, market attributes, inventor name, technical feasibility, and commercial value (Pantano and Stylidis, 2021). Patents are relevant empirical sources for innovation researchers because they effectively reflect innovation and synthesise technological evolution in a specific area (Pantano and Pizzi, 2020). Patents confer the patent holder the exclusive right of exploitation. This protection is limited geographically and temporarily (Najda-Janoszka and Kopera (2014).

We started by collecting the list of European firms, with the NACE Code 5510 - Hotels and similar accommodation, that had filled patents during the period in analysis from the Amadeus database. This selection yielded 72 hotel firms. In the second phase, we gather information from the same database regarding these firms' characteristics: size (number of employees), operating revenue, profit margin and the patents filled (n=222). In the third stage, we collected information for each patent using Google Patents, namely information on the patent number, patent title, patent abstract, application date, and country. We then performed a content analysis of the patents, organising the patents registered by hotel firms into categories based on similarity. Finally, we used the information concerning the categories of patents and the characteristics of firms to identify clusters of firms – i.e., groups of companies with similar patenting behaviour and characteristics.

4. Results

4.1 Longitudinal Patent Applications Analysis: 2000-2019 (20 Years)

Figure 1 shows a growing trend in the number of patents in the period analysed. The highest number of patents registered was 59 in 2018 (an outlier considering the other years' results), followed by 20 patents registered in 2002 and 2012. In 2011 and 2015, no patents were registered.



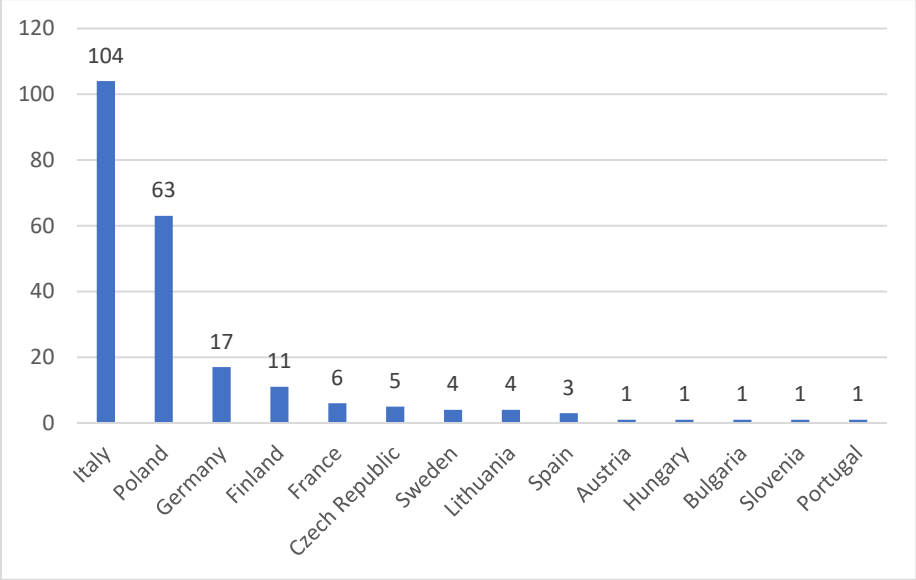
Source: The authors

Figure 1: Number of Patents by Year (2000 – 2019)

The average of the series of data is 11.1 patents per year, with a standard deviation (S.D.) of 12.5. In the first decade analysed (2000 to 2009), 89 patents (40% of 222) were filled. In the second decade (2010 to 2019), 133 patents (60% of 222). So, there is a significant increase in the number of patents from the first to the second decade.

4.2 Patents by Country of Origin of the Firm (2000-2019)

In the total of 222 patents, Italy stands out with 104 patents, followed by Poland with 63. Germany and Finland come third and fourth, with 17 and 11 patents, respectively. Another group consists of France (6), the Czech Republic (5), Sweden (4), Lithuania (4) and Spain (3). With only one patent, one finds Austria, Hungary, Bulgaria, Slovenia, and Portugal (see Figure 2).



Source: The authors

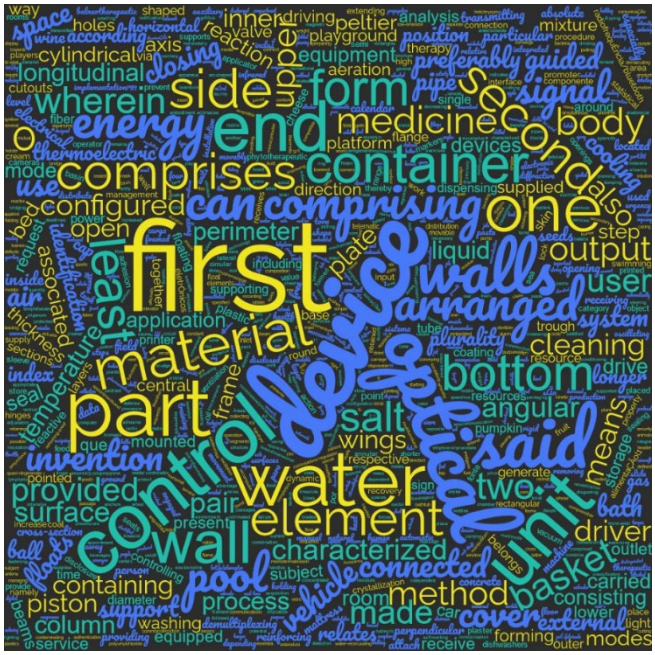
Figure 2: Number of Patents by Country (period: 2000 – 2019)

4.3 Thematic Analysis

According to the type of innovation, following the Oslo Manual (Data, 2005) typology, we found that of the 222 patents analysed, 188 (about 84,7%) are product innovations and the remaining 34 (15,3%) concern process innovations.

Concerning the areas of the patents, we highlight those related to the digital context, those related to SPAs, health and wellness, and those related to food and beverage (F&B). In the first case, we observed that the total number of patents related to the digital context was 17, representing only 8% of the total, and non-digital technology patents amounted to 205 (92%). Contrarily, there is a reasonable number of patents related to SPAs, health and wellness and F&B. In the first case, 23 patents were identified, representing 10% of the total. Concerning F&B, they totalled 20 patents (9%).

Figure 3 is a word cloud based on the patents' abstracts, representing words with four characters or more that appeared more than 15 times in the abstracts of the patents. The word 'device' confirms that most patents concern some devices, although not all are related to the industry. Words such as 'water', 'control',' container', 'salt', 'cleaning', and 'pool' highlight the significant issues these hotel firms were trying to address.



Source: The authors

Figure 3: Word Cloud Based on the Abstracts of the Patents

4.4 Clustering Results

A two-step cluster analysis was performed using the number of patents as the clustering variable. Seventy-one companies were included in the analysis since one of the companies (with 46 patents) was considered an outlier. Two clusters were identified. Cluster 1, the largest, comprises 64 companies with a mean result of 1.7 patents (S.D. = 1,15) in the period analysed. Cluster 2 includes seven firms with a mean result of 9,6 patents (S.D. = 2,23).

The two clusters were compared regarding three characterisation variables: operating revenue, profit margin and the number of employees in 2020. Table 1 shows that firms in Cluster 1 have lower operating revenue and profit margin but more employees than those in Cluster 2, which are smaller but more resilient firms. These firms are also more innovative than firms in Cluster 1 when accounting for the number of patents. 2020 was a year where both revenue and profit margins of hotel firms were significantly affected by the COVID-19 pandemic. Therefore, we interpreted the differences between the two clusters regarding financial outcomes as a proxy for resilience.

Table 1: Differences Between Clusters

		Average	SD
Cluster 1	Operating revenue	4575,38	17698,46
	Patents	1,70	1,15
	Profit margin	-47,67	133,69
	No. employees	109,04	512,03
Cluster 2	Operating revenue	12767,91	23495,01
	Patents	9,57	2,23
	Profit margin	-10,01	12,11
	No. employees	47,14	61,91

Source: The authors

5. Discussion, Limitations and Future Research

In this study, we attempted to answer the research questions "*What types of patent applications do hotel firms submit?*" and "*What characterises the hotel firms that submit patent applications*?". The results suggest that

hotel firms tend to patent inventions useful for innovating processes or products. However, European hotel firms mostly register patents for devices that constitute product innovations. Although some patents are helpful for hotels themselves, they are also applicable in other industries (*e.g.*, types of beds; flavoured beers; baskets for dishwashers). In this regard, our results are similar to those of Sucurro and Boffa (2018), who found that most patents are unrelated to hotel firms' core business. Most of the categories Sucurro and Boffa (2018) found were confirmed in this study: hospitality services, food and beverage, internal organisation, and patents unrelated to tourism.

Concerning our second research question, we found two types of hotel firms regarding patenting behaviour. In the larger group (64 firms), we found firms with lower operating revenue and profit margin but more employees than those in the smaller group. This smaller group of firms (7) have better performance, are smaller firms in terms of the number of employees, and by this measure (no. of patents), more innovative (Abbas, Zhang, and Khan 2014; Ardito, D'Adda, and Messeni Petruzzelli, 2016). Concerning the differences between the groups regarding firm performance, our result is similar to Sucurro and Boffa's (2018). Our results are, however, surprising in what concerns firm size and patenting level. It is argued in the literature that small firms are less likely to use patents to protect their investment and more likely to use secrecy (e.g., Hughes and Mina, 2010). However, our results reveal that the hotel firms registering more patents are smaller than the other group.

Previous studies on the patenting behaviour of hotel firms have a narrow focus (a specific country, in one case; a specific technology, in another). By addressing a larger data set, our study has relevant implications for theory, bringing a fresh approach to the study of innovation in the industry and revealing that patenting has been a growing industry trend. Therefore, we question the approach of hotel firms as exclusive innovation adopters. The study has relevant implications for theory, trailing a fresh stream of research in T&H literature – that of patenting behaviour of hotel firms. We agree that the standard indicators used in international statistics, such as the number of patents and R&D investments, are insufficient to learn about T&H innovation patterns, as has been substantially argued in the literature (Janoszka and Kopera (2014). However, they should not be discarded, as our results suggest.

Our results are also relevant for practitioners. Firstly, by highlighting the association between innovation and firm performance and, secondly, by revealing that hotel managers should explore avenues for knowledge creation, patenting and innovation, in-house or in partnership, to achieve competitive advantages. Considering the trend in the industry, managers, when trying to capture returns from innovation investments, should consider whether or not to patent. Furthermore, the motives to file patents go beyond appropriation. They include improving corporate image and motivating employees (Blind et al., 2006). To explore in-house innovation opportunities, hotel managers should support the intrapreneurial efforts of their employees (Calisto and Sarkar, 2022). Similarly, managers should consider that high personnel turnover constitutes one of the most important sources of internal innovation barriers (Hjalager, 2002) for T&H firms.

This study has limitations, the first being that it relies totally on secondary data and, therefore unable to understand the motives behind the patenting behaviour of these firms or how the process developed. This should be explored in future research. Additionally, it is essential to consider that patent analysis has some limitations (Ardito, D'Adda, and Messeni Petruzzelli, 2016), mainly because not all inventions are technically patentable (Archibugi and Pianta, 1996). Additionally, the simple count of patents does not inform the economic value of the developed technologies. Future studies should also focus on how hotel firms with registered patents use those patents. Notwithstanding these limitations, this study's results highlight the need for more studies on the patenting behaviour of hotel firms and, in the same line, of other hospitality firms, such as restaurants or cruise firms.

6. Conclusive Notes

Since most research on innovation in the industry excludes the patenting behaviour of hotel firms, we address this gap in the T&H literature, using secondary data regarding the patents registered by hotel firms and variables concerning the characteristics of those firms. Two hundred twenty-two patents (222) from 72 hotel firms in 14 countries were analysed and categorised using a qualitative and quantitative mixed approach. Our results question the approach of hotel firms as exclusive innovation adopters. Some hotel firms have an impressive track record of patent applications, with firms that have submitted dozens of applications each, and regarding the countries of origin of the patents, Italy stands out from the rest.

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