

HALE ALAN

Analyzing and mapping the use of trademark and patent data in management and business research: A bibliometric analysis

Abstract

Research background and purpose: Trademark and patent data are widely recognized as key indicators of innovation and creativity. In recent years, the scope and analytical value of these datasets have expanded considerably, enabling the generation of novel insights and enhancing the informational content of intellectual property records. This study examines the principal themes underlying the use of trademark and patent data, demonstrating their relevance and applicability across diverse areas of management and business research. Moreover, the study identifies the most salient topics and uncovers potential research gaps that warrant further investigation and hold promise for advancing the understanding and application of innovation metrics.

Design/methodology/approach: This exploratory–descriptive study employs bibliometric methods to analyze scholarly publications on patent and trademark data. Co-word and thematic evolution analyses were conducted to identify trends and intellectual structures within the literature. Author-assigned keywords were systematically extracted and analyzed. Data were retrieved from the Web of Science (WoS) database, covering the period 2012–2023, with the search limited to the business, and management category.

Findings: The findings demonstrate that the growing relevance of scientific databases is closely linked to the strategic use of patent and trademark data in driving knowledge accumulation and innovation insights. The results of the study demonstrate that there is a significant scope for further exploration of a variety of concepts and topics related to interdisciplinary fields within the datasets of patents and trademarks. The findings of this review illustrate that the emergence of key themes associated with the accumulation of scientific databases is driven by the utilization of patent and trademark datasets. These include the terms "innovation", "research and development", "performance", "technology", "absorptive capacity" and "knowledge". The themes of "entrepreneurship", "sustainability", "leadership", "organizational change", "self-efficacy", "self-employment", "social capital", "commercialization" and "creativity" are evident in both the patent and trademark datasets and can be distinguished from other themes in literature.

Value added and limitations: This review adds value by identifying dominant research areas, influential publications, and emerging trends, while also highlighting understudied topics and knowledge gaps that offer opportunities for future research and strategic advancement of the field. A potential limitation is the reliance on a single academic database.

Keywords: *patent, trademark, innovation, bibliometric analysis, science mapping*

JEL

Classification: M00, M1, O32, O34, F17

Received: 2025-11-05; **Revised:** 2026-01-19; **Accepted:** 2026-02-09

1. Introduction

Intellectual property rights encompass a broad spectrum of legal protections, including patents, service marks and trademarks, copyrights, industrial designs, geographical indications, related rights, industrial layout designs (topographies), and trade secrets, as defined by the World Intellectual Property Organization (WIPO). Intellectual property (IP) is generally understood as creations of the human mind – such as inventions, literary and artistic works, symbols, names, images, and designs—that are used in commercial and economic contexts (Lee et al., 2022). As intangible assets, IP rights play a central role in shaping firms’ competitive strategies, innovation trajectories, and value creation processes.

Since the 1960s, academic research has progressively advanced understanding of the relationship between intellectual property and economic performance. Early studies focused primarily on patents as indicators of technological progress and innovation intensity. Over time, however, attention has expanded to include other forms of IP, particularly trademarks, which have emerged as strategically significant instruments enabling firms to compete based on brand identity, reputation, and market differentiation rather than price alone. Trademarks are especially relevant in industries characterized by low technological complexity, non-functional innovation, or limited patentability, where differentiation is achieved through branding, design, and symbolic value rather than through formal technological invention.

While patents are predominantly associated with the protection of technological inventions and are often used to signal firms’ engagement in innovation-driven business models, trademarks are more closely linked to downstream stages of the innovation process, particularly commercialization, branding, and marketing activities (Mendonça et al., 2004). Trademarks facilitate value appropriation by enabling firms to communicate quality, reliability, and distinctiveness to consumers. Although the intersection between patent protection and trade secret law has attracted scholarly interest, trademarks continue to play a critical and enduring role in corporate strategy. Despite their importance, relatively few studies have examined the long-term and longitudinal effects of trademark activity on firm performance and innovation outcomes, pointing to a notable gap in literature.

Patent information represents a technology-based competitive strategy, as patent documents disclose both technical specifications and commercially relevant information. When systematically analyzed, patent data offer valuable insights into firms’ technological capabilities, innovation strategies, and management of high-value intangible assets (Lee & Lee, 2017). In contrast, trade secrets protect commercially valuable information that firms choose not to disclose publicly, thereby maintaining exclusivity without formal registration. Patent documents typically contain detailed technical descriptions, classifications, and symbolic elements – such as keywords and claims – that define the

goods and services offered to the market. These characteristics signal firms' investments in research and development (R&D), technological competencies, and long-term innovation strategies. By granting exclusive rights, patents restrict unauthorized use and imitation, enabling firms to appropriate returns on R&D investments and sustain competitive advantage (Lee & Lee, 2019).

Several major institutions maintain extensive and widely used patent and trademark databases that support academic research and policy analysis. Among these, the United States Patent and Trademark Office (USPTO) provide one of the most comprehensive and accessible patent databases, including detailed information on patents linked to publicly funded research and identifiable project numbers. This transparency has encouraged extensive scholarly use of USPTO data. Similarly, the European Patent Office (EPO) and the World Intellectual Property Organization (WIPO) offer large-scale, internationally comparable patent datasets that facilitate cross-country and longitudinal analyses. In the domain of trademarks, the Office for Harmonization in the Internal Market (OHIM) now the European Union Intellectual Property Office (EUIPO) along with national trademark offices, provides particularly suitable resources for analyzing non-technological and market-oriented innovation. Millot (2009) notes that trademark data derived from these sources are especially valuable for capturing innovation activities that are not reflected in patent statistics.

The growing availability of IP databases has coincided with the increasing use of bibliometric and data-driven analytical methods in management and business research. Bibliometric data now constitutes a foundational component of contemporary evaluation and mapping approaches, enabling researchers to identify conceptual structures, thematic patterns, and knowledge dynamics within large bodies of literature. The integration of advanced analytical techniques – such as co-word analysis, network visualization, and thematic evolution analysis – into patent and trademark datasets has significantly enhanced the precision and explanatory power of IP-based research.

Against this background, the present review aims to conceptually map and synthesize the key constructs, themes, and research streams in management and business studies that employ patent and trademark data. By examining how IP-based datasets are combined with other empirical sources, this review clarifies dominant and emerging research areas while identifying unresolved conceptual issues and promising directions for future theory development and empirical inquiry. In doing so, it contributes to a more integrated understanding of intellectual property data inform management and business research.

Prior studies demonstrate that patent and trademark indicators can yield insights extending beyond innovation outcomes alone. For instance, DeGrazia et al. (2020) show that IP-based measures can shed light on broader organizational and societal

phenomena, including working conditions and labor-related dynamics. Despite such contributions, a substantial number of topics within the core domains of business and management remain insufficiently explored. Existing research has often employed patent and trademark data in isolation, resulting in fragmented applications and limited integration across theoretical perspectives and research traditions.

Moreover, IP-related datasets are inherently dynamic, reflecting firms' and other economic actors' abilities to anticipate, respond to, and shape emerging technological trajectories and evolving market demands. This dynamic character underscores the considerable yet underutilized potential of patent and trademark data for advancing management and business research. Accordingly, this review is guided by the following research questions:

- RQ1: What co-occurrence patterns of themes and conceptual perspectives emerge in management and business research using patent data?
- RQ3: What co-occurrence patterns of themes and conceptual perspectives emerge in management and business research using trademark data?
- RQ3: How does the combined use of patent and trademark data reveal co-occurring themes and conceptual perspectives in management and business research, and which of these dominate the existing literature?

This review addresses these questions by systematically assessing the application and significance of patent and trademark data in academic publications and by identifying gaps in the extant literature. To respond to each research question, relevant studies were retrieved from the selected database, systematically grouped, and presented sequentially to provide a structured and comprehensive synthesis of the field.

2. Literature review

2.1. Patent dataset usage

Patents are widely recognized as key outputs of research and development (R&D) activities and are among the most frequently used indicators of innovation (Gotsch & Hipp, 2014). They play a significant and positive role in enhancing a company's performance by capturing and evaluating innovative ideas and R&D inputs (Agostini et al., 2016). In general, patent rights enable inventors to protect their novel inventions from unauthorized use by third parties. However, the continuous accumulation of patent data presents growing challenges for data management (Sjögren et al., 2018). To maximize the utility of patent data, it must be made accessible and organized in a simplified format. This includes the use of techniques that facilitate patent classification and highlight the content effectively (Souza et al., 2021).

Two main approaches – deductive and abstractive – are commonly used to summarize accumulated data. The deductive approach focuses on identifying key statements or keywords that capture the overall meaning of a document, aiming to extract essential information directly from the text (Wang et al., 2011). In contrast, abstractive summarization seeks to develop a more interpretive understanding by expressing the core message of the text in natural language. This approach uses linguistic and semantic techniques to analyze and represent the content, ultimately producing a coherent abstract that reflects the main points of the original text (Wang et al., 2011).

Patent-based indicators are widely regarded as some of the most important and frequently used measures of innovation, largely due to the strong link between patents and innovative output. Patents serve not only as legal instruments but also as rich sources of technological and economic information. However, there is no standardized method for analyzing patent data. The interpretations derived from patent statistics can vary significantly, depending on the analytical frameworks or policy objectives being applied.

Patent analysis enables a comprehensive understanding of collaborative studies in emerging technologies and the current landscape of market development by revealing the technological development processes within industries (Chang, 2022). Such analyses allow for the observation of emerging trends in specific technologies. By applying text mining techniques to patent data, researchers can trace the trajectory of technological advancement and identify new opportunities for innovation.

To explore the expansion of technological progress, patent citation networks are commonly utilized. For instance, Hu et al. (2012) introduced the concept of the ego patent citation network, a framework used to assess the value of patents. Lee et al. (2015) noted that the structural characteristics of such networks can reveal important attributes of patents, including their technological significance and influence.

Patent records have been widely used in numerous studies to determine the status of various industries and to map the distribution of technological development through data mining methods. In particular, social network analysis has emerged as a prominent technique for examining technological interactions and industry-specific shifts. This approach uncovers the relationships and patterns within patent data, offering insights into how technological fields evolve and interact (Lee et al., 2015; Hu et al., 2012; Gress, 2010; Daim et al., 2012).

2.2. Trademarks dataset usage

Trademark applications and registrations provide valuable information that can serve as objective indicators for assessing changes within specific sectors or regions over time. The literature has increasingly clarified the potential uses and outcomes of analyzing trademark data (Castaldi et al., 2022). Trademark analysis offers a promising approach to

addressing some of the limitations of traditional innovation research and measurement indicators, particularly in sectors such as manufacturing (Hipp & Grupp, 2005). This includes studies that examine regional disparities in innovation performance and patterns of product diversification (Schautschick & Greenhalgh, 2016).

For small businesses and firms operating in the service industry, trademark-based analyses can help assess current performance levels and identify business potential. However, Iversen and Herstad (2022, p. 276) argue that obtaining reliable and valid results for businesses with such characteristics remains challenging due to the limited availability and granularity of relevant data.

According to Castaldi (2018), trademarks serve two primary functions: first, as signals of a company's resources, and second, as identifiers that distinguish those resources from competitors. Building on this perspective, Gotsch and Hipp (2014) contend that the analysis of trademark data offers valuable insights for innovation research, particularly within the manufacturing industry. They argue that such analyses help address the challenges inherent in assessing abstract innovation concepts – an argument also supported by Hipp and Grupp (2005). The practical relevance of trademark data for studying innovation has been further demonstrated in several empirical studies (Amara et al., 2008; Gotsch & Hipp, 2012; Mendonça et al., 2004).

Trademark analysis offers valuable insights into innovation within the service sector and is often regarded as a more effective approach than conventional survey-based methods (DeGrazia et al. (2020). According to DeGrazia et al. (2020), indicators derived from trademark data can also inform commercial decision-making, economic forecasting, and the development of government policies. A growing body of research has identified strong relationships between trademark indicators and the innovative activities of service-oriented industries (Jensen & Webster, 2011; Schmoch & Gauch, 2009; Greenhalgh & Rogers, 2007). Compared with patents, trademark data are particularly useful for capturing innovations that lack technological novelty or are not intended for legal protection through patenting (Milot, 2011).

Castaldi and Mendonça (2022) emphasize the increasing importance of trademarks as strategic assets for analyzing regional innovation patterns, industrial dynamics, and entrepreneurial success. Similarly, González-Pedraz and Mayordomo (2012) found that financial markets exhibit a significant short-term response to developments in the trademark sector. Their study revealed that trademark registrations are associated with positive market returns, whereas trademark cancellations correlate with negative yields. These findings highlight the strategic potential of trademarks for banks, particularly when leveraged as a source of competitive advantage in the development of new financial products.

Bei (2019), using trademark data from the United States Patent and Trademark Office (USPTO), examined the relationship between trademarks and firms' technological acquisition strategies. The study found that manufacturing companies with strong and

innovative trademarks are generally less likely to commercialize external inventions, and when they do, their innovation performance tends to be lower. However, when entering new industries, firms with high-value trademarks are more likely to successfully commercialize external innovations. These findings suggest that trademark strength not only reflects internal innovation capabilities but can also facilitate cross-sector innovation initiatives.

2.3. Contribution of patent and trademark datasets to management and business literature

The contribution of patents and trademarks to firms' marketing value – as well as their impact on market performance, economic outcomes, and marketing capabilities – has been widely examined in the management and business literature. Innovation researchers increasingly rely on patent and trademark indicators at both national and international levels, as these datasets provide objective and quantifiable measures of innovative activity. Moreover, such indicators are widely recognized as reliable and valid tools in economic and management research, particularly for benchmarking, ranking, and conducting cross-country comparisons.

A substantial body of research has examined the role of patents in shaping business strategies. Scholars in this field have enhanced understanding of technological development, business models, and organizational capabilities, while also supporting research on the creation of new products and trademarks (Flikkema et al., 2014, 2019; Sandner & Block, 2011). Although patents are widely used to represent the technological outputs and capabilities of R&D-intensive firms, several studies suggest that they provide only limited insight into actual innovation outcomes (Castaldi & Dosso, 2018, p. 2).

Vries et al. (2017) distinguish between two key intellectual property tools by asserting that patents primarily serve to protect technological innovations, whereas trademarks are intended to strengthen marketing efforts. In this regard, Flikkema, De Man, and Wolters (2010) argue that branding enhances the marketability of a company's assets, increases the perceived value of its offerings, reinforces its corporate image, and improves both customer loyalty and negotiation power. Within the management domain, branding is often interpreted as a response to evolving business practices, which Çela (2015) characterizes as a form of "management fashion" (see also Greenhalgh & Rogers, 2007).

Numerous empirical studies have examined the relationship between trademark usage and firm performance, consistently providing robust evidence that trademarks have positive effects on both economic and marketing outcomes (Greenhalgh & Rogers, 2007; Griffith et al., 2005; Krasnikov et al., 2009).

Lee and Lee (2017) analyzed trademark and patent datasets using text mining techniques to identify emerging business opportunities. Their study found that,

despite its potential to reveal promising and evolving business areas, the combined use of patent and trademark data has received relatively little attention in research. To uncover technology-driven research gaps and business opportunities, data mining and text mining methods are applied to correlate commercial trademark data with technological patent data. While patent data are primarily used for competitor analysis due to their focus on technological attributes, trademark data provide insights into business sectors that generate market interest. When gaps or issues that could contribute significantly to the fields of business and management are linked with patent data (reflecting technological aspects) and trademark data (reflecting commercial aspects), meaningful and robust results can be achieved through integrated analysis.

3. Methodology and dataset

3.1. Data analysis

This study falls within the exploratory-descriptive research category and employs the bibliometric method to analyze academic and scientific output related to trademark and patent data. Bibliometrics, first defined by Pritchard (1969), is a quantitative methodology that focuses on measuring the volume and patterns of scientific publications using statistical indicators. As a scientific discipline, bibliometrics serves not only to quantify technological research output but also to assess its development and implementation over time. This study offers a retrospective analysis of academic publications that utilize trademark and patent datasets, aiming to evaluate the academic contributions within this domain. Through this analysis, the interconnections between publications are identified, and the structure and evolution of the research field are mapped.

Following the conclusions of Choi and Hwang (2014), the study also recommends conducting community network analysis after establishing a keyword network. This subsequent analysis should be grounded in significant technological insights extracted from individual patents using text mining techniques, thereby offering a deeper understanding of thematic clusters and technological trajectories. Patent literature represents a rich and valuable source of data for analyzing and understanding major technological developments. Through a systematic approach involving correlation, measurement, and comparison, researchers can extract meaningful insights into the technological landscape (Wartburg et al., 2005).

To examine trends and relationships, co-word analysis and thematic evolution analysis were conducted. In addition, search keywords were extracted from the selected publications and systematically analyzed. Although the study draws on a single academic database, the Web of Science (WoS), this choice is methodologically

justified. WoS was selected due to its stringent journal selection criteria, comprehensive indexing standards, and its focus on high-quality, peer-reviewed scholarly output. The dataset spans the period from 2012 to 2023, a timeframe that captures the most relevant and mature developments in the field. Consequently, while the reliance on a single database represents a delimitation, it does not compromise the analytical rigor or the validity of the findings. Its standardised, comprehensive citation metadata enable reliable bibliometric analyses, including co-word and thematic evolution analyses. Thanks to its broad disciplinary coverage and international recognition, WoS provides a robust and authoritative dataset for examining thematic trends and intellectual structures in management and business research. The search on WoS was conducted within the business, and management category.

The following keywords were used in the search process: “patent”, “patent data”, “patent dataset”, “patent analyses”, “patent registration”, “patent application”, “patent statistic”, “patent licensing data”, “patent index”, “patent transfer”, “patent citation-network analysis”, “trademark”, “trademark data”, “trademark dataset”, “trademark analyses”, “trademark registration”, “trademark application”, “trademark statistic”.

In conducting this integrative review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were applied to ensure transparency and replicability in the identification, screening, and selection of relevant studies, particularly with respect to clearly defined inclusion and exclusion criteria (Moher et al., 2009). Consistent with Zupic and Čater (2015), a bibliometric approach was employed as a systematic and objective method to map the structure of the literature, identify influential publications, and analyze thematic patterns within the field, thereby reducing subjectivity in the review process.

3.2. Themes in the literature

A bibliometric analysis is a methodology that may be utilized to identify the authors and publications that have exerted the most significant influence within a specific field of study. However, to classify these in more specific thematic groups, additional analysis is required based on Keyword Plus Analysis. The terms used by authors who focus on literature and the keywords used in this area were explained so that we can find the right publications. Table 1 illustrates the various research inquiries and sources pertaining to management and business literature, organized according to themes and keywords. This is derived from the relevant studies that were used and evaluated for the patent and trademark datasets.

Table 1. Themes and keywords in management and business literature

Search terms	Related keywords	Sample references
Patent citation-network analysis	Technological trajectory Design hierarchy Network analysis Technological knowledge flow Network invulnerability Technology cluster Centralization Diffusion Information Innovation Knowledge spillover Reciprocity External learning Knowledge acquisition Localization Standardization Essential patents Main path analysis Panel data econometrics Knowledge flow Link prediction Future-oriented analysis Technological forecasting Social change Patent strategy property rights Regulatory systems	Malhotra et al., (2021); Choe et al., (2016); Lin et al., (2021); Sharma and Tripathi, (2017); Hur, (2017); Bekkers and Martinelli, (2012); Suh, (2015); Smojver, Štorga and Zovak, (2021); Kim and Bae, (2017); Barber and Diestre, (2022).
Patents Patent registration Patent application	Nanotechnology International collaboration Network analysis State-owned enterprises Innovation High-tech industries Knowledge intensive services Firm performance Government policy Invention disclosure University-industry technology Transfer Institutional change Subsidy Quality Regional resilience Competition Triadic patents Topic model Timing Innovation policy Biomimetic Social implementation	Zheng et al., (2014); Castelnovo, (2022); Christodoulou et al., (2018); Fong et al., (2018); Thakur-Wernz and Wernz, (2022); Dang and Motohashi, (2015); Dong and Yang, (2019); Dosi et al., (2017); Klemetsen, et al., (2016); Filippetti et al., (2020); Graham et al., (2013); Choi and Hwang, (2014); Goel and Saunoris, (2020); Lee et al., (2015); Graham et al., (2018)

Patent data Patent dataset	Artificial intelligence Machine learning Biotechnology Joint patents Innovation value Technological alliances Academic patenting University-industry collaboration Technology transfer	Giczy et al., (2022); Ardila et al., (2020); Wang and Jiao, (2022); Agovino et al., (2018); Correa and Ornaghi, (2014); Forestal et al., (2022).
Patent analysis Patent statistic Patent index	Startup innovation Sustainable development Sustainability Innovation Top management team Exploration	Kwon, (2019); Guderian et al., (2021); Santos and Qin, (2019); Lee and Lee (2017); Zhang et al. (2022); Altuntaş et al., (2015); Lawson, (2013); Noh et al., (2015).
Trademark dataset Trademarks data Trademark indicators Trademark analyses Trademark registration Trademark application	Technological alliances Complementary assets External technology sourcing Innovation Regional resilience Assets, capabilities Operationalization Strategies Firm survival Firm productivity Revenue growth Firm profitability Firm market value	Butticè et al., (2020); Melnyk et al., (2014); Alan and Koker, (2021); Filippetti et al., (2020); Ribeiro et al., (2022); Graham et al., (2018); Schmoch, (2003); Mendonça, et al., (2004); Castaldi, (2020); Castaldi and Dosso, (2018); Santos et al., (2022); Iversen and Herstad, (2022); deGrazia et al., (2020); Jensen and Webster, (2008); Buddelmeyer et al., (2010); Helmers and Rogers, (2010); Schautschick, (2015); de Rassenfosse, (2017); Graham et al., (2013); Gotsch and Hipp, (2012:2014); Bei, (2019); Crass et al., (2019);
Trademark and Patent dataset	Business opportunity Competitor intelligence Technology-based SMEs Intellectual property Economic and financial performance Complementarity Super modularity Innovation	Lee and Lee, (2017); Thoma, (2020); Agostini et al., (2016); Kaivo-oja (2016); Llerena and Millot, (2020); De Vries et al., (2017); Alshowaish et al., (2022); Heikkilä, (2019);

Source: own study

Table 1 provides a comprehensive overview of a range of studies, enabling the drawing of conclusions and subsequent analysis. It also highlights key research themes that can be used to identify publications addressing specific research questions. Additionally, a list of related keywords has been compiled. To select the most relevant publications and obtain representative samples within the specified area, three selection filters were applied. Duplicate or repetitive publications were excluded to prevent data redundancy. Following a detailed examination of each publication title, studies deemed irrelevant

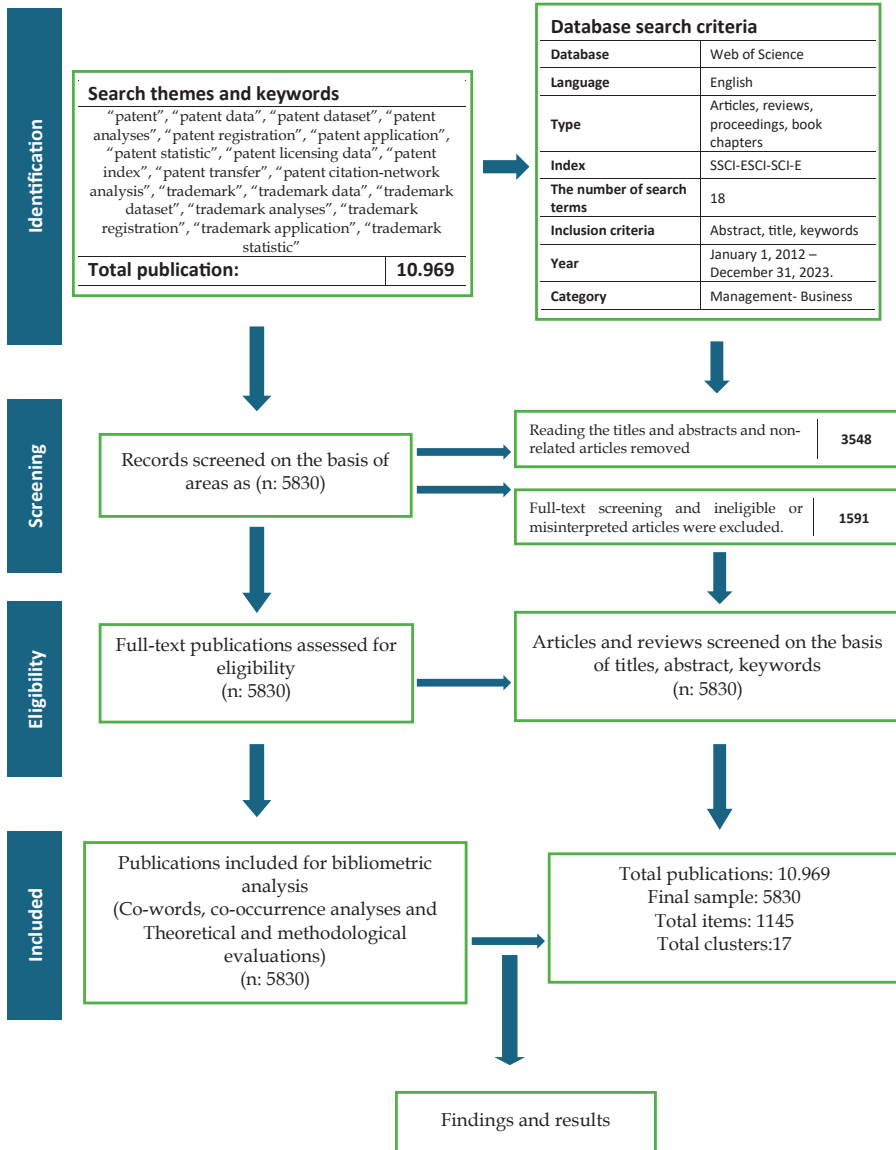


Figure 1. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram

Source: own study

to the subject or search terms were removed. In the final stage of the selection process, all abstracts and keywords were thoroughly reviewed, and any materials not pertinent to the search terms were excluded. The overall process and PRISMA workflow of this review are illustrated in Figure 1.

The search themes comprised a total of 10,969 publications published between January 1, 2012, and December 31, 2023. After the removal of duplicate entries, 5,830 publications relevant to the research questions and inclusion criteria were retained for analysis. The use of the English language for titles, abstracts, and keywords was limited to specific publication types. It is particularly important to note that all studies containing the terms “*patent*” and “*trademark*” were included in the dataset. The number of publications, co-occurrence items, and identified clusters are presented in Table 2.




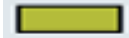
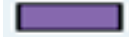



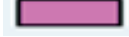
Table 2. Numbers of publication, co-occurrence items, and cluster

Themes and related keywords		Publication	Items	Clusters
Patent	Total 10101 * Selected 5318	4219	923	6
Patent citation network analysis		154	30	3
Patent registration		62	11	4
Patent application		891	243	7
Patent index		325	84	6
Patent data		1907	635	9
Patent dataset		259	108	6
Patent analysis		2098	640	7
Patent statistic		186	60	6
Trademark	Total 868 * Selected 512	422	127	7
Trademarks data		168	50	4
Trademark dataset		20	6	2
Trademark indicators		79	27	4
Trademark analyses		128	43	5
Trademark registration		14	4	1
Trademark application		37	12	3
Total	5830	10969	3003	80

Source: own study

According to Figure 2, the distribution of cluster titles and corresponding cluster colors for the dataset, which comprises a total of nine clusters, are presented in Table 3. The patent literature consists of 1,376 items organized into these nine clusters. The first 30 items and their respective total link strengths are listed in Table 4. Based on the cluster color distribution illustrated in Figure 2 and detailed in Table 3, the most prominent clusters are represented by the colors red, blue, green, and yellow, respectively, each corresponding to key thematic areas within the dataset.

Table 3. Patent dataset cluster color

Cluster	Items	Color
Cluster 1	337	
Cluster 2	215	
Cluster 3	207	
Cluster 4	165	
Cluster 5	133	
Cluster 6	127	
Cluster 7	106	
Cluster 8	41	
Cluster 9	33	

Source: own study

Table 4. Top 30 Findings of topics with using patent dataset

No.	Search themes and keywords	Occurrences	Total link strength
1	Innovation	1245	10498
2	Research and development	996	9417
3	Performance	931	8194
4	Knowledge	684	5807
5	Technology	632	5063
6	Absorptive capacity	380	3671
7	Management	287	2300

8	Networks	252	2110
9	Productivity	214	1956
10	Exploration	202	1967
11	Technology transfer	204	1468
12	Collaboration	188	1716
13	Strategy	185	1593
14	Evolution	178	1451
15	Spillovers	169	1542
16	Markets	165	1402
17	Commercialization	164	1449
18	Knowledge transfer	146	1335
19	Market value	123	1072
20	Product development	122	1068
21	Knowledge spillovers	111	997
22	Open innovation	115	982
23	Technological innovation	87	912
24	R&D	90	764
25	Resource-based view	82	758
26	Entrepreneurship	96	749
27	Alliances	84	745
28	Structural holes	76	735
29	Collaboration network	70	682
30	Competitive advantage	80	679

Source: own study

According to Table 4, the first 30 themes related to the patent dataset are presented, and all identified themes are interrelated. *Innovation*, ranked first, aligns with findings from previous research and literature, which is an expected outcome. The concept of *R&D*, ranked second, reflects activities directly associated with patent research. Patent

Table 5. Summary of high-frequency keywords and themes clusters

Item No.	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9
1	3d printing	Academic engagement	Adoption	Absorptive capacity	Innovation management	Business model	Corporate entrepreneurship	Corporate venture capital	Alliances formation
2	Additive manufacturing	Academic entrepreneurship	Agency cost	Alliance network	Information technology	Corporate innovation	Firm innovation	Knowledge diffusion	Behavioral theory
3	Artificial intelligence	Academic inventor	Alliance portfolio	Ambidexterity	Innovation ecosystem	Corporate performance	Innovation performance	Strategic alliances	Technology innovation
4	Bibliometric analyses	Academic spin offs	Business performance	Brokerage	Knowledge diffusion	Digital innovation	Knowledge acquisition		Value creation
5	Big data	Collaborations	Business strategy	Collaboration network	Open innovation	Entrepreneurial ecosystem	Joint ventures		
6	Block chain	Commercialization	Collaborative innovation	Collaborative network	R&D productivity	Firm growth	Knowledge creation		
7	Business	Entrepreneurial university	Competition	Creativity	Research based theory	Innovation strategy	Knowledge workers		
8	Business ecosystem	Entrepreneurship	Competitive advantage	Diversification	Strategic management	Innovation systems	Leadership		
9	Business intelligence	Firm growth	Competitiveness	Embeddedness	Technological innovation	Knowledge based theory	Organizational knowledge		
10	Business model	Firm survival	Corporate diversification	Exploitation innovation		Organizational innovation	Technological performance		
11	Centrality	Industrial innovation	Corporate social responsibilities	Innovation capability		Tactic knowledge	Top management team		
12	Cloud computing	Innovation strategy	Decision making	Innovation network		Transaction cost			
13	Clustering Analyses	Institutions	Dynamic capabilities	Innovation performance					
14	Communication	Knowledge exchange	Eco-innovation	Interfirm network					

15	Competitive advantage	Knowledge transfer	Employment	Interorganizational collaboration					
16	Competitive intelligence	Organizational change	Entrepreneurial orientation	Knowledge acquisition					
17	Data mining	Productivity	Financial performance	Knowledge creation					
18	Decision making	Regional development	Firm performance	Managerial performance					
19	Deep learning	Regional dev. systems	Firm size	Network centrality					
20	Digitalization	Research collaboration	Firm value	Network dynamic					
21	Disruptive technology	Research commercialization	Green innovation	Network embeddedness					
22	E-commerce	Self-efficacy	Human capital	Network structure					
23	Emerging industry	Self-employment	Human resource management	Organizational ambidexterity					
24	Energy	Spillover	Innovation	Organizational culture					
25	Entropy	Spin offs	Institutional based view	Organizational innovation					
26	Evolution	Start ups	Institutional theory	Product development					
27	Extraction	Technology transfer	Intellectual capital	Social capital					
28	Game theory	Technology based firms	Knowledge sharing	Strategic alliances					
29	Industry convergence	Technology commercialization	Leadership	Strategic management					
30	Innovation strategy	Triple helix	Organizational learning	Structural holes					

Source: own study

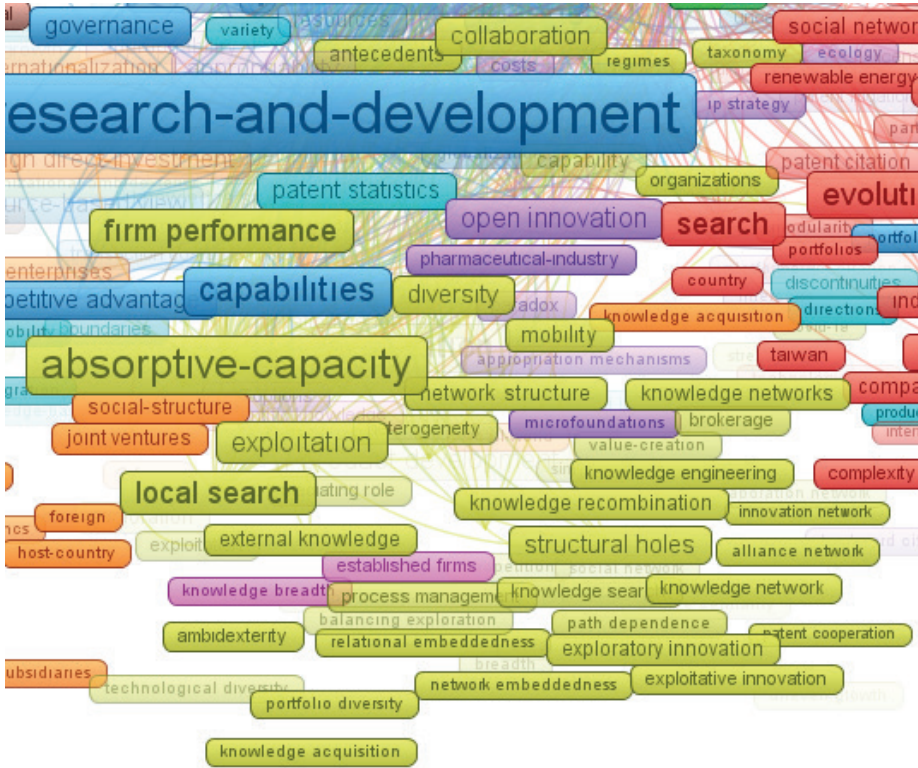


Figure 5. Cluster 4, (magnified view) of the patent dataset

Source: own study

In Figure 5, the visual mapping representing the fourth cluster (depicted in yellow) is magnified for detailed analysis. This cluster highlights themes related to *social capital*, including *social networks*, *structural holes*, and *relational embeddedness*. These terms frequently co-occur and collectively represent research focusing on network structures, relationships, and the mechanisms through which social interactions influence innovation and organizational performance.

4.2. Keywords co-occurrence analyses of trademark dataset usage in literature

In Figure 6, the visual mapping displays 145 themes from the trademark dataset, organized into a total of eight clusters. Although the volume of literature on trademarks

is greater than that for other intellectual property tools, the number of terms showing significant co-occurrences is relatively limited. The top 30 themes identified in the existing literature related to business, and management using the trademark dataset are presented in Table 7, while the distribution of items across clusters is summarized in Table 8.

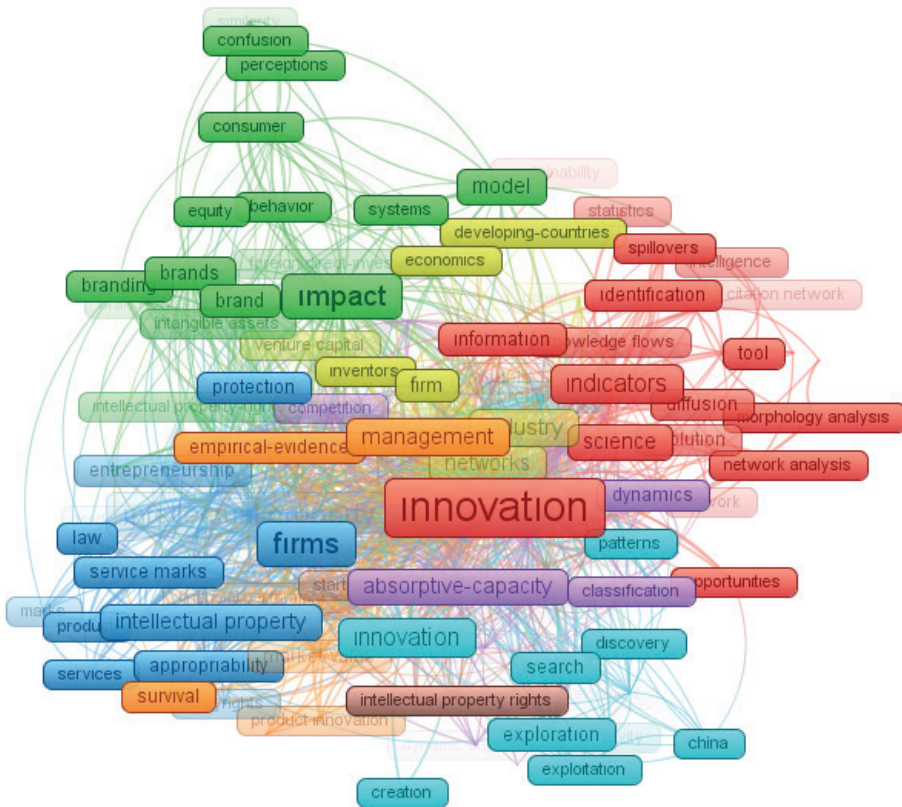










Figure 6. Keyword co-occurrence clustering of the trademark dataset

Source: own study

Table 6. Trademark dataset cluster color

Cluster	Items	Color
Cluster 1	32	
Cluster 2	21	
Cluster 3	18	
Cluster 4	18	
Cluster 5	16	
Cluster 6	15	
Cluster 7	14	
Cluster 8	11	

Source: own study

Table 7. Top 30 Findings of trademark dataset literature

No	Search Themes and Keywords	Occurrences	Total link strength
1	Innovation	99	97
2	Research and development	78	78
3	Performance	79	78
4	Technology	50	313
5	Knowledge	48	288
6	Strategy	25	143
7	Absorptive capacity	20	119
8	Market value	16	112
9	Exploration	15	88
10	Firm performance	12	81
11	SMEs	9	73

12	Networks	18	69
13	Productivity	11	65
14	Entrepreneurship	9	56
15	Open innovation	8	55
16	Competition	7	55
17	Start-ups	7	49
18	Knowledge flows	8	48
19	Commercialization	7	47
20	Technological innovation	8	47
21	Product innovation	6	43
22	Exploitation	8	41
23	Spillovers	7	40
24	Dynamic capabilities	6	38
25	Product development	6	36
26	Venture capital	5	36
27	Knowledge flow	6	36
28	Competitive advantage	7	33
29	Creativity	5	32
30	Collaboration	5	31

Source: own study

Table 7 presents the top 30 themes identified in the trademark dataset analysis. Among these, *innovation*, *research and development*, *performance*, *technology*, and *knowledge* emerge as the most frequently co-occurring terms, indicating their centrality within the literature.

Table 8. Summary of high-frequency keywords and themes clusters related to trademark dataset

Item No.	Cluster 1	Cluster 2	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8
1	Knowledge flow	Entrepreneurship	Absorptive capacity	Technology transfer	Competition	Collaboration	Commercialization
2	Spillover	Trade secret	Alliances	Venture capital	Competitive advantage	Exploitation	Entrepreneurship
3	Sustainability		Collaboration		Firm performance	Exploration	Start up
4	Technological innovation		Commercialization		Market Value	Productivity	Strategies
5			Knowledge management		Product innovation		
6			Open Innovation		Strategy		
7			Performance				
8			Product development				
9			Technological innovation				

Source: own study

Table 8 presents the top themes organized according to the eight clusters formed from the trademark dataset. Among these, the fourth cluster contains the highest number of themes, indicating its substantial contribution to the literature. In contrast, the third cluster shows few significant or interrelated themes. Overall, the number of co-occurring terms in the trademark dataset is lower compared to the patent dataset; however, several themes demonstrate similarities across both datasets. The analysis emphasizes themes that differentiate the field's scope, excluding the most frequently occurring terms. Notably, themes such as *commercialization*, *sustainability*, *entrepreneurship*, and *creativity* emerge as distinct findings in the scientific literature.

4.3. Keywords co-occurrence analyses of trademark and patent dataset usage in literature

Figure 7 and Table 9 illustrate the common themes that emerge prominently in the literature based on both trademark and patent datasets. In Figure 7, the most notable themes include *innovation*, *productivity*, *commercialization*, *product innovation*, *green innovation*, *structural holes*, *knowledge creation*, and *eco-innovation*, among others, highlighting the overlapping research focus across both fields.

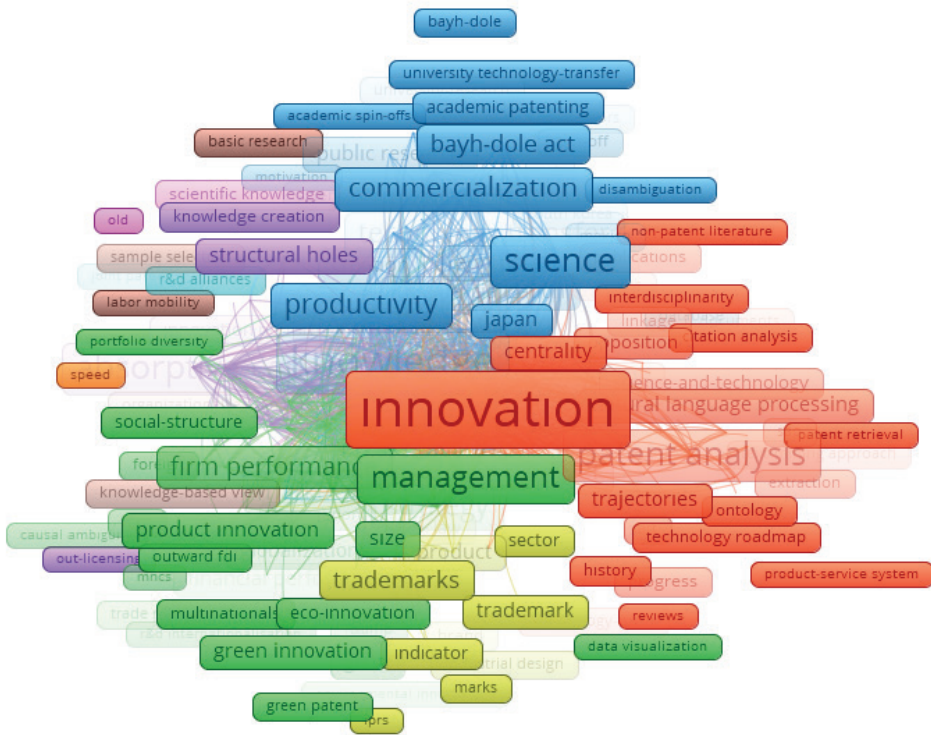


Figure 7. Keyword co-occurrence clustering of patent and trademark datasets using VOSviewer

Source: own study

Table 9. Themes and keywords related to patent and trademark datasets

no	Search themes and keywords	Occurrences	Total link strength
1	Innovation	1344	11560
2	Research and development	1075	10277
3	Performance	1008	9367
4	Knowledge	732	6594
5	Technology	682	5847
6	Absorptive capacity	400	4050
7	Networks	270	2366
8	Productivity	225	2138
9	Strategy	210	1943
10	Collaboration	195	1877
11	Commercialization	171	1593
12	Technology transfer	210	1573
13	Firm performance	160	1515
14	Knowledge transfer	147	1403
15	Entrepreneurship	143	1272
16	Product development	128	1167
17	Open innovation	123	1133
18	Knowledge spillover	117	1110
19	Strategic alliances	102	1022
20	Technological innovation	95	1032
21	Competition	97	899
22	Resource based view	85	830
23	Competitive advantage	87	768
24	Structural holes	76	764
25	Collaboration network	74	758
26	Knowledge flows	81	755

27	Dynamic capabilities	72	733
28	Product innovation	71	688
29	Innovation performance	60	612
30	Knowledge management	74	536

Source: own study

According to Table 9, the combined analysis of both trademark and patent datasets reveals a total of 1,511 items and 11 clusters of co-occurrences. Across all clusters, the most consistently interrelated themes are *innovation*, *product*, and *knowledge*. Additional prominent themes identified through the combined analysis include *research and development*, *performance*, *technology*, and *knowledge*, while terms such as *dynamic capabilities*, *collaboration networks*, *structural holes*, and *strategic alliances* emerge as particularly distinctive, reflecting key areas of focus in the integrated literature.

5. Discussion

Intellectual property (IP) rights and innovation constitute two of the most closely interconnected and extensively examined constructs within the management, knowledge, and innovation literature (Flikkema et al., 2014). The prominence of IP in scholarly research reflects its fundamental role in shaping economic performance, technological progress, and competitive advantage. Innovation, in particular, is widely recognized as a critical driver of economic activity and long-term growth, especially in R&D-intensive firms that rely on highly skilled human capital and knowledge-based assets. In this context, innovation is frequently regarded as a benchmark of scientific and technological excellence, underpinning firm competitiveness and national economic development. Consequently, IP-focused studies of innovation have consistently emphasized the role of technological advancement in enhancing productivity, fostering industrial transformation, and contributing to the creation of national wealth.

Within empirical research, patent and trademark indicators are among the most commonly employed proxies for assessing innovation and its economic relevance at the firm and industry levels. These indicators offer several advantages, including broad availability, standardized classification systems, and the ability to capture innovation-related activities across countries and sectors. However, a substantial portion of the literature relies either on patent-based indicators alone or on survey-derived measures of innovative activity, both of which may present methodological limitations. Patent counts, for instance, do not fully capture incremental, process-based, or non-

technological innovations, while survey-based measures may suffer from subjectivity, recall bias, or limited comparability across contexts. Moreover, patent registration does not necessarily represent an optimal or universal competitive strategy, as not all innovations are patentable and not all patented inventions embody economically valuable or commercially successful innovations. These limitations have prompted growing scholarly interest in the development and application of more objective, reliable, and multidimensional indicators of innovation, reinforcing the relevance of IP data in innovation research (Mendoza et al., 2004).

In this regard, patent statistics have become increasingly prominent in the analysis and measurement of innovation, owing to their demonstrated technological significance and economic value (Dang & Motohashi, 2015). Patents provide insights into firms' inventive capabilities, technological trajectories, and knowledge accumulation processes, thereby serving as valuable indicators of upstream innovation activities. At the same time, a complementary stream of research has highlighted the importance of trademark data, particularly in capturing downstream innovation outcomes related to market positioning, branding, and commercialization. Empirical evidence indicates a positive correlation between firms' innovation performance and their trademark registration activities, suggesting that trademarks reflect not only marketing strategies but also underlying creative and innovative capabilities. Firm-level studies further demonstrate that trademark indicators are positively associated with economic performance outcomes, including revenue growth and market valuation (Seethamraju, 2003; Griffiths et al., 2005), as well as with organizational creativity and knowledge recombination processes (Schautschick & Greenhalgh, 2016).

Trademarks play a particularly salient role in the commercialization stage of the innovation process, which follows invention and development and involves bringing new or improved products and services to market (Nam & Barnett, 2011). By signaling quality, differentiation, and brand identity, trademarks facilitate consumer recognition and trust, thereby enabling firms to appropriate value from their innovative efforts. Recent studies emphasize that trademark activity is strongly linked to a range of firm-level outcomes, including survival, productivity, profitability, employment growth, and income generation, underscoring their relevance as indicators of commercially successful innovation (deGrazia et al., 2020). As such, trademarks provide a valuable lens through which to examine how innovation translates into economic and organizational performance.

Furthermore, prior research demonstrates that both patents and trademarks exert a positive influence on firm valuation, survival prospects, and access to external financing, particularly venture capital (VC) funding (Sandner & Block, 2011). IP assets serve as credible signals of firm quality, technological potential, and growth prospects, reducing information asymmetries between firms and investors. The strategic use of patents is closely associated with increased VC investment, enhanced customer

acquisition, and improved financial sustainability, especially for small and medium-sized enterprises (SMEs) operating in knowledge-intensive industries. In this sense, IP rights not only protect innovative outputs but also shape how firms organize, manage, and commercialize innovation processes.

From a business and management perspective, IP rights – primarily articulated through patents and increasingly through trademarks – play a central role in guiding strategic decision-making and technology management. Firms are progressively focused on developing high-value technologies and knowledge-based assets that can be successfully commercialized through effective IP strategies. While the literature on patent-based innovation is well established, research explicitly examining the role of trademarks remains comparatively limited. This imbalance points to an important gap in the existing body of knowledge and highlights the need for more integrated approaches that jointly consider patents and trademarks in the analysis of innovation, commercialization, and firm performance. Addressing this gap offers significant potential to advance understanding within management, business, and innovation research, while providing more comprehensive insights into the multifaceted nature of intellectual property and its strategic value.

The theoretical foundation of this study is anchored in the interdisciplinary literature on intellectual property (IP) rights, management, and strategic management. Since the late 1990s, scholarly work in economics and law has increasingly examined IP management, often adopting traditional and incremental analytical approaches. While these perspectives have provided valuable legal and economic insights, they have also constrained the development of more dynamic management theories and business practices that explicitly address the strategic role of IP within organizations. As a result, management-focused research has increasingly sought to integrate IP considerations into broader strategic and innovation frameworks.

A foundational pillar of IP theory is Coase's (1960) seminal contribution, which emphasized the role of transaction costs in shaping the effectiveness of property rights. Coase demonstrated that IP rights can generate productive and efficient outcomes when transaction costs are minimized and property rights are clearly defined and transferable. This perspective underscores the importance of organizational and institutional arrangements in enabling firms to leverage IP assets strategically. Complementing this view, early theoretical contributions by Schumpeter (1934, 1939) established a fundamental link between innovation and economic dynamics, introducing the concept of "creative destruction." Schumpeter (1942) further argued that economic development is driven by firms' ability to introduce new products, enter new markets, and adopt novel production methods, thereby continuously transforming industries and competitive landscapes.

Building on these foundations, subsequent research has highlighted the necessity for firms to integrate IP management into the strategic management process,

particularly in relation to technological innovation. Contemporary theoretical frameworks emphasize that innovation and technological advancement are central drivers of economic growth, firm competitiveness, and wealth creation. From a strategic management perspective, firms are expected to formulate and implement coherent strategies for managing technological IP, encompassing activities such as IP creation, acquisition, protection, exploitation, and commercialization. In this context, recurring concepts such as innovation, performance, technology, knowledge, and research and development – frequently observed in the literature – constitute core dimensions of IP management, open innovation, and broader innovation-driven strategies.

Innovation research itself represents one of the most influential and extensively explored domains within business and management scholarship, encompassing both theoretical and empirical approaches. Firms that place innovation at the center of their strategic orientation tend to organize their structures, processes, and resources around inherently innovative capabilities. Such enterprises differentiate themselves through creativity, productivity, and adaptability, often engaging in collaborative arrangements with other firms, research institutions, or external partners to sustain and enhance innovation outcomes. These collaborative strategies reflect a shift toward more open and networked models of innovation, in which IP plays a critical coordinating and value-appropriation role.

A wide range of concepts associated with IP activities emerges from innovation-driven strategies, including creativity, reproducibility, organizational capabilities, managerial vision, competitive advantage, market value, and overall firm performance. Firms that hold substantial portfolios of registered IP rights are often better positioned to achieve industry leadership, as IP assets facilitate strategic partnerships and knowledge exchange with other organizations. Although collaboration with universities and public research institutions remains common, empirical evidence suggests that inter-firm collaboration within the private sector frequently yields more immediate and commercially relevant benefits (Friesike, 2011).

Moreover, firms with extensive and well-managed IP portfolios tend to experience accelerated innovative growth relative to their competitors. Such firms are more likely to introduce technologically sophisticated and differentiated products, target niche markets, and strengthen brand recognition by raising barriers to imitation (Neuhäusler, 2012). In addition to formal IP rights, the accumulation and strategic sharing of tacit knowledge constitutes a crucial component of effective IP management. Managing this knowledge requires careful balancing of openness and protection, particularly with respect to privacy, confidentiality, and proprietary interests (Thomä & Bizer, 2013). Together, these theoretical perspectives highlight the strategic importance of IP not only as a legal mechanism but also as a central managerial and organizational resource that shapes innovation processes and competitive outcomes.

6. Conclusion

The research questions developed in this study enable a comprehensive assessment of the current state of the literature and facilitate the identification of conceptual and thematic gaps. To address these questions, the analysis focused on the relevance and application of patent and trademark data within management and business research. Each research question formulated in this study was systematically addressed. First, the analysis examined which themes and conceptual perspectives co-occur in management and business research that employs patent data. Second, it identified the themes and conceptual perspectives that emerge together in studies using trademark data. Finally, the study investigated how the combined use of patent and trademark datasets reveals shared thematic structures and dominant conceptual perspectives within management and business research. In line with these objectives, the primary aim of this research was to generate new insights from patent and trademark datasets by synthesizing existing studies in the management literature. Despite the growing volume of research in this area, numerous topics remain insufficiently explored. Moreover, although intellectual property (IP)-based datasets are inherently dynamic, they continue to reflect the innovative capacities of economic actors and their ability to anticipate and respond to future market demands.

The findings indicate that several core concepts dominate the literature across datasets. Specifically, the most prominent and frequently occurring terms include *innovation*, *research and development*, *performance*, *technology*, *absorptive capacity*, and *knowledge*. These themes form the conceptual backbone of IP-based management research and reflect sustained scholarly interest in innovation-driven firm behavior and knowledge-based competitive advantage.

In addition to these themes, a number of supplementary concepts were identified across both patent and trademark datasets. These include *entrepreneurship*, *sustainability*, *leadership*, *organizational change*, *self-efficacy*, *self-employment*, *social capital*, *commercialization*, and *creativity*. Although these themes occur less frequently, their presence indicates a broadening of IP-based research beyond traditional innovation and technology perspectives toward more behavioral, organizational, and societal dimensions. Their relatively lower frequency suggests that these areas remain emergent and present valuable opportunities for future theoretical and empirical investigation.

The visualization derived from the patent dataset identified 1,145 items with meaningful co-occurrence relationships, while incoherent, redundant, or irrelevant terms were excluded to ensure analytical clarity. Analysis of the patent dataset revealed a strong concentration of data science- and technology-oriented themes, including *3D printing*, *artificial intelligence (AI)*, *data mining*, *big data*, *blockchain*, *cloud computing*, and *deep learning*. The prominence of these terms indicates that recent patent-based

management research is increasingly aligned with information technologies and digital innovation, reflecting dominant trends in contemporary business and innovation scholarship.

In contrast, the trademark dataset exhibited a different thematic structure, emphasizing concepts more closely related to market-facing and organizational phenomena. Themes such as *organizational change*, *self-efficacy*, and *self-employment* emerged more clearly, underscoring the relevance of trademark data for capturing managerial, behavioral, and entrepreneurial dimensions of innovation that are less visible in patent-based analyses. These findings suggest that trademark data complement patent data by offering insights into downstream innovation processes, including branding, commercialization, and market differentiation.

Although certain themes – such as *eco-innovation*, *green innovation*, *organizational learning*, *knowledge workers*, *human capital*, *human resource management*, *strategic management*, and *leadership* – appear less frequently in the patent dataset, their presence nonetheless highlights important intersections between IP, sustainability, and organizational strategy. These underrepresented themes point to promising avenues for future research that integrate IP data with broader management and organizational theories. Additionally, concepts related to *social networks*, *social capital*, and *network structures* were found to cluster together, emphasizing the interconnected nature of social and organizational relationships in shaping innovation processes and knowledge diffusion.

Overall, the findings demonstrate that while patent and trademark data have been widely used to examine innovation and technological development, their combined application enables a more nuanced and comprehensive understanding of the thematic landscape of management and business research. By revealing both dominant and emerging conceptual perspectives, this study contributes to identifying key research gaps and highlights the potential of integrated IP-based analyses to advance future scholarship.

7. Limitations

Although the study has clear theoretical implications, one potential limitation is its reliance on a single academic database. This decision was methodologically justified, as the research topics addressed are sparsely represented in alternative databases, which would not have substantially expanded the dataset. The Web of Science (WoS) was therefore deliberately selected due to its comprehensive coverage, rigorous journal selection criteria, and well-established reputation as one of the most authoritative and reliable sources of peer-reviewed scholarly publications worldwide. Moreover, the dataset retrieved through WoS proved sufficiently robust, coherent, and analytically meaningful, yielding valid and interpretable findings. Consequently, the use of a single,

high-quality database does not compromise the credibility of the results but rather ensures methodological consistency and data reliability.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author did not use Generative AI and AI-assisted technologies in the writing process.

References

- Agostini, L., Filippini, R., & Nosella, A. (2016). Protecting intellectual property to enhance firm performance: Does it work for SMEs? *Knowledge Management Research & Practice*, 14(1), 96–105. <https://doi.org/10.1057/kmnp.2014.20>
- Agovino, M., Aldieri, L., Garofalo, A., & Vinci, C. P. (2018). R&D spillovers and employment: Evidence from European patent data. *Empirica*, 45(2), 247–260. <https://doi.org/10.1007/s10663-016-9359-x>
- Alan, H. & Köker, A. R. (2021). Structural Social Capital Studies in Management and Organization Literature: A Bibliometric Network Study. *Journal of Management and Business Administration*, 29(4), 2–31. <https://doi.org/10.7206/cemj.2658-0845.58>
- Alshowaish, H., Al-Ohali, Y., & Al-Nafjan, A. (2022). Trademark image similarity detection using convolutional neural network. *Applied Sciences*, 12, 1752. <https://doi.org/10.3390/app12031752>
- Altuntaş, S., Dereli, T., & Kusiak, A. (2015). Analysis of patent documents with weighted association rules. *Technological Forecasting and Social Change*, 92, 249–262. <https://doi.org/10.1016/j.techfore.2014.09.012>
- Amara, N., Landry, R., & Traoré, N. (2008). Managing the protection of innovations in knowledge-intensive business services. *Research Policy*, 37(9), 1530–1547. <https://doi.org/10.1016/j.respol.2008.07.001>
- Ardila, H. E. M., Florez, L. C. G., & Castro, J. F. G. (2020). Dataset on technological alliances by using joint patents in the biotechnology industry. *Data in Brief*, 32, 106124. <https://doi.org/10.1016/j.dib.2020.106124>
- Barber, B., & Diestre, L. (2022). Can firms avoid tough patent examiners through examiner-shopping? Strategic timing of citations in USPTO patent applications. *Strategic Management Journal*, 43, 1854–1871. <https://doi.org/10.1002/smj.3386>
- Bei, X. (2019). Trademarks, specialized complementary assets, and the external sourcing of innovation. *Research Policy*, 48, 103709. <https://doi.org/10.1016/j.respol.2019.01.016>
- Bekkers, R., & Martinelli, A. (2012). Knowledge positions in high-tech markets: Trajectories, standards, strategies and true innovators. *Technological Forecasting and Social Change*, 79, 1192–1216. <https://doi.org/10.1016/j.techfore.2012.01.009>
- Buddelmeyer, H., Jensen, P. H., & Webster, E. (2010). Innovation and the determinants of company survival. *Oxford Economic Papers*, 62(2), 261–285. <https://doi.org/10.1093/oxep/gpp012>

- Butticè, V., Caviggioli, F., Franzoni, C., Scellatob, G., Stryszowskie, P., & Thumm, N. (2020). Counterfeiting in digital technologies: An empirical analysis of the economic performance and innovative activities of affected companies. *Research Policy*, 49(5), 103959. <https://doi.org/10.1016/j.respol.2020.103959>
- Castaldi, C., & Dosso, M. (2018). *From R&D to market: Using trademarks to capture the market capability of top R&D investors* (JRC Working Papers on Corporate R&D and Innovation, No. 01/2018). European Commission, Joint Research Centre (JRC). <https://hdl.handle.net/10419/202177>
- Castaldi, C. (2020). All the great things you can do with trademark data: Taking stock and looking ahead. *Strategic Organization*, 18(3), 472–484. <https://doi.org/10.1177/1476127019847835>
- Castaldi, C. & Mendonça, S. (2022). Regions and trademarks: Research opportunities and policy insights from leveraging trademarks in regional innovation studies. *Regional Studies*, 56(2), 177–189. <https://doi.org/10.1080/00343404.2021.1939865>
- Castelnovo, P. (2022). Innovation in private and state-owned enterprises: A cross-industry analysis of patenting activity. *Structural Change and Economic Dynamics*, 62, 98–113. <https://doi.org/10.1016/j.strueco.2022.05.007>
- Chang, S. H. (2022). Technology network and development trends of government-funded patents. *International Journal of Innovation Science*, 15(2), 329–346. <https://doi.org/10.1108/IJIS-12-2021-0234>
- Choe, H., Lee, D. H., Kim, H. D., & Seo, W. (2016). Structural properties and inter-organizational knowledge flows of patent citation network: The case of organic solar cells. *Renewable and Sustainable Energy Reviews*, 55, 361–370. <https://doi.org/10.1016/j.rser.2015.10.150>
- Christodoulou, D., Lev, B., & Ma, L. (2018). The productivity of Chinese patents: The role of business area and ownership type. *International Journal of Production Economics*, 199, 107–124. <https://doi.org/10.1016/j.ijpe.2017.12.024>
- Choi, J. & Hwang, Y.-S. (2014). Patent keyword network analysis for improving technology development efficiency. *Technological Forecasting and Social Change*, 83(C), 170–182. <https://doi.org/10.1016/j.techfore.2013.07.004>
- Coase, R. H. (1960). The problem of social cost. *Journal of Law and Economics*, 3, 1–44.
- Correa, J. A., & Ornaghi, C. (2014). Competition & innovation: Evidence from U.S. patent and productivity data. *Journal of Industrial Economics*, 62(2), 258–285. <https://doi.org/10.1111/joie.12050>
- Crass, D., Czarnitzki, D., & Toole, A. A. (2019). The dynamic relationship between investments in brand equity and firm profitability: Evidence using trademark registrations. *International Journal of the Economics of Business*, 26(1), 157–176. <https://doi.org/10.1080/13571516.2019.1553292>
- Çela, M. (2015). The importance of trademarks and a review of empirical studies. *European Journal of Sustainable Development*, 4(3), 125–134. <https://doi.org/10.14207/ejsd.2015.v4n3p125>
- Daim, T., Iskin, I., Li, X., Zielsdorff, C., Bayraktaroglu, A. E., Dereli, T., & Durmusoglu, A. (2012). Patent analysis of wind energy technology using the patent alert system. *World Patent Information*, 34(1), 37–47. <https://doi.org/10.1016/j.wpi.2011.11.001>
- Dang, J., & Motohashi, K. (2015). Patent statistics: A good indicator for innovation in China? Patent subsidy program impacts on patent quality. *China Economic Review*, 35, 137–155. <https://doi.org/10.1016/j.chieco.2015.03.012>
- DeGrazia, C. A. W., Myers, A., & Toole, A. A. (2020). Innovation activities and business cycles: Are trademarks a leading indicator? *Industry and Innovation*, 27(1–2), 184–203. <https://doi.org/10.1080/13662716.2019.1650252>

- De Rassenfosse, G. (2017). An assessment of how well we account for intangibles. *Industrial and Corporate Change*, 26(3), 517–534. <https://doi.org/10.1093/icc/dtx010>
- De Vries, G., Pennings, E., Block, J. H., & Fisch, C. (2017). Trademark or patent? The effects of market concentration, customer type and venture capital financing on start-ups' initial IP applications. *Industry and Innovation*, 24(4), 325–345. <https://doi.org/10.1080/13662716.2016.1231607>
- Dong, J. Q., & Yang, C.-H. (2019). Information technology and innovation outcomes: Is knowledge recombination the missing link? *European Journal of Information Systems*, 28(6), 612–626. <https://doi.org/10.1080/0960085X.2019.1648890>
- Dosi, G., Grazzi, M. & Moschella, D. (2017). What do firms know? What do they produce? A new look at the relationship between patenting profiles and patterns of product diversification, *Small Bus Econ.* 48, 413–429. <https://doi.org/10.1007/s11187-016-9783-0>
- Flikkema, M. J., De Man, A. P., & Wolters, M. J. J. (2010). *New trademark registration as an indicator of innovation: Results of an explorative study of Benelux trademark data* (Research Memorandum No. 2010-9). Vrije Universiteit Amsterdam, Faculty of Economics and Business Administration. <http://degree.uvu.nl/repec/vua/wpaper/pdf/20100009.pdf>
- Flikkema, M., De Man, A. P., & Castaldi, C. (2014). Are trademark counts a valid indicator of innovation? Results of an in-depth study of new Benelux trademarks filed by SMEs. *Industry and Innovation*, 21(4), 310–331. <https://doi.org/10.1080/13662716.2014.934547>
- Flikkema, M., Castaldi, C., De Man, A. P., & Seip, M. (2015). Explaining the trademark–innovation linkage: The role of patents and trademark filing strategies. *Academy of Management Proceedings*, 2015(1), 16624. <https://doi.org/10.5465/ambpp.2015.16624abstract>
- Flikkema, M., Castaldi, C., De Man, A. P., & Seip, M. (2019). Trademarks' relatedness to product and service innovation: A branding strategy approach. *Research Policy*, 48(6), 1340–1353. <https://doi.org/10.1016/j.respol.2019.01.018>
- Filippetti, A., Gkotsis, P., Vezzani, A., et al. (2020). Are innovative regions more resilient? Evidence from Europe in 2008–2016. *Economics of Policy*, 37, 807–832. <https://doi.org/10.1007/s40888-020-00195-4>
- Fong, P. S. W., Chang, X., & Chen, Q. (2018). Faculty patent assignment in the Chinese mainland: Evidence from the top 35 patent application universities. *Journal of Technology Transfer*, 43, 69–95. <https://doi.org/10.1007/s10961-016-9506-x>
- Forestal, R. L., Lee, H. I., Pi, S. M., & Liu, S.-H. (2022). Spatio-temporal clustering analysis and technological forecasting of nanotechnology using patent data. *Technology Analysis & Strategic Management*, 36(5), 1037–1053. <https://doi.org/10.1080/09537325.2022.2069006>
- Friesike, S. (2011). *Profiting from innovation by managing intellectual property* [Doctoral dissertation, University of St. Gallen]. <https://www.e-helvetica.nb.admin.ch/api/download/urn%3Anbn%3Ach%3Abel-223649%3Aadis3954.pdf>
- Giczy, A. V., Pairolero, N. A., & Toole, A. A. (2022). Identifying artificial intelligence (AI) invention: A novel AI patent dataset. *The Journal of Technology Transfer*, 47, 476–505. <https://doi.org/10.1007/s10961-021-09863-6>
- Goel, R.K. & Saunoris, J.W. (2020). Where is the entrepreneurship bang for the patenting buck? Utility versus design patents. *Managerial and Decision Economics*, 41, 25–35. <https://doi.org/10.1002/mde.3088>
- González-Pedraz, C., & Mayordomo, S. (2012). Trademark activity and the market performance of U.S. commercial banks. *Journal of Business Economics and Management*, 13(5), 931–950. <https://doi.org/10.3846/16111699.2011.643447>

- Gotsch, M., & Hipp, C. (2012). Measurement of innovation activities in the knowledge-intensive services industry: A trademark approach. *The Service Industries Journal*, 32(13), 2167–2184. <https://doi.org/10.1080/02642069.2011.574275>
- Gotsch, M., & Hipp, C. (2014). Using trademarks to measure innovation in knowledge-intensive business services. *Technology Innovation Management Review*, 4(5), 18–30. <https://doi.org/10.22215/timreview/790>
- Graham, S. J. H., Marco, A. C., & Myers, A. F. (2018). Monetizing marks: Insights from the USPTO trademark assignment dataset. *Journal of Economics & Management Strategy*, 27, 403–432. <https://doi.org/10.1111/jems.12242>
- Graham, S. J. H., Hancock, G., Marco, A. C., & Myers, A. (2013). The USPTO trademark case files dataset: Descriptions, lessons, and insights. *Journal of Economics & Management Strategy*, 22(4), 669–705. <https://doi.org/10.1111/jems.12035>
- Greenhalgh, C., & Rogers, M. (2007). *Trade marks and performance in UK firms: Evidence of Schumpeterian competition through innovation* (Economics Discussion Paper No. 297). University of Oxford.
- Gress, B. (2010). Properties of the USPTO patent citation network: 1963–2002. *World Patent Information*, 32(1), 3–21. <https://doi.org/10.1016/j.wpi.2009.05.008>
- Griffiths, W. E., Jensen, P. H., & Webster, E. (2005). *The effects on firm profits of the stock of intellectual property rights* (IPRIA Working Paper No. 05/05). Intellectual Property Research Institute of Australia.
- Guderian, C.C., Bican, P.M., Riar, F.J. & Chattopadhyay, S. (2021), Innovation management in crisis: patent analytics as a response to the COVID-19 pandemic. *R&D Management*, 51, 223-239. <https://doi.org/10.1111/radm.12447>
- Heikkilä, J. (2019). IPR gender gaps: A first look at utility model, design right and trademark filings. *Scientometrics*, 118, 869–883.
- Helmers, C., & Rogers, M. (2010). Innovation and the survival of new firms in the UK. *Review of Industrial Organization*, 36(3), 227–248. <https://doi.org/10.1007/s11151-010-9247-7>
- Hipp, C., & Grupp, H. (2005). Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies. *Research Policy*, 34(4), 517–535. <https://doi.org/10.1016/j.respol.2005.03.002>
- Hu, X., Rousseau, R., & Chen, J. (2012). A new approach for measuring the value of patents based on structural indicators for ego patent citation networks. *Journal of the American Society for Information Science and Technology*, 63(9), 1834–1842. <https://doi.org/10.1002/asi.22677>
- Hur, W. (2017). The patterns of knowledge spillovers across technology sectors evidenced in patent citation networks. *Scientometrics*, 111, 595–619. <https://doi.org/10.1007/s11192-017-2299-3>
- Iversen, E. J., & Herstad, S. J. (2022). Dynamics of regional diversification: A new approach using trademark data. *Regional Studies*, 56(2), 276–289. <https://doi.org/10.1080/00343404.2021.1900536>
- Jensen, P. H., & Webster, E. (2008). Labelling characteristics and demand for retail grocery products in Australia. *Australian Economic Papers*, 47(2), 129–140. <https://doi.org/10.1111/j.1467-8454.2008.00338.x>
- Jensen, P. H., & Webster, E. (2004). *Patterns of trademarking activity in Australia* (IPRIA Working Paper No. 02/04). University of Melbourne, Intellectual Property Research Institute of Australia. https://melbourneinstitute.unimelb.edu.au/downloads/working_paper_series/2004/wp2004n02.pdf

- Kaivo-Oja, J. (2016). Benchmarking analysis of patent and trademark applications in the European Union: A comprehensive EU innovation policy evaluation for years 1960–2013. *European Integration Studies*, 10, 169–190. <https://doi.org/10.5755/j01.eis.0.10.14611>
- Kim, J., & Bae, H. (2017). A novel approach to forecast promising technology through patent analysis. *Technological Forecasting and Social Change*, 118, 11–26. <https://doi.org/10.1016/j.techfore.2016.11.039>
- Klemetsen, M. E., Bye, B., & Raknerud, A. (2018). Can Direct Regulations Spur Innovations in Environmental Technologies? A Study on Firm-Level Patenting. *The Scandinavian Journal of Economics*, 120(2), 338–371. <http://www.jstor.org/stable/45097704>
- Krasnikov, A., Mishra, S., & Orozco, D. (2009). Evaluating the financial impact of branding using trademarks: A framework and empirical evidence. *Journal of Marketing*, 73(6), 154–166. <https://doi.org/10.1509/jmkg.73.6.154>
- Kwon, O. (2019). A study on how startups approach sustainable development through intellectual property. *Sustainable Development*, 28(4), 613–625. <https://doi.org/10.1002/sd.2019>
- Lawson, C. (2013). Academic inventions outside the University: Investigating patent ownership in the UK. *Industry and Innovation*, 20(5), 385–398. <https://doi.org/10.1080/13662716.2013.824191>
- Lee, M., & Lee, S. (2017). Identifying new business opportunities from competitor intelligence: An integrated use of patent and trademark databases. *Technological Forecasting and Social Change*, 119, 170–183. <https://doi.org/10.1016/j.techfore.2017.03.026>
- Lee, C., & Lee, G. (2019). Technology opportunity analysis based on recombinant search: Patent landscape analysis for idea generation. *Scientometrics*, 121(2), 603–632. <https://doi.org/10.1007/s11192-019-03224-7>
- Lee, W. S., Han, E. J., & Sohn, S. Y. (2015). Predicting the pattern of technology convergence using big-data technology on large-scale triadic patents. *Technological Forecasting & Social Change*, 100, 317–329. <https://doi.org/10.1016/j.techfore.2015.07.022>
- Lee, K., Kang, R., & Park, D. (2022). How industrial design matters for firm growth at different stages of development: Evidence from Korea, 1970s to 2010s. *Asian Economic Journal*, 36(2), 101–126. <https://doi.org/10.1111/asej.12291>
- Lin, L. L. H., Lyu, Y., & Cheng, L. (2021). Invulnerability in innovation networks: The importance of technology cluster coupling and network centralization. *Technology Analysis & Strategic Management*, 35(4), 451–463. <https://doi.org/10.1080/09537325.2021.1979202>
- Llerena, P., & Millot, V. (2020). Two better than one? Modelling the complementary or substitute relationship between patents and trademarks. *Industry and Innovation*, 27(1–2), 52–79. <https://doi.org/10.1080/13662716.2019.1696188>
- Malhotra, A., et al. (2021). How do new use environments influence a technology's knowledge trajectory? A patent citation network analysis of lithium-ion battery technology. *Research Policy*, 50, 104318. <https://doi.org/10.1016/j.respol.2020.104318>
- Melnyk, V., Giarratana, M.S. & Torres, A. (2014), Marking your trade: cultural factors in the prolongation of trademarks, *Journal of Business Research*, 67 (4), 478-485. <https://doi.org/10.1016/j.jbusres.2013.06.003>
- Mendonça, S., Pereira, T. S., & Godinho, M. M. (2004). Trademarks as an indicator of innovation and industrial change. *Research Policy*, 33(9), 1385–1404. <https://doi.org/10.1016/j.respol.2004.09.005>
- Millot, V. (2009). *Trademarks as an indicator of product and marketing innovation* (OECD Science, Technology and Industry Working Papers, No. 2009/6). OECD Publishing.

- Millot, V. (2011). *Firms' intangible assets: Who relies on trademarks? Analysis of French and German firms' trademarking behaviour* (DRUID Working Paper). http://druid8.sit.aau.dk/acc_papers/mrfhruoxl97gkxq4ajhh8ln9o2.pdf
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, T. P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, 6(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- Nam, Y., & Barnett, G. A. (2011). Globalization of technology: Network analysis of global patents and trademarks. *Technological Forecasting & Social Change*, 78, 1471–1485. <https://doi.org/10.1016/j.techfore.2011.06.005>
- Neuhäusler, P. (2012). The use of patents and informal appropriation mechanisms: Differences between sectors and among companies. *Technovation*, 32, 681–693. <https://doi.org/10.1016/j.technovation.2012.07.004>
- Noh, H., Jo, Y., & Lee, S. (2015). Keyword selection and processing strategy for applying text mining to patent analysis. *Expert Systems with Applications*, 42, 4348–4360. <https://doi.org/10.1016/j.eswa.2015.01.050>
- Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of Documentation*, 25(4), 348–349.
- Ribeiro, L. C., Santos, U. P., & Muzaka, V. (2022). Trademarks as an indicator of innovation: Towards a fuller picture. *Scientometrics*, 127, 481–508. <https://doi.org/10.1007/s11192-021-04197-2>
- Sandner, P. G., & Block, J. (2011). The market value of R&D, patents, and trademarks. *Research Policy*, 40(7), 969–985. <https://doi.org/10.1016/j.respol.2011.04.004>
- Santos, U. P., Ribeiro, L. C., Diniz, S. C., & Machado, A. F. (2022). Notes on the use of trademark registrations as an innovation metric for the creative and cultural industries: An analysis based on USPTO data. *Creative Industries Journal*, 17(3), 381–399. <https://doi.org/10.1080/17510694.2022.2089444>
- Santos, R. S., & Qin, L. (2019). Risk capital and emerging technologies: Innovation and investment patterns based on artificial intelligence patent data analysis. *Journal of Risk and Financial Management*, 12(4), 189. <https://doi.org/10.3390/jrfm12040189>
- Schautschick, P., & Greenhalgh, C. (2016). Empirical studies of trade marks: The existing economic literature. *Economics of Innovation and New Technology*, 25(4), 358–390. <https://doi.org/10.1080/10438599.2015.1064598>
- Schautschick, P. (2015). *An economic investigation of the use and impact of patents and trade marks in Germany* [Doctoral dissertation, Ludwig-Maximilians-Universität München]. <https://edoc.ub.uni-muenchen.de/18300/>
- Schmoch, U., & Gauch, S. (2009). Service marks as indicators for innovation in knowledge-based services. *Research Evaluation*, 18(4), 323–335. <https://doi.org/10.3152/095820209X451023>
- Schmoch, U. (2003). Service marks as novel innovation indicator. *Research Evaluation*, 12(2), 149–156. <https://doi.org/10.3152/147154403781776708>
- Schumpeter, J. A. (1934). *The theory of economic development*. Transaction Publishers.
- Schumpeter, J. A. (1939). *Business cycles: A theoretical, historical, and statistical analysis of the capitalist process*. McGraw-Hill.
- Schumpeter, J. A. (1942). *Capitalism, socialism and democracy*. Harper & Row.
- Seethamraju, C. (2003). The value relevance of trademarks. In J. Hand & L. Baruch (Eds.), *Intangible assets: Values, measures and risks*. Oxford University Press.

- Seip, M., Castaldi, C., Flikkema, M., & De Man, A. P. (2018). The timing of trademark application in innovation processes. *Technovation*, 72–73, 34–45. <https://doi.org/10.1016/j.technovation.2018.02.001>
- Sharma, P., & Tripathi, R. C. (2017). Patent citation: A technique for measuring the knowledge flow of information and innovation. *World Patent Information*, 51, 31–42. <https://doi.org/10.1016/j.wpi.2017.11.002>
- Sjögren, R., Stridh, K., Skotare, T., & Trygg, J. (2018). Multivariate patent analysis: Using chemometrics to analyze collections of chemical and pharmaceutical patents. *Journal of Chemometrics*, 34(1), e3041. <https://doi.org/10.1002/cem.3041>
- Smojver, V., Štorga, M., & Zovak, G. (2021). Exploring knowledge flow within a technology domain by conducting a dynamic analysis of a patent co-citation network. *Journal of Knowledge Management*, 25(2), 433–453. <https://doi.org/10.1108/JKM-01-2020-0079>
- Souza, C. M., Meireles, M. R. G., & Almeida, P. E. M. (2021). A comparative study of abstractive and extractive summarization techniques to label subgroups on patent dataset. *Scientometrics*, 126, 135–156. <https://doi.org/10.1007/s11192-020-03732-x>
- Suh, J. H. (2015). Exploring the effect of structural patent indicators in forward patent citation networks on patent price from firm market value. *Technology Analysis & Strategic Management*, 27(5), 485–502. <https://doi.org/10.1080/09537325.2015.1011613>
- Thakur-Wernz, P., & Wernz, C. (2022). Impact of stronger intellectual property rights regime on innovation: Evidence from de alio versus de novo Indian bio-pharmaceutical firms. *Journal of Business Research*, 138, 457–473. <https://doi.org/10.1016/j.jbusres.2021.08.074>
- Thoma, G. (2020). The valuation of patent–trademark pairing as IP strategy: Evidence from the USPTO. *Industry and Innovation*, 27(1–2), 80–104. <https://doi.org/10.1080/13662716.2019.1633281>
- Thomä, J., & Bizer, K. (2013). To protect or not to protect? Modes of appropriability in the small enterprise sector. *Research Policy*, 42, 35–49. <https://doi.org/10.1016/j.respol.2012.04.019>
- Van Eck, N. J., & Waltman, L. (2007). Bibliometric mapping of the computational intelligence field. *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems*, 15(5), 625–645. <https://doi.org/10.1142/S0218488507004911>
- Wang, D., Zhu, S., Li, T., Chi, Y., & Gong, Y. (2011). Integrating document clustering and multidocument summarization. *ACM Transactions on Knowledge Discovery from Data*, 5(3), 14. <https://doi.org/10.1145/1993077.1993078>
- Wang, X.-X., & Jiao, H.-Y. (2022). The impact of network positions in scientific collaboration on pharmaceutical firms' technological innovation performance: Moderating roles of scientific collaboration strength and patent stock. *Frontiers in Public Health*, 10, 980845. <https://doi.org/10.3389/fpubh.2022.980845>
- Wartburg, T., Teichert, K., & Rost, K. (2005). Inventive progress measured by multistage patent citation analysis. *Research Policy*, 34(10), 1591–1607. <https://doi.org/10.1016/j.respol.2005.08.001>
- Zhang, W., Chen, J. & Li, W. (2022). Limiting hESC patents in China under a dual-value perspective. *EMBO Reports*, 23, EMBR202255998. <https://doi.org/10.15252/embr.202255998>
- Zheng, J., Zhao, Z., Zhang, X., Chen, D., & Huang, M. (2014). International collaboration development in nanotechnology: A perspective of patent network analysis. *Scientometrics*, 98, 683–702. <https://doi.org/10.1007/s11192-013-1081-x>
- Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, 18(3), 429–472. <https://doi.org/10.1177/1094428114562629>