IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Exploring Product Innovation: A Comprehensive Bibliometric Analysis

[1]Pankaj Kumar Jha, [2]Dr. B. Charumathi
[1]Research Scholar, [2]Professor
Department of Management Studies,
Pondicherry University, Pondicherry

Abstract

Product innovation refers to the creation and introduction of new or significantly improved goods or services that enhance functionality, usability, or value for consumers, addressing the evolving market needs and competitive pressures. This study presents a bibliometric analysis of product innovation research based on 1,484 articles retrieved from Scopus databases. The analysis was conducted using Biblioshiny, a user-friendly interface of the R-based Bibliometrix package. The study provides insights into the publication trends, influential authors, key journals, collaborations, and thematic evolution of product innovation research. China is the leading country in scientific production. also, findings reveal significant contributions from prolific authors and journals, highlighting key topics and trends and suggesting future research directions. Emerging economies, green product innovation, innovation performance, product innovation, product innovation performance, radical innovation, resource-based view, and sustainable product innovation are suggested from the thematic evolution.

Keywords: Product innovation, Innovation, Product Innovation Performance, Green Product Innovation, Functionality, Usability, Bibliometric Analysis, Biblioshiny.

1. INTRODUCTION

Product innovation refers to the process of developing and introducing new or significantly improved goods or services that provide enhanced functionality, usability, quality, or value to users. It encompasses the generation of novel ideas, the integration of advanced technologies, and the adaptation or refinement of existing products to meet changing market needs and consumer demands (Li & Atuahene-Gima, 2001; Sok & O'Cass, 2015). Product innovation is a key driver of competitive advantage, fostering growth and addressing emerging challenges in dynamic business environments (Lee & Kim, 2011).

Product innovation is centred around improving various aspects of a product to serve consumers better. Enhanced functionality is achieved by designing products that perform more efficiently or offer new features that significantly increase their utility (Laverne et al., 2015). Improved usability simplifies the design and user interfaces, ensuring products are intuitive and easy for a wider audience. Superior quality is often a priority, with innovations aiming to improve durability (Killen et al., 2008) or aesthetic appeal, ensuring the product lasts longer and meets higher standards. Additionally, added value is a key objective, where innovations deliver greater consumer benefits, whether through cost-effectiveness, unique features, or enriched user experiences, making the product more appealing and beneficial to the target market (Falahat et al., 2020).

Product innovation drives a company's success through unique value propositions that enhance competitiveness and distinguish the business in the marketplace. Furthermore, innovation opens up opportunities for market growth and expansion, enabling companies to explore new customer segments and geographic regions (Eggert et al., 2011). It also allows businesses to adapt to changing market dynamics, responding to shifting consumer preferences and emerging technological trends, ensuring continued relevance in an evolving landscape. Additionally, product innovation plays a critical role in addressing global challenges, as many new products are designed to provide solutions to pressing issues such as climate change, health crises, and other societal concerns (Bisbe & Otley, 2004; Dangelico & Pujari, 2010; De Medeiros et al., 2014).

Product innovation is multifaceted and can present significant obstacles for companies. High research and development (R&D) costs are a primary hurdle, as developing new products often requires substantial research, development, and extensive testing to ensure their viability (Chandy & Tellis, 1998a; Cunha et al., 2014; Tatikonda & Rosenthal, 2000). Market uncertainty is another challenge, as predicting consumer acceptance of novel products can be difficult, with many factors influencing demand (Lin et al., 2013; Melander, 2018). Technological risks also pose a threat, as implementing advanced technologies might lead to unforeseen complications or failures, affecting the product's success. Additionally, intense competition in fast-paced industries requires continuous innovation to maintain a competitive edge, demanding constant effort and resources to stay ahead of rival companies.

Product innovation highlights critical areas such as green and sustainable product innovation, which have gained prominence due to the growing global focus on environmental sustainability and eco-friendly practices (De Medeiros et al., 2014; Kuncoro & Suriani, 2018). These themes reflect the need to integrate sustainability principles into product design and development processes to meet pressing environmental and social challenges. Additionally, emerging trends in radical innovation, innovation performance, and knowledge sharing underscore the importance of disruptive technologies, performance metrics, and collaborative strategies in achieving impactful outcomes.

Regional and contextual factors, such as those in emerging economies, also play a pivotal role, with cultural, economic, and infrastructural dynamics shaping innovation strategies in these markets (Lau & Ngo, 2004; Wang et al., 2021). The study explores how Corporate Social Responsibility (CSR) aligns with product innovation, illustrating the increasing emphasis on ethical and socially responsible practices in business operations.

Moreover, foundational themes like product design, manufacturing, and niche areas such as milk segregation in product development demonstrate the breadth of the field, encompassing usability, production efficiency, and targeted innovations to meet specific regulatory and consumer needs (Rindova & Petkova, 2007). Analysing the frequency and thematic evolution of key terms over time, the research reveals shifting priorities within academic and industry discourse, maintaining a consistent focus on product development and research and development (R&D) alongside a growing emphasis on sustainability and competition.

2. RESEARCH QUESTIONS

The following are the research questions of the study:

1. What is the scope and coverage of existing literature on product innovation suitable for bibliometric analysis?
2. How has the volume, geographical distribution, and temporal trend of product innovation research evolved over time?
3. Which authors, institutions, and journals are most influential in the field of product innovation based on citation analysis?
4. What are the key themes, concepts, and emerging trends in product innovation research, particularly in relation to idea generation, technological integration, product refinement, and market adaptation?

3. OBJECTIVES

The following are the objectives of the study:

1. Conduct a thorough review to identify and compile relevant literature on product innovation, ensuring a complete dataset for bibliometric analysis.
2. Perform a bibliometric analysis to evaluate the volume, geographical distribution, and temporal trends in product innovation research, highlighting its growth and evolution.
3. Analyse citation patterns to identify the most frequently cited authors, prominent institutions, and influential journals in product innovation.
4. Investigate the content of the literature to uncover significant topics and emerging themes, focusing on critical aspects such as idea generation, technological integration, product refinement, and market adaptation.

4. METHODOLOGY

Selection of Database and Systematic Literature Search

The study conducted a structured and comprehensive search for relevant literature using the Scopus database to ensure high-quality and relevant data for analysis. Scopus database is a premier multidisciplinary research platform offering comprehensive access to a high volume of peer-reviewed journals, conference proceedings, books, and patents across diverse disciplines, including science, technology, medicine, social sciences, and arts. Renowned for its extensive metadata and citation data, Scopus facilitates detailed bibliometric analyses by providing insights into citation trends, author productivity, and institutional contributions. Its advanced search capabilities allow researchers to construct precise queries using Boolean

operators, filters, and other tools to refine results by subject, publication type, or timeframe. Additionally, Scopus supports seamless integration with bibliometric software such as Biblioshiny and VOSviewer, enabling advanced visualisation and analysis. The global coverage and rigorous quality standards of Scopus ensure reliable and relevant literature for systematic searches, making it an essential resource for academic investigations and research synthesis.

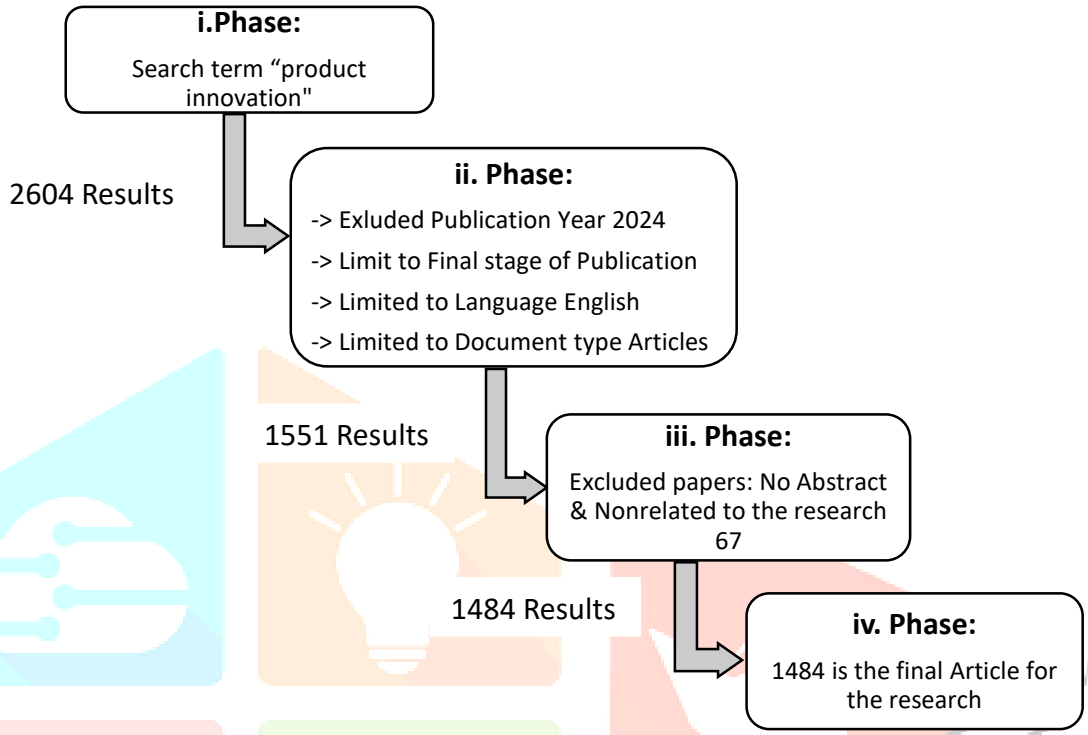

Figure 1: Data collection and preparation process. Source: Author’s own elaboration

The foundational research on product innovation falls within science, social sciences, and business. For this study, Scopus has been chosen as the most suitable database due to its relevance and comprehensive coverage. To conduct bibliometric studies on product innovation, the process began with a title search using the keyword "product innovation" to ensure that the articles closely align with the scope of the study. Following the title search, a total of 2,604 publications were identified. The dataset covered a publication period from 1973 to 2024; however, 2024 was excluded from the analysis as the study was conducted in the same year, and the year had not yet concluded. The research exclusively focused on document types classified as articles, reviews, and conference papers. To maintain consistency, only papers published in English, sourced from journals, and finalised in their publication stage were included, resulting in an initial selection of 1,551 papers. Subsequently, 67 papers were excluded due to the absence of abstracts or their irrelevance to the research, finally leaving 1,484 articles for the study. Figure 1 justifies the data collection and preparation process.

The Scopus code used for the final data extraction is given below:

TITLE ("product innovation") AND (EXCLUDE (PUBYEAR , 2024)) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "ch") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (PUBSTAGE , "final"))

Bibliometric Analysis

Bibliometric analysis is a powerful quantitative methodology that evaluates patterns, relationships, and trends within academic research, providing critical insights into specific domains (Donthu et al., 2021). Using advanced tools like the biblioshiny package in R, researchers systematically process bibliographic data extracted from reputable databases such as Scopus or Web of Science (Ellegaard & Wallin, 2015). This process begins with data preparation, where metadata like author names, titles, keywords, publication years, and citations are cleaned and structured to ensure accuracy. Citation analysis follows, identifying influential articles, authors, and journals by assessing metrics like citation counts and h-index scores. Collaboration network analysis maps relationships among researchers, institutions, and nations, offering a visual representation of scholarly partnerships and geographic trends. Thematic and content analyses then uncover core and emerging topics by examining keyword co-occurrence and conceptual patterns in abstracts and titles. Visualisation tools are crucial in this process, presenting complex data as citation networks, collaboration maps, thematic clusters, and temporal trends (Liao et al., 2018). These insights help identify research gaps, track field evolution, and inform strategic decisions, making bibliometric analysis an invaluable tool for advancing knowledge and guiding future research in fields like "Product Innovation."

Narrative Synthesis

A qualitative method is used to interpret and integrate the results of bibliometric analysis, providing a deeper understanding of the data. Once the bibliometric analysis, including citation analysis, collaboration network analysis, and thematic analysis, is complete, the next step is to summarise the findings through narrative synthesis. This involves positioning the results within the broader context of existing literature on product innovation, identifying key trends, dominant topics, emerging themes, and research gaps. The synthesis will also explore emerging themes, such as the growing role of artificial intelligence, and identify research gaps, such as a lack of studies on consumer experiences or the intersection of sustainability with advanced technology. By weaving these insights together, narrative synthesis provides a cohesive story about the field's evolution, identifies areas needing further research, and guides future investigations, helping researchers, policymakers, and practitioners understand the state of product innovation research and inform their decisions moving forward.

5. RESULTS AND DISCUSSION

The descriptive analysis for product innovation is organised into five sections: documents, sources, authors, affiliations, countries, and keywords.

Table 1: Summary of Datasets

Description	Results	Description	Results
MAIN INFORMATION ABOUT DATA		**AUTHORS**	
Timespan	1973:2023	Authors	3133
Sources (Journals, Books, etc)	628	Authors of single-authored docs	248
Documents	1484	**AUTHORS COLLABORATION**	
Annual Growth Rate %	10.24	Single-authored docs	275
Document Average Age	10.2	Co-Authors per Doc	2.71
Average citations per doc	52.79	International co-authorships %	26.95
References	75300	**DOCUMENT TYPES**	
DOCUMENT CONTENTS		Article	1409
Keywords Plus (ID)	3320	Conference paper	26
Author's Keywords (DE)	3426	Review	49
Note: Prepared by the Authors			

Table 1 presents an overview of the dataset's composition, characteristics, and collaboration patterns, providing essential insights for deeper analysis and a better understanding of the data. The data spans from 1973 to 2023 and includes 628 sources such as journals and books, with a total of 1,484 documents. The annual growth rate of the documents is 10.24%, and the average age of the documents is 10.2 years. Each document averages 52.79 citations, with a total of 75,300 references. The contents include 3,320 keywords plus and 3,426 authors' keywords. The authorship involves 3,133 authors, with 248 being single-authored. Of the 1,484 documents, 275 are single-authored, and the average number of co-authors per document is 2.71. Additionally, 26.95% of the documents feature international co-authorship. Regarding document types, 1,409 are articles, 26 are conference papers, and 49 are reviews.

Table 2: Volume of Publications and Citations

Year	MTCpA	N	MTCpY	CY	Year	MTCpA	N	MTCpY	CY	Year	MTCpA	N	MTCpY	CY
1973	1	1.00	0.02	52	1993	11.56	9.00	0.36	32	2009	76.1	31.00	4.76	16
1974	231	1.00	4.53	51	1994	16.14	7.00	0.52	31	2010	132.3	44.00	8.82	15
1975	1190	2.00	23.80	50	1995	31	8.00	1.03	30	2011	48.47	38.00	3.46	14
1978	7.5	2.00	0.16	47	1996	77.36	11.00	2.67	29	2012	48.85	40.00	3.76	13
1979	9	1.00	0.20	46	1997	79.85	13.00	2.85	28	2013	51.73	49.00	4.31	12
1982	5.5	2.00	0.13	43	1998	143.73	11.00	5.32	27	2014	64.5	78.00	5.86	11
1983	32	2.00	0.76	42	1999	135.33	6.00	5.20	26	2015	36.27	64.00	3.63	10
1984	144.6	5.00	3.53	41	2000	155.55	20.00	6.22	25	2016	63.97	71.00	7.11	9
1985	12.33	3.00	0.31	40	2001	201.81	16.00	8.41	24	2017	40.91	70.00	5.11	8
1986	8.67	3.00	0.22	39	2002	109.21	29.00	4.75	23	2018	36.33	99.00	5.19	7
1987	40.83	6.00	1.07	38	2003	39.15	27.00	1.78	22	2019	31.37	95.00	5.23	6
1988	39.86	7.00	1.08	37	2004	137.44	16.00	6.54	21	2020	28.38	112.00	5.68	5
1989	24.2	5.00	0.67	36	2005	143.87	23.00	7.19	20	2021	22.7	105.00	5.68	4
1990	20	5.00	0.57	35	2006	52.8	25.00	2.78	19	2022	14.69	129.00	4.90	3
1991	43	2.00	1.26	34	2007	190.96	23.00	10.61	18	2023	6.88	131.00	3.44	2

1992	118.5	6.00	3.59	33	2008	83	31.00	4.88	17					

Note: Prepared by the Authors; N - Number of articles published each year, MTCpA- Mean Total Citation per Article, MTCpY- Mean Total Citation per Year and CY - Total Citable Years

Table 2 provides a comprehensive year-wise overview of publication activity and citation metrics from 1973 to 2023, highlighting trends in both research productivity and impact. Over the five-decade span, there is a clear growth in the number of articles published annually, with a notable surge in recent years reaching 131 articles in 2023. Citation trends show that older articles, particularly from the 1970s to 1990s, have significantly higher mean citations per article (MTCpA), owing to their longer exposure time; for instance, articles from 1975 have an MTCpA of 1190 despite only 2 articles being published that year. In contrast, more recent publications exhibit higher output but lower MTCpA, as they have had less time to accumulate citations. The Citable Years (CY) column, which reflects how long articles from a given year have been available to be cited, naturally declines over time from 52 years for 1973 to just 2 years for 2023. Overall, the table illustrates a dynamic evolution in both the volume and influence of scholarly output within the field.

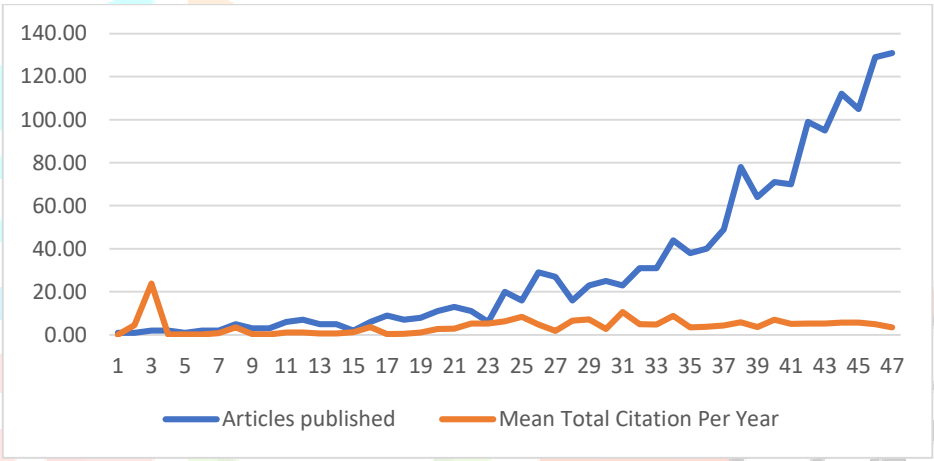

Figure 2: Annual Scientific Production Vs Average Citation Per Year

Figure 2, titled "Annual Scientific Production vs. Average Citation Per Year," likely compares two key metrics over time: the Annual Scientific Production (which refers to the number of articles or publications produced each year) and the Average Citation Per Year (which refers to the average number of citations received by these articles each year). In this figure, the trend shows that while annual scientific production has steadily increased over time, the Average Citation Per Year has likely decreased or plateaued.

Top 10 globally cited documents

Table 3: Top 10 Globally Cited Documents						
Title	**Author**	**Year**	**Source Title**	**TC**	**TCPY**	**NTC**
A dynamic model of process and product innovation	Utterback J.M.; Abernathy W.J.	1975	Omega	2374	47.48	1.99
The dynamics of product innovation and firm competencies	Danneels E.	2002	Strategic Management Journal	1577	68.57	14.4
Resolving the capability-rigidity paradox in new product innovation	Atuahene-Gima K.	2005	Journal of Marketing	1172	58.6	8.15
Product innovation strategy and the performance of new technology ventures in China	Li H.; Atuahene-Gima K.	2001	Academy of Management Journal	1156	48.17	5.73
Collaborating to create: The internet as a platform for customer engagement in product innovation	Sawhney M.; Verona G.; Prandelli E.	2005	Journal of Interactive Marketing	1027	51.35	7.14
The importance of diverse collaborative networks for the novelty of product innovation	Nieto M.J.; Santamaría L.	2007	Technovation	1011	56.17	5.29
Technological capability, strategic flexibility, and product innovation	Zhou K.Z.; Wu F.	2010	Strategic Management Journal	958	63.87	7.24
Organizing for radical product innovation: The overlooked role of willingness to cannibalize	Chandy R.K.; Tellis G.J.	1998	Journal of Marketing Research	938	34.74	6.53
The incumbent's curse? Incumbency, size, and radical product innovation	Chandy R.K.; Tellis G.J.	2000	Journal of Marketing	914	36.56	5.88
Mainstreaming green product innovation: Why and how companies integrate environmental sustainability	Dangelico R.M.; Pujari D.	2010	Journal of Business Ethics	897	59.8	6.78
Note: Prepared by the Authors; TC- Total Citations, TCPY - TC Per Year, NTC - Normalised TC						

Table 3 presents ten significant academic papers on product and process innovation, along with citation metrics that reflect their influence and relevance. The Total Citations range from 897 to 2374, with older papers generally receiving higher total citations. The TC per Year demonstrates the ongoing relevance of certain papers, such as the 2002 paper by Danneels, which has the highest citation rate per year. The Normalised TC further highlights the paper's relative impact within its field, showing that Danneels' work has had a particularly significant influence. Overall, the table reflects the enduring impact of these studies on the field of product innovation, with more recent works maintaining strong citation rates and influencing areas such as green product innovation and technological capability in strategic flexibility.

Sources

Table 4: Top 10 Sources						
Element	**h_index**	**g_index**	**m_index**	**TC**	**NP**	**PY_start**
JOURNAL OF PRODUCT INNOVATION MANAGEMENT	36	47	0.947	5730	47	1987
TECHNOVATION	26	42	0.65	3774	42	1985
INDUSTRIAL MARKETING MANAGEMENT	21	26	0.447	2192	26	1978
JOURNAL OF BUSINESS RESEARCH	21	31	0.538	2423	31	1986
RESEARCH POLICY	19	21	0.475	2021	21	1985
BUSINESS STRATEGY AND THE ENVIRONMENT	18	20	0.563	2391	20	1993
JOURNAL OF CLEANER PRODUCTION	18	22	1.059	2611	22	2008
EUROPEAN JOURNAL OF INNOVATION MANAGEMENT	17	27	0.63	1469	27	1998
SUSTAINABILITY (SWITZERLAND)	14	23	1.273	572	33	2014
R AND D MANAGEMENT	11	13	0.393	706	13	1997
Note: Prepared by the Authors						

Table 4 provides citation metrics for ten academic journals focused on innovation management, emphasising their academic influence and publication histories. Notably, the Journal of Product Innovation Management boasts the highest h-index (36), reflecting a significant number of influential papers, and has accumulated 5730 citations since its 1987 launch. Other journals, such as technovation and industrial marketing management, have also contributed significantly, with impressive total citations and citation indices, while newer journals like sustainability (switzerland) (established in 2014) show strong citation performance, including a notably high m-index of 1.273, highlighting its rapid impact despite its relatively recent start.

Author

Table 5: Most Productive Authors						
Element	**h_index**	**g_index**	**m_index**	**TC**	**NP**	**PY_start**
LI Y	9	17	0.474	588	17	2006
WANG Y	9	15	0.9	795	15	2015
WU J	9	9	0.643	766	9	2011
DOUGHERTY D	8	9	0.242	1689	9	1992
LI J	8	11	0.421	758	11	2006
ZHANG M	7	8	0.7	543	8	2015
ATUAHENE-GIMA K	6	6	0.25	4250	6	2001
LI S	6	9	0.545	251	9	2014
ZHANG H	6	6	0.6	592	6	2015
ZHANG J	6	9	0.375	382	9	2009
Note: Prepared by the Authors						

Table 5 provides citation metrics for ten researchers, illustrating their academic influence and publication history. LI Y has an h-index of 9 with 588 citations from 17 papers since 2006, while WANG Y has 9 publications and 795 citations, along with a higher g-index of 15. In contrast, DOUGHERTY D, who began in 1992, has accumulated 1689 citations despite publishing only 9 papers, indicating a strong long-term impact. The table highlights the different citation levels across these researchers, with more established figures

like DOUGHERTY D showing higher total citations, and newer scholars like ZHANG M (2015) exhibiting a rapidly increasing citation rate.

Affiliations

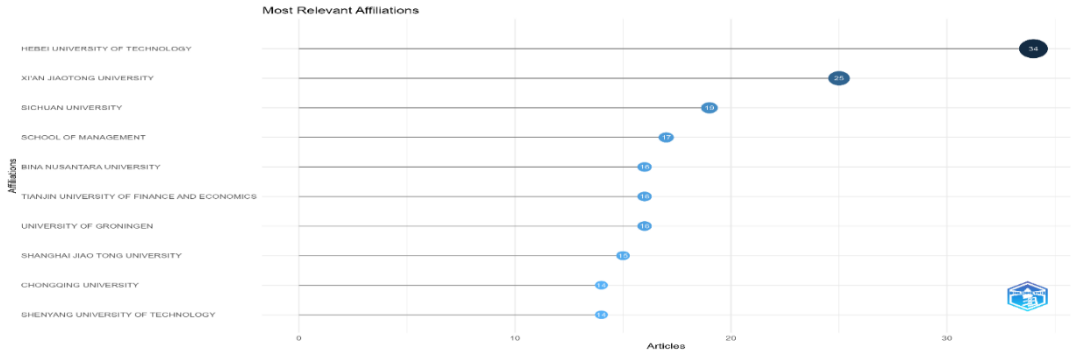

Figure 3: Most Relevant Affiliations

Figure 3 provides the affiliations of various academic institutions and the number of articles published by their researchers. Hebei University Of Technology leads with the most publications, totaling 34, followed by Xi'an Jiaotong University with 25. Other institutions, such as Sichuan University and School Of Management, have 19 and 17 articles, respectively. Several universities, including Bina Nusantara University, Tianjin University Of Finance And Economics, University Of Groningen, and Shanghai Jiao Tong University, have 16 publications. Both Chongqing University and Shenyang University Of Technology have published 14 articles, reflecting a diverse range of publication activity across these institutions. The table illustrates the academic output of these universities through their research publications.

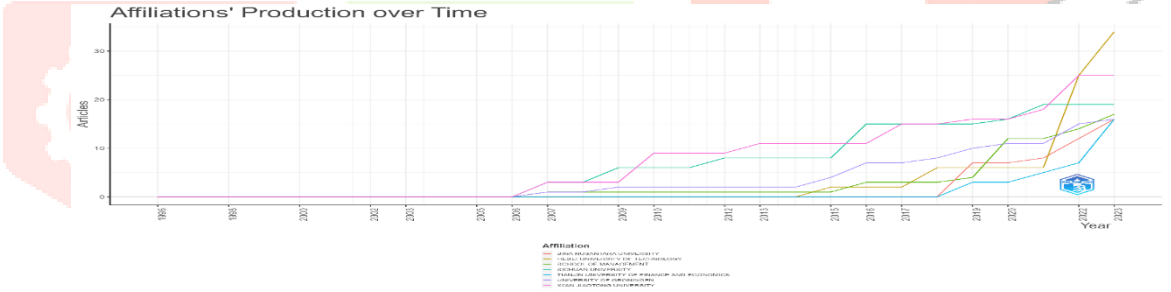

Figure 4: Affiliation Production Over Time

Figure 4 illustrates the academic production of various affiliations over time, highlighting the publication trends of different institutions. It tracks how the number of articles produced by each affiliation has evolved, providing insights into their research output across the years.

Countries Scientific Production

Table 6: Countries' Production of Articles							
Country	**Articles**	**SCP**	**MCP**	**Freq**	**MCP_Ratio**	**TC**	**AAC**
CHINA	247	182	65	0.166	0.263	10931	44.26
USA	125	89	36	0.084	0.288	9118	72.94
UNITED KINGDOM	70	41	29	0.047	0.414	3357	47.96
SPAIN	69	45	24	0.046	0.348	5175	75.00
ITALY	51	34	17	0.034	0.333	4044	79.29
NETHERLANDS	41	29	12	0.028	0.293	2139	52.17
INDONESIA	39	39	0	0.026	0	413	10.59
GERMANY	36	24	12	0.024	0.333	2157	59.92
SWEDEN	32	24	8	0.022	0.25	1213	37.91
AUSTRALIA	26	15	11	0.018	0.423	1369	52.65
Note: Prepared by the Authors; SCP- Single Country Production, MCP- Multiple Country Production, AAC- Average Article Citation							

Table 6 displays citation metrics for academic articles across various countries, emphasising their research productivity and impact. The Country column lists ten nations, while the Articles column shows the number of publications from each country. China leads with 247 articles and 10,931 citations, averaging 44.26 citations per article. Conversely, Indonesia has 39 articles with the lowest average citation count of 10.59 and no multiple-country publications. Countries such as the USA, Spain, and Italy have strong citation impact, with average citations ranging from 47.96 to 79.29, highlighting their significant academic influence.

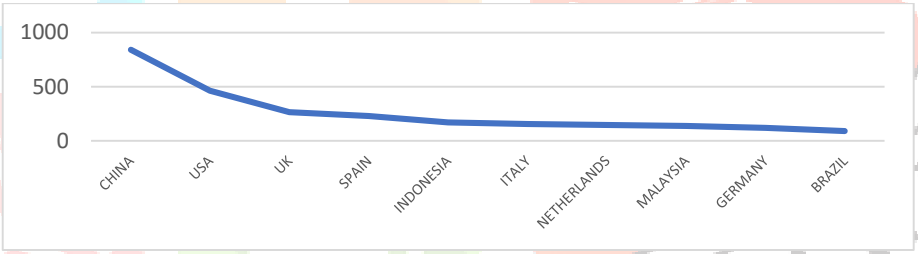

Figure 5: Countries' scientific production

Figure 5 shows in terms of countries' scientific production, the frequency of articles published by CHINA is very high compared with other countries.

Keywords

Figure 5 highlights the keyword frequency of occurrence to reflect the key focus areas within product innovation research. Product development leads with 183 mentions, underscoring its core importance in research on creating and improving new products. Product design follows closely with 82 mentions, emphasising its role in shaping products for usability and market appeal. Commerce (68 occurrences) focuses on trade and economic activities, while competition (60 mentions) highlights the significance of market rivalry. The term sustainable development (43 mentions) signals increasing attention to environmentally conscious practices, and marketing (41 mentions) shows the role of strategies to promote and position products. Sales (39 mentions) and manufacturing (38 mentions) are crucial in discussing product distribution and production processes. Additionally, research and development (38 mentions) emphasise the importance of innovation and technological advancements. Finally, manufacture (37 mentions) reflects the broader

product production process. In summary, the table emphasises key areas such as development, design, competition, and sustainability in product innovation.

Figure 6: Word Cloud

Figure 7: The Words' Frequency over Time in the research chart displays the trends of specific terms related to business and product innovation over a period, highlighting their shifting prominence in academic and industry discussions. Here's an explanation of the key trends for each term:

Product Development: As the most frequently mentioned term, its occurrence likely reflects an ongoing and steady focus on the creation and improvement of new products. Over time, this term may show a gradual increase as product development continues to be central to innovation efforts across industries.

Product Design: This term is also significant, though it appears slightly less frequently than product development. The frequency might reflect a steady concern with the design aspects of products—how they function, appeal to users, and meet market demands. This could be a more specialised focus within the broader field of product development.

Commerce: The frequency of this term likely fluctuates in relation to broader economic trends and the global focus on market dynamics. It could see spikes during periods of economic change, such as during trade booms or shifts in business practices related to e-commerce.

Competition: As a key driver of innovation, competition likely rises in frequency in response to changing market conditions. Increased competition would drive more attention to strategies businesses use to outperform rivals, leading to a potential increase in the frequency of this term during periods of heightened market rivalry.

Sustainable Development: This term has likely gained more attention over time, reflecting growing concerns with environmental impact and sustainability in business practices. The frequency of "sustainable development" might show an upward trend as industries and governments increasingly prioritise sustainability.

Marketing: Marketing remains a crucial part of business strategy. Its frequency may vary depending on the research focus on consumer behaviour, advertising strategies, or digital marketing trends, often showing consistent or slightly rising mentions as marketing innovations evolve.

Sales: The focus on sales strategies may rise during times of economic growth, product launches, or shifts in consumer behaviour. Sales tactics are directly tied to the performance of businesses, so their frequency can be influenced by market conditions.

Manufacturing: This term is often tied to discussions of production efficiency, automation, and supply chain issues. Over time, the frequency of "manufacturing" might reflect technological advancements or disruptions in the industry, especially when new manufacturing methods or innovations are introduced.

Research and Development: R&D is typically a key term in innovation, reflecting investment in new technologies, scientific discovery, and industrial advances. The frequency of R&D mentions could rise with a greater focus on technological progress or funding in innovation sectors.

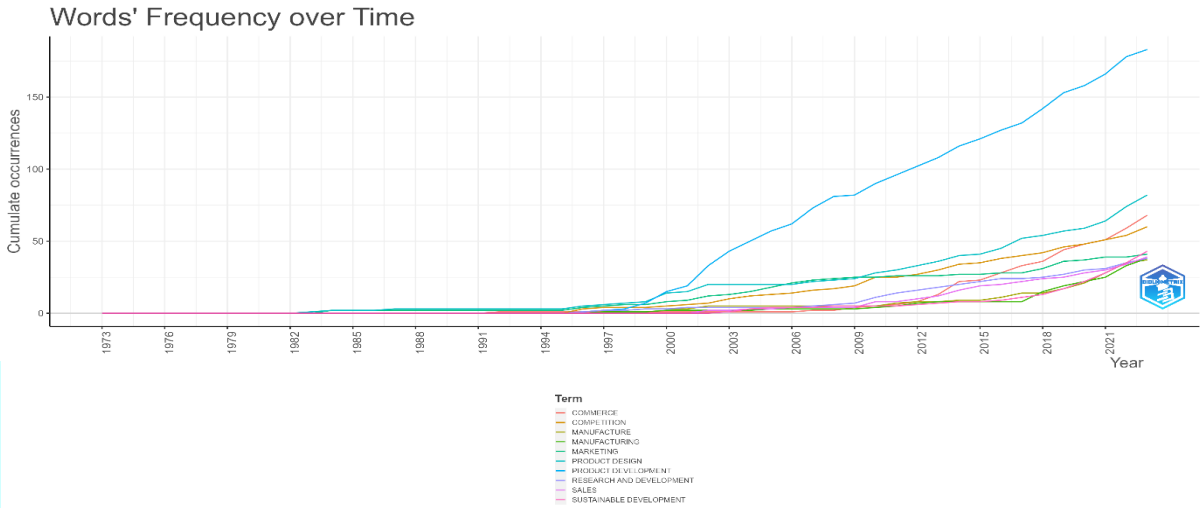

Figure 7: Word Frequency

Co-citation Network

In the context of the Co-citation Network listed, the authors Hair J.F., Podsakoff P.M., Damanpour F., Fornell C., Porter M.E., Atuahene-Gima K., Zahra S.A., Dangelico R.M., Grant R.M., and Zhou K.Z.—are linked top frequent citation in the papers.

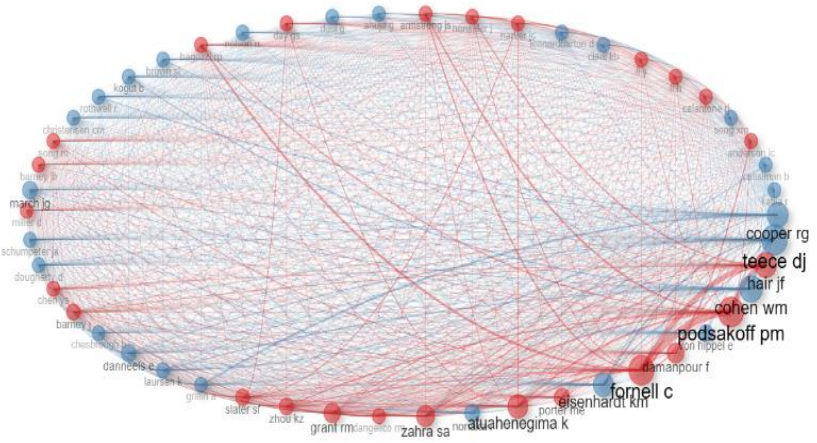

Figure 8: Co-citation Network

Collaboration Network

The Collaboration Network refers to the pattern and frequency of academic or research collaborations between scholars, institutions, or countries. When focusing on countries, this network highlights which nations collaborate most frequently in research and innovation efforts. In this context, the USA, the United Kingdom, and China are identified as the most collaborative countries, reflecting their central role in the global research landscape (Figure 9).

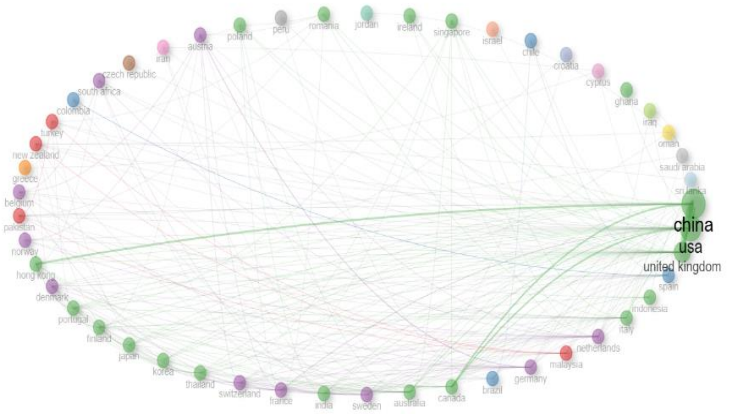

Figure 9: Collaboration Network

Thematic Evolution

From 1973-2013, there was a thematic connection in product innovation (Figure 10). This theme evolved to corporate social responsibility, green products, green product innovation, innovation, knowledge sharing, product design, and product innovation in 2014-2019. Product Innovation in 2014-2019 theme evolved to Emerging economies, green product innovation, innovation performance, milk segregation, product innovation, product innovation performance, radical innovation, resource-based view, sustainable product innovation, 2020-2023.

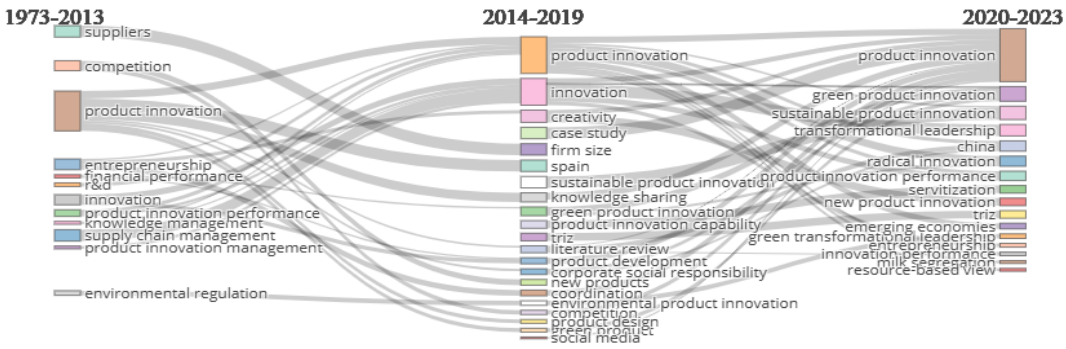

Figure 10: Thematic Evolution

Top 10 Articles Citation Analysis

Utterback & Abernathy (1975) examined the relationship between firm characteristics, such as production process stages and competitive strategies, and innovation patterns. Using data from the Myers and Marquis study across five industry segments, the study tested hypotheses on how innovation capability aligned with competitive strategy. Findings showed strong statistical support, revealing that innovation types and stimuli varied systematically with process stages and competition basis. The paper integrated insights from economics, management, and organisation theory, presenting a framework that highlighted key innovation resources, barriers, and constraints. Despite limitations like confidentiality restrictions and process

segmentation assumptions, the study emphasised the need for a deeper understanding of technological change and recommended further empirical testing and model refinement.

Danneels (2002) examined how product innovation supported the renewal and development of firm competencies over time in high-tech industries. Based on field research involving five high-tech firms and 34 in-depth interviews, it applied resource-based theory and organisational learning concepts, particularly exploitation and exploration. A distinction was made between first-order competences (existing capabilities) and second-order competences (capability to develop new ones), though the latter proved abstract for some informants. A typology was introduced to classify product innovation projects by required competences, offering a framework for understanding the dynamic link between innovation and organisational renewal. Despite conceptual contributions, limitations included a small sample, limited generalizability, and omission of external factors like alliances. Practical implications emphasised learning from failures, adapting evaluation metrics, and strengthening knowledge transfer. Future research was suggested for broader industries and inter-company learning.

Atuahene-Gima (2005) examined how firms balanced competence exploitation and exploration to improve incremental and radical innovation performance. Based on data from 500 electronics firms in Guangdong province, it found that market orientation—especially customer and competitor orientations—significantly influenced this balance. Interfunctional coordination and perceived market opportunity positively moderated the link between exploration and radical innovation. The research addressed gaps in understanding the impact of market orientations on innovation and highlighted the capability-rigidity paradox. Contributions included integrating market orientation into the resource-based view and offering strategies for managing competencies. Limitations involved industry-specific data and lack of causal inference. Future research was suggested on coordination costs, competitor orientation development, and overcoming competency traps.

Li & Atuahene-Gima (2001) analyzed how product innovation strategies impacted firm performance in China's transitional economy, using data from 47–62 new technology ventures. Resource dependence theory framed the investigation, focusing on the moderating effects of institutional support, environmental turbulence, and relationship-based strategies. Product innovation strategy showed a positive effect on performance, while political networking failed to enhance effectiveness and often incurred transaction costs. Institutional support strengthened the strategy-performance relationship. Hierarchical moderated regression and factor analysis were used, with controls for firm size, age, origin, and ownership. Limitations included small sample size, unreliable environmental turbulence constructs, and a cross-sectional design limiting causal inference. The research emphasised challenges in transitional economies and recommended future time-lagged studies to explore environmental moderators such as hostility, dynamism, and heterogeneity.

Sawhney et al (2005) examined how the Internet facilitated collaborative innovation through customer engagement, highlighting co-creation of value as a competitive advantage in the network economy. Case studies of Ducati and Eli Lilly illustrated the use of online tools like polls, surveys, and platforms such as InnoCentive across product development stages. Traditional customer involvement was contrasted with emerging virtual collaboration models. Organisational transformation was emphasised as essential for sustaining co-innovation. Although variables were not explicitly defined, the study offered practical insights

for marketing and innovation management and recommended further research on digital collaboration mechanisms and their performance impact.

Nieto & Santamaría (2007) examined the influence of collaborative network types on the degree of novelty in product innovations using longitudinal data from the Spanish Business Strategies Survey (1991–2002), covering 6,500 observations from 1,300 manufacturing firms. Collaboration with suppliers and clients significantly improved innovation novelty, while competitor collaboration negatively affected outcomes. Network heterogeneity facilitated access to diverse information, enhancing innovation performance. Continuity in collaboration supported both radical and incremental innovations. Limitations included restricted generalizability due to the Spain-specific sample and limited analysis of competitor collaboration effects. Emphasis was placed on configuring diverse and sustained partnerships for innovation success, with recommendations for future research to investigate collaboration depth and process innovation impacts.

Zhou & Wu (2010) analysed how technological capability affected exploitation and exploration in new product development using data from 192 high-tech firms in China. Technological capability positively influenced exploitation but showed a curvilinear relationship with exploration, where excessive capability hindered innovation due to organisational inertia. Strategic flexibility strengthened the positive effect of technological capability on exploration, helping firms avoid competence traps. The research integrated absorptive capacity and organisational inertia theories, highlighting the need to balance efficiency and adaptability. Limitations included a cross-sectional design and reliance on managerial perceptions. Future research was recommended to adopt longitudinal and multi-domain approaches.

Chandy & Tellis (1998) examined drivers of radical product innovation, focusing on willingness to cannibalise existing products. Based on a survey of 192 strategic business units, internal product markets, strong product champion roles, and future-market focus positively influenced this willingness. Findings challenged the view that firm size drives innovation, highlighting the greater impact of organisational factors and managerial attitudes. Limitations included a focus on high-tech industries, weak measurement scales, and the absence of performance metrics. Emphasising cannibalisation and future customer needs was deemed essential for innovation, with calls for future research on low-tech sectors, risk propensity, and improved assessment methods.

Chandy & Tellis (2000) reassessed the belief that large firms are less likely to introduce radical innovations. Analysing 64 major innovations across 49 product categories over 150 years, findings showed that while small firms introduced slightly more radical innovations, large firms, particularly post–World War II, also contributed significantly. The "incumbent's curse" was found to be context-dependent rather than universal. Using secondary data from over 250 books and 500 articles, and expert ratings, the study highlighted that radical innovation depended more on organisational and attitudinal factors than on firm size. Limitations included a focus on successful innovations, a lack of failure data, and an absence of internal firm insights.

Dangelico & Pujari (2010) examined how firms integrated sustainability into product development through a multiple case study of 12 small and medium-sized manufacturers in Italy and Canada. A conceptual framework was proposed around energy minimisation, materials reduction, and pollution prevention. Green innovation was found essential for growth and regulatory compliance, but faced barriers such as high costs,

limited customer awareness, and complex eco-labelling. A practical toolbox was introduced to guide firms in managing green innovation. The research emphasised the need for life cycle assessment, public policy support, and tailored strategies and suggested future studies on green portfolios, investment impacts, and stakeholder influence.

6. DIRECTIONS FOR FUTURE RESEARCH AREAS IN PRODUCT INNOVATION

This study suggests research areas which offer diverse opportunities for advancing product innovation while addressing environmental concerns, market dynamics, and organisational challenges. They reflect a blend of macro-level themes, such as sustainability and CSR, and micro-level topics, like niche market segmentation and design optimisation.

Green Product Innovation: This area emphasises the creation of environmentally friendly products and sustainable practices. Research focuses on developing materials, technologies, and processes that minimise environmental impact. Topics include renewable energy integration, recyclable materials, and reducing carbon footprints during production. Understanding consumer acceptance of green innovations and identifying barriers to adoption are also crucial.

Sustainable Product Innovation: Sustainable innovation involves embedding sustainability principles into the design and production of goods. This includes using renewable resources, reducing waste, and designing for product lifecycle management. Research may investigate the long-term viability of products, ethical sourcing, and how companies can align sustainability with profitability and consumer demand.

Innovation Performance: Innovation performance explores the effectiveness of innovation strategies, focusing on measurable outcomes like market success, speed to market, and competitive advantage. Research could examine factors influencing performance, such as organisational culture, leadership, and external collaboration. Advanced metrics and models for evaluating innovation outcomes are also a key focus.

Radical Innovation: This area studies groundbreaking innovations that fundamentally change industries or create entirely new markets. Radical innovation often involves high-risk, high-reward strategies. Topics include identifying disruptive technologies, fostering creative ideation, and managing the uncertainty associated with such innovations.

Emerging Economies: Research in this area examines how product innovation is implemented in developing countries. Topics include overcoming challenges like limited infrastructure, cultural differences, and resource constraints. Studies may also focus on affordable innovation models tailored to these markets and strategies to enhance global competitiveness for businesses in emerging economies.

Corporate Social Responsibility (CSR): CSR to product innovation, exploring how social and environmental responsibility can drive the development of ethical and sustainable products. Topics include consumer expectations of CSR, regulatory impacts, and how businesses can align CSR initiatives with their innovation goals to build brand loyalty and reputation.

Resource-Based View (RBV): The RBV framework emphasises leveraging a company's unique resources, such as intellectual property, expertise, and technology, to achieve superior innovation

outcomes. Research may focus on identifying critical resources, optimising their use, and understanding how internal capabilities drive innovation and competitive advantage.

Knowledge Sharing: Knowledge sharing highlights the collaborative exchange of information, skills, and expertise within teams and across organisations. Research explores how knowledge sharing fosters creativity, accelerates problem-solving, and enhances innovation efficiency. Challenges like knowledge hoarding and strategies for fostering a culture of openness are key areas of interest.

Product Design: This field delves into the methodologies, tools, and technologies used to create products that meet user needs and preferences. Research topics include user-centred design, incorporating cutting-edge technologies like AI and virtual reality into design processes, and balancing aesthetics with functionality to maximise consumer satisfaction.

7. CONCLUSION

This study on product innovation through bibliometric analysis reveals a progressively evolving field characterised by both enduring foundational themes and emerging priorities. Green and sustainable innovation has gained prominence, reflecting the global shift toward environmentally responsible development and reinforcing the integration of sustainability into product strategies. Core concepts such as innovation performance, radical innovation, and knowledge sharing highlight the strategic and collaborative dimensions essential for advancing impactful innovation. Contextual influences, particularly within emerging economies, further shape innovation trajectories, underscoring the importance of cultural, economic, and infrastructural factors. The alignment of product innovation with Corporate Social Responsibility (CSR) illustrates a growing convergence between innovation and ethical, value-driven practices. While traditional focuses on product design, usability, and manufacturing efficiency remain integral, the emergence of niche topics such as milk segregation exemplifies the field's responsiveness to evolving consumer and regulatory demands. The temporal shift in thematic frequency marked by sustained attention to R&D and a rising emphasis on sustainability and competitiveness reflects a dynamic and adaptive landscape driven by technological progress, market imperatives, and societal expectations.

REFERENCE

Atuahene-Gima, K. (2005). Resolving the Capability–Rigidity Paradox in New Product Innovation.

Bisbe, J., & Otley, D. (2004). The effects of the interactive use of management control systems on product innovation. Accounting, Organisations and Society, 29(8), 709–737. https://doi.org/10.1016/j.aos.2003.10.010

Chandy, R. K., & Tellis, G. J. (1998a). Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize. Journal of Marketing Research, 35(4), 474. https://doi.org/10.2307/3152166

Chandy, R. K., & Tellis, G. J. (1998b). Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize. Journal of Marketing Research, 35(4), 474. https://doi.org/10.2307/3152166

Chandy, R. K., & Tellis, G. J. (2000). The Incumbent's Curse? Incumbency, Size, and Radical Product Innovation. Journal of Marketing, 64(3), 1–17. https://doi.org/10.1509/jmkg.64.3.1.18033

Cunha, M. P. E., Rego, A., Oliveira, P., Rosado, P., & Habib, N. (2014). Product Innovation in Resource-Poor Environments: Three Research Streams. Journal of Product Innovation Management, 31(2), 202–210. https://doi.org/10.1111/jpim.12090

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming Green Product Innovation: Why and How Companies Integrate Environmental Sustainability. Journal of Business Ethics, 95(3), 471–486. https://doi.org/10.1007/s10551-010-0434-0

Danneels, E. (2002). The dynamics of product innovation and firm competencies. Strategic Management Journal, 23(12), 1095–1121. https://doi.org/10.1002/smj.275

De Medeiros, J. F., Ribeiro, J. L. D., & Cortimiglia, M. N. (2014). Success factors for environmentally sustainable product innovation: A systematic literature review. Journal of Cleaner Production, 65, 76–86. https://doi.org/10.1016/j.jclepro.2013.08.035

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Eggert, A., Hogreve, J., Ulaga, W., & Muenkhoff, E. (2011). Industrial services, product innovations, and firm profitability: A multiple-group latent growth curve analysis. Industrial Marketing Management, 40(5), 661–670. https://doi.org/10.1016/j.indmarman.2011.05.007

Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? Scientometrics, 105(3), 1809–1831. https://doi.org/10.1007/s11192-015-1645-z

Falahat, M., Ramayah, T., Soto-Acosta, P., & Lee, Y.-Y. (2020). SMEs' internationalisation: The role of product innovation, market intelligence, pricing and marketing communication capabilities as drivers of SMEs' international performance. Technological Forecasting and Social Change, 152, 119908. https://doi.org/10.1016/j.techfore.2020.119908

Killen, C. P., Hunt, R. A., & Kleinschmidt, E. J. (2008). Project portfolio management for product innovation. International Journal of Quality & Reliability Management, 25(1), 24–38. https://doi.org/10.1108/02656710810843559

Kuncoro, W., & Suriani, W. O. (2018). Achieving sustainable competitive advantage through product innovation and market driving. Asia Pacific Management Review, 23(3), 186–192. https://doi.org/10.1016/j.apmrv.2017.07.006

Lau, C., & Ngo, H. (2004). The HR system, organizational culture, and product innovation. International Business Review, 13(6), 685–703. https://doi.org/10.1016/j.ibusrev.2004.08.001

Laverne, F., Segonds, F., Anwer, N., & Le Coq, M. (2015). Assembly Based Methods to Support Product Innovation in Design for Additive Manufacturing: An Exploratory Case Study. Journal of Mechanical Design, 137(12), 121701. https://doi.org/10.1115/1.4031589

Lee, K., & Kim, J. (2011). Integrating Suppliers into Green Product Innovation Development: An Empirical Case Study in the Semiconductor Industry. Business Strategy and the Environment, 20(8), 527–538. https://doi.org/10.1002/bse.714

Li, H., & Atuahene-Gima, K. (2001). Product Innovation Strategy And The Performance Of New Technology Ventures In China. Academy of Management Journal, 44(6), 1123–1134. https://doi.org/10.2307/3069392

Liao, H., Tang, M., Luo, L., Li, C., Chiclana, F., & Zeng, X.-J. (2018). A Bibliometric Analysis and Visualization of Medical Big Data Research. Sustainability, 10(1), 166. https://doi.org/10.3390/su10010166

Lin, R.-J., Tan, K.-H., & Geng, Y. (2013). Market demand, green product innovation, and firm performance: Evidence from Vietnam motorcycle industry. Journal of Cleaner Production, 40, 101–107. https://doi.org/10.1016/j.jclepro.2012.01.001

Melander, L. (2018). Customer and Supplier Collaboration in Green Product Innovation: External and Internal Capabilities. Business Strategy and the Environment, 27(6), 677–693. https://doi.org/10.1002/bse.2024

Nieto, M. J., & Santamaría, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. Technovation, 27(6–7), 367–377. https://doi.org/10.1016/j.technovation.2006.10.001

Rindova, V. P., & Petkova, A. P. (2007). When Is a New Thing a Good Thing? Technological Change, Product Form Design, and Perceptions of Value for Product Innovations. Organization Science, 18(2), 217–232. https://doi.org/10.1287/orsc.1060.0233

Sawhney, M., Verona, G., & Prandelli, E. (2005). Collaborating to create: The Internet as a platform for customer engagement in product innovation. Journal of Interactive Marketing, 19(4), 4–17. https://doi.org/10.1002/dir.20046

Sok, P., & O'Cass, A. (2015). Examining the new product innovation–performance relationship: Optimising the role of individual-level creativity and attention-to-detail. Industrial Marketing Management, 47, 156–165. https://doi.org/10.1016/j.indmarman.2015.02.040

Tatikonda, M. V., & Rosenthal, S. R. (2000). Technology novelty, project complexity, and product development project execution success: A deeper look at task uncertainty in product innovation. IEEE Transactions on Engineering Management, 47(1), 74–87. https://doi.org/10.1109/17.820727

Utterback, J. M., & Abernathy, W. J. (1975). A Dynamic Model of Process and Product Innovation.

Wang, M., Li, Y., Li, J., & Wang, Z. (2021). Green process innovation, green product innovation and its economic performance improvement paths: A survey and structural model. Journal of Environmental Management, 297, 113282. https://doi.org/10.1016/j.jenvman.2021.113282

Zhou, K. Z., & Wu, F. (2010). Technological capability, strategic flexibility, and product innovation. Strategic Management Journal, 31(5), 547–561. https://doi.org/10.1002/smj.830