HOW DOES ECOLOGICAL IMBALANCE MATTERS: A BIBLIOMETRIC ANALYSIS OF ECOLOGICAL IMPACT ON BUSINESSES?

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Abstract: This study offers an absolute analysis of the literature related to Ecological Impact on Businesses derived from Scopus database and explained with the help of bibliometric analysis and visualization. We explored a range of significant authors, institutions, and keywords in-depth using visualisation tools such as R-Studio and VOS Viewer. We searched the term Ecological Impact on Businesses and limited our search to the subject area of Business, Management and Accounting and only English Language articles were included. Citation analysis and reference co-citation analysis were performed, and the results showed that USA received the highest number of citations i.e. 1660 between the year 2000 to 2024 which is 57.20 average article citation and also USA produced highest number of articles as well which is 1502 articles in the last 24 years. India ranks on 5th and produces 362 articles from 2000 to 2024. Author Luthra S had produced highest number of articles. This study will aid scholars and practitioners interested in environmental implications on businesses in staying up to date on the most applicable current research and examine fresh opportunities of enquiry in the related topic of research.

Keywords: Ecological Impact, Business, Bibliometric Analysis, Citation Analysis, Scopus

Ecology Imbalance refers to the disturbance of natural ecosystems and the loss of biodiversity typically brought on by human activities such as pollution, deforestation and climate change (The Problem of Biodiversity Loss, Encyclopaedia Britannica, 2019). The ecological imbalance can impact business in several different ways like loss of natural resources which can hinder the production of business depending on natural resources. For example, the companies who make cosmetics or pharmaceutical products may struggle to obtain natural resources for the extraction of natural ingredients as the result of habitat destruction and extinction of many species. The imbalance can adversely affect the operations and supply chains of the business and can impact badly the agricultural sector, tourism and hospitality industry, etc. The ecological imbalance results in many natural disasters which can surely damage the business in ways like supply chain disruptions, infrastructure loss of the business and interruption in the business operations. Without addressing and finding the solutions of ecological imbalances, businesses can face numerous challenges and increased financial losses. However, businesses are also being held accountable for their impact on the environment and sustainability practices. Businesses face pressure from consumers, investors and many regulatory bodies to adopt more sustainable and environmentally responsible activities (Olubodun & Agbaje, 2021). Therefore, businesses who fail to address ecological imbalances can face reputational damage and loss of market share (Encyclopaedia Britannica, 2019). Businesses are beyond compare in their ability to mobilise financial, human and physical capacity, frequently manage large scale land holdings, use resources and supply goods that have impact on a diverse range of ecosystems (Armsworth et al., 2010). Sustainable growth is also the broadly used term which is increasingly dominant in recent times. Discussions regarding sustainability no longer consider sustainability merely as an ecological concern but takes into account its economic and social dimensions also (Krykun, 2016). The problems related to ecological impact on business are diverse and wide ranging. As firms continue to grow and expand, it is crucial to evaluate and address the environmental concerns of their processes. One can show concern for environmental issues in a variety of ways. Businesses that implement methods to minimize energy use, reducing waste output, and encourage sustainable procurement can make a beneficial influence on the atmosphere while improving their bottom-line.

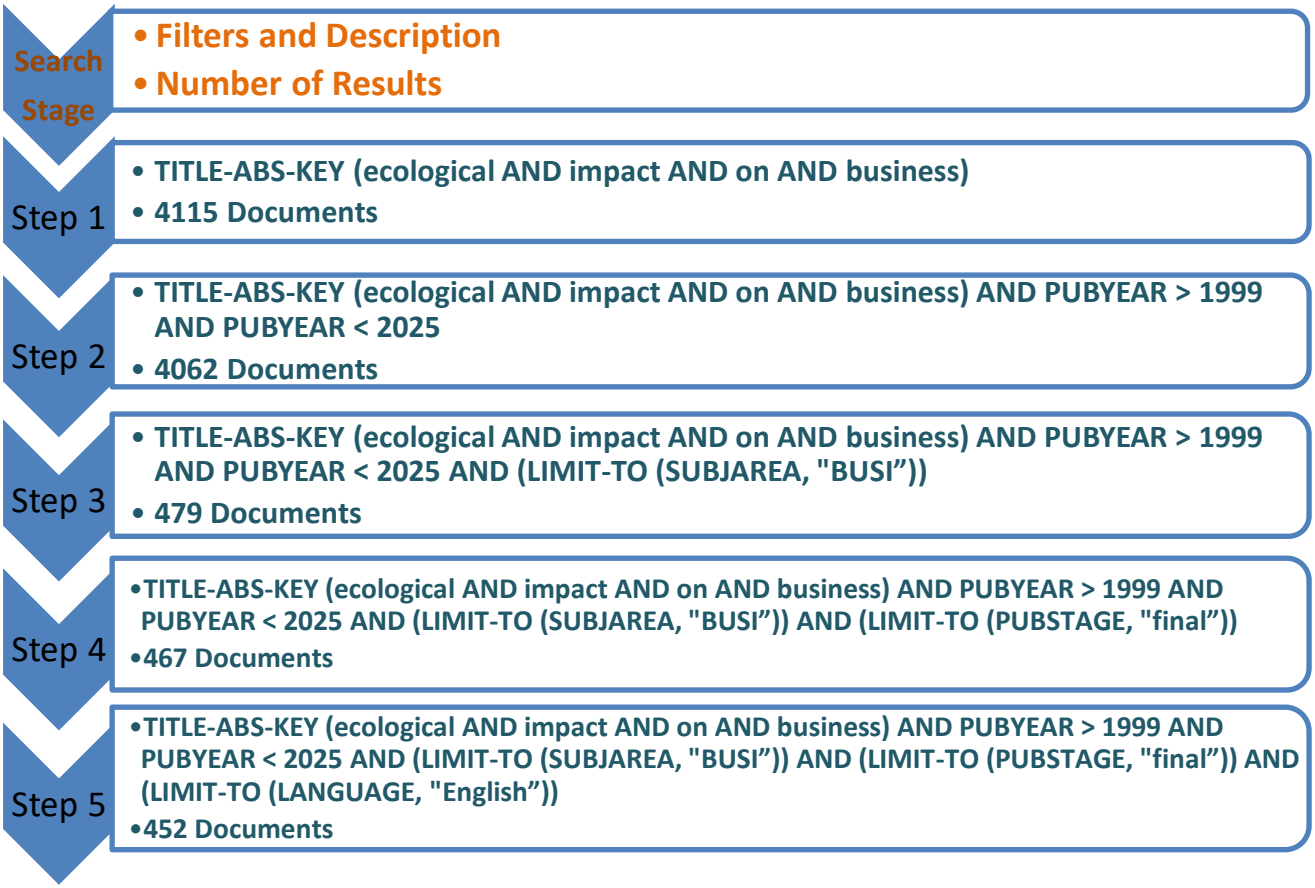
LITERATURE REVIEW

Ecological modernization theory proposes integrating economic and environmental goals within an industrial modernity framework. According to ecological modernization, environmental regulations can provide corporate benefits from innovation through better product design and economic performance (Smith and Crotty, 2008). Many businesses have realized in recent years that environmental concerns are major roadblocks to a company's sustainability. To overcome these barriers much research has been conducted to create quantitative measurements linked to industry operations to prevent waste and pollution (Wu et al., 2015). Environmental issues such as climate change, water, pollutions) have become more important strategic variables for businesses over the past few decades due to increasing demand from stakeholders to lessen their impacts on ecosystem (Houdet et al., 2012). The typical

attitude to business is not ecofriendly and as the problem of environment change deepens, consumers are becoming gradually informed of the ecological influence of their favoured firms. Consumers are becoming more selective about the companies from which they buy products and are becoming aware that how their purchases effect the environment (Tchanturia and Dalakishvili, 2023). Environmental alignment recognizes the business's responsibility to protect the natural environment. Firms that prioritize their social and environmental effect recognize the crucial role industries play in achieving a sustainable economic system (Andres et al., 2009). Broman and Robert, 2015 presents a unifying 'Framework for Strategic Sustainable Development' (FSSD) that has evolved over 25 years through collaboration between scientists and practitioners. The FSSD aims to guide planning and decision-making process towards sustainability by providing a structured approach to understanding and addressing the global sustainability challenge. They said organizations who have employed FSSD have been able to reduce their adverse effects on ecological and social systems. Numerous businesses successfully integrate various social activities into their global strategies. In addition to maintaining profitability of stakeholders, businesses nowadays strive to improve living standards and condition of life as well as appropriate ecological conditions of the areas in which they operate (Krykun, 2016). Ecological science ought to play a pivotal role in impact assessment by offering analytical methods for researching the interactions between organisms and their surroundings, forecasting the effects of specific development projects on important ecosystem components, and assessing the environmental implications of the plans, policies and initiatives. Ecological impact assessments are becoming more and more necessary for industrial consent and regulatory processes (Treweek, 1995). Every organizational action has a direct or indirect n impact on the environment, whether consciously or unconsciously (Etzion, 2007). Although it is good that academics are becoming more aware of and interested in how corporations might better safeguard biodiversity, this interest has only grown within a relatively tiny portion of corporate sustainability scholars (Panwar et al., 2023). Lukas, 2010 offers a comprehensive framework which draws theoretical ideas from the fields of ecological economics and strategic management, to boost our understanding of environmental management practices (EMPs) and their association with sustainable competitive benefit. A growing area of interest for businesses is Environmental Management Accounting (EM). Eco efficiency is a metric that combines quantitative and qualitative data regarding a company's environmental as well as changes in performance over time. In Japan, a draft standard and guideline says that eco efficiency data is a crucial indication and should be created by an EMA system and included in corporate environmental reports. EMA is a new instrument for environmental management which was initially designed to trace and monitor physical environmental flows and costs (Burritt and Saka, 2006). Businesses are incorporating green practices into their supply chains with great vigour in an effort to balance triple-bottom line performance. As a result, Green Supply Chain Practices is now an instrument for offering practical approach and lowering environmental effects while also affording economic benefits to industries (Wu et al., 2015). Business organizations encounter complicated challenges now and in future to which they require social, technological and economical solutions. Climate change has significant indirect repercussions that are difficult to manage. Indirect effect refers to imported global climate change impacts on specific corporate organizations or sectors (Beermann, 2011).

RESEARCH METHODOLOGY

The source from where data is collected is very critical while conducting a Bibliometric Analysis. To obtain data for our study we used the Scopus core collection which was comprised of around 18000 HQ Publications and 1.3 billion cited references in the beginning of 1900 (Gautam, Solkhe and Singh, 2022). We followed the advance search approach for retrieving literature from the Scopus Database. The exact strategy is listed below.

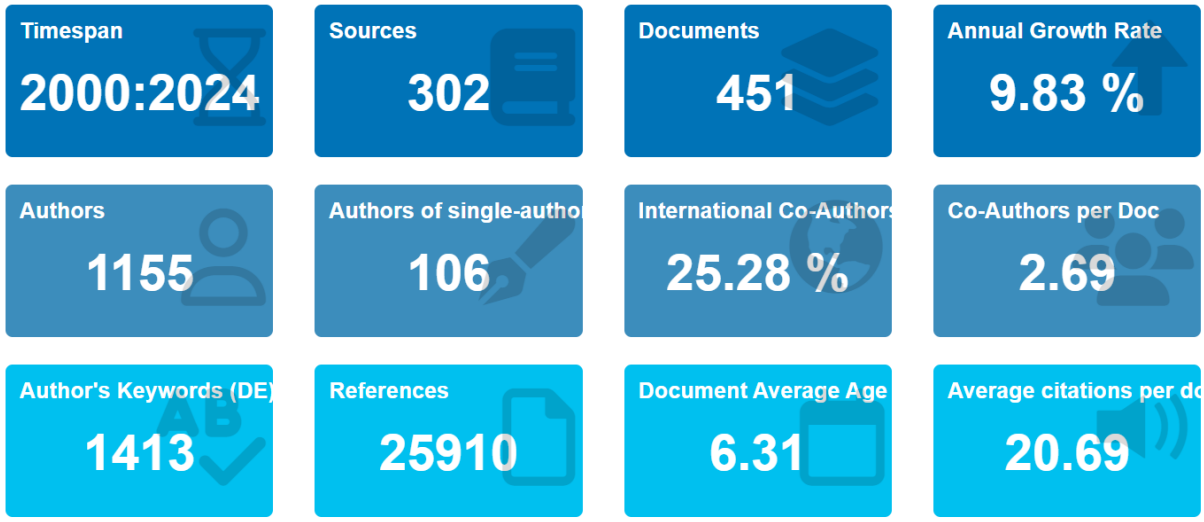


We searched the term 'Ecological Impact on Business' and limited our search to the subject area of Business, Management and Accounting from the year 2000 to 2024. Only English language documents which reached the final stage of publication or finally published were included. By following this retrieval method, we got 452 final documents for our analysis dated on 4th May 2024. The software R-Studio and VOS Viewer were used for exploration to find the answers to several research questions such as

(a) Which year was the most productive?
(b) Which country contributed the most to this field?
(c) Which type of publications was most popular?
(d) Which journals were most preferred?
(e) Which authors and institutions were most productive?
(f) which articles were most cited, and
(g) Which keywords were most frequently used for this type of research?

After the data was analysed using R-Studio and VOS Viewer, many tables were retrieved. To satisfy our analytical requirements, a few tables that were pulled from R-Studio and VOS Viewer were modified, and graphs were made in MS-Excel for better visibility. Figure 1 shows the main information we got from the Bibliometric Analysis ran on R Studio.

Figure-1: Main Information Retrieved from Bibliometrics Analysis



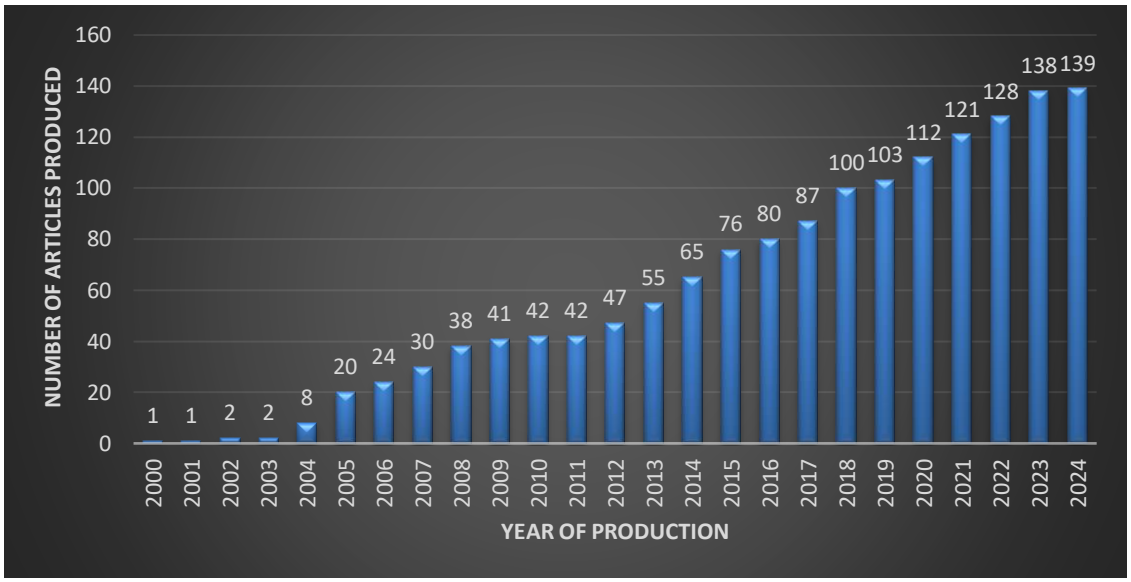
DATA ANALYSIS

Annual Scientific Production

Figure 2 displays the trend of documents released annually in the area of Ecological Impact on Business. The data is extracted from the bibliometric analysis and a diagram is made from excel. The findings showed that from the year 2000 to 2003 there was a dearth of research and later on from the year 2004 there was an increasing trend on this topic. 638 articles were produced in the last five years. Year 2024 had the greatest number of articles published which is 139 articles in a year. This graph showed that researchers' attention is currently being drawn more to the ecological impact on businesses because there is an increasing awareness about the environment.

Figure- 2: Annual Scientific Production

TOP 10 COUNTERIE'S TOTAL AND AVERAGE ARTICLE CITATIONS

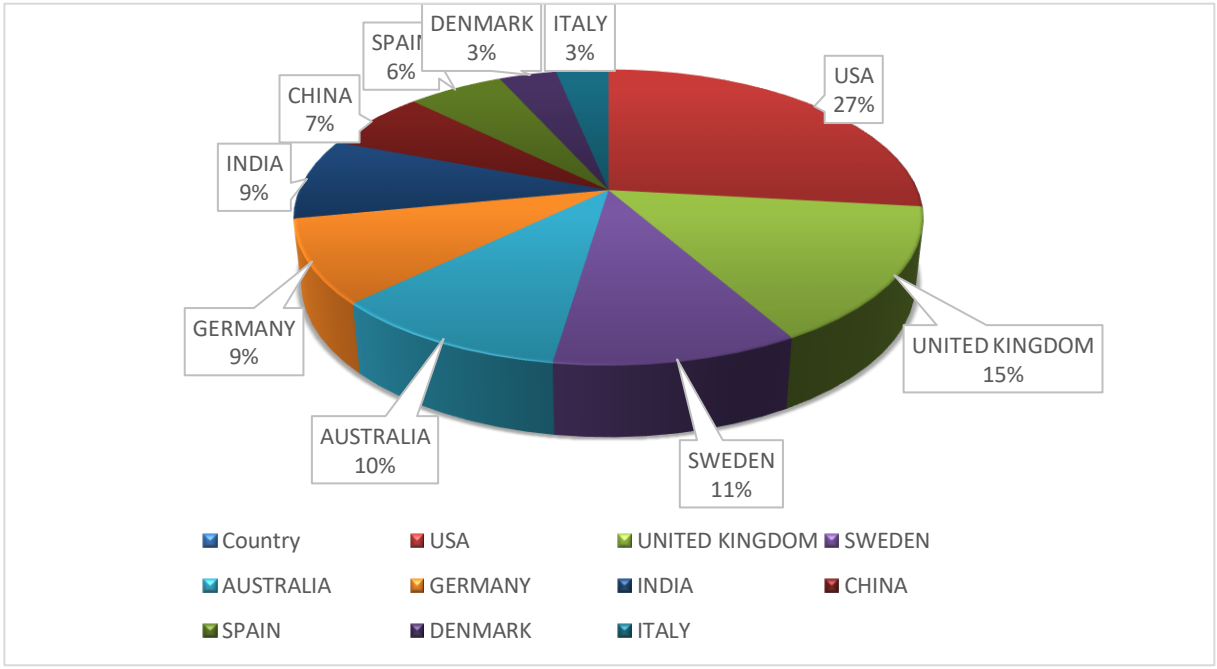


By the bibliographic coupling study, the countries with the highest total citations and average article citations were identified. The top 10 countries were shortlisted for the analysis purpose. Table 1 depicts that United States of America is the country which has highest total citation (1660) which is 27 percent as shown in Figure 3 but have less average article citations as compared to Sweden. India got 6th position in this field having 549 total citations, but its average article citations are greater than UK, Australia, Germany, China, Spain and Italy.

Table-1: Total and Average Article Citations

Column1	Column2	Column3
Country	**TC**	**Average Article Citations**
USA	1660	57.20
UNITED KINGDOM	925	33.00
SWEDEN	661	82.60
AUSTRALIA	649	38.20
GERMANY	564	16.60
INDIA	549	39.20
CHINA	407	18.50
SPAIN	365	33.20
DENMARK	219	43.80
ITALY	200	20.00

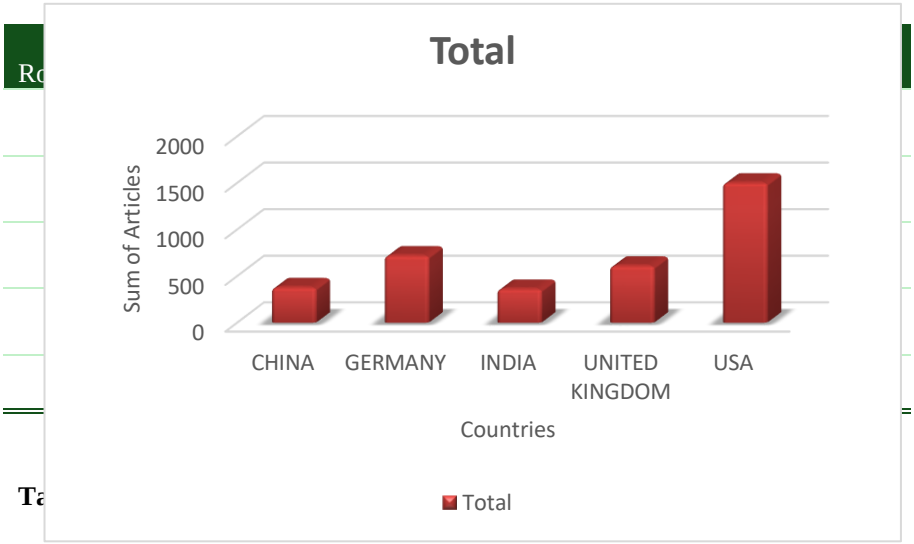
Figure-3: Pie Chart showing Percentage of Total Citations per Country



TOTAL NUMBER OF ARTICLES PRODUCED

According to Table 2, USA again is the top country in producing highest number of articles i.e. 1502 articles in the last 24 years and India ranks 5th in top five countries and produced 362 articles. Second is Germany with 720 articles produced. UK and China had produced 610 and 379 articles respectively.

Figure- 4



MOST RELEVANT AUTHORS IN THE FIELD

Figure 5 displays Top Authors and their Number of Articles Produced. Luthra S and Waghe S are the top two relevant authors with 5 articles each. Govindan K and Mangla SK had published 4 documents each. Luthra S worked on Sustainable and Green Supply Chain Management. In table 3 we have shown the list of articles published by two most relevant authors that are Luthra S and Waghe S. Table 3 is showing the 10 top articles by top 2 authors along with their Title, Journal name, DOI, total citation and total citations per year.

Figure- 5: Top Authors and their number of Articles

	Column	Column2
Authors	**Articles**	**Articles Fractionalized**
LUTHRA S	5	1.33
WAAGE S	5	3.17
GOVINDAN K	4	1.12
MANGLA SK	4	1.00
WANG H	3	0.92
ALCARAZ JM	2	0.67
ALVAREZ-RISCO A	2	0.75
ANGUELOV N	2	2.00
BON AT	2	0.50
BURRITT RL	2	0.75

Table-3: Most Relevant Authors and their List of Articles

AUTHOR	YEAR	TI	SO	DOI	TC	TCpY
LUTHRA S	2016	The Impacts of Critical Success Factors for Implementing Green Supply Chain Management Towards Sustainability: An Empirical Investigation of Indian Automobile Industry	Journal Of Cleaner Production	10.1016/j.jclepro.2016.01.095	253	28.111
LUTHRA S	2016	Critical Success Factors for Reverse Logistics in Indian Industries: A Structural Model	Journal Of Cleaner Production	10.1016/j.jclepro.2016.03.124	149	16.556
LUTHRA S	2019	Mapping The Human Resource Focused Enablers with Sustainability Viewpoints in Indian Power Sector	Journal Of Cleaner Production	10.1016/j.jclepro.2018.11.132	31	5.167
LUTHRA S	2017	Management Of Risks in Sustainable Supply Chain Using AHP And Monte Carlo Simulation	Managerial Strategies for Business Sustainability During Turbulent Times	10.4018/978-1-5225-2716-9.ch004	4	0.5
LUTHRA S	2018	Management Of Risks in Sustainable Supply Chain Using AHP And Monte Carlo Simulation	Global Business Expansion: Concepts, Methodologies, Tools, And Appl.	10.4018/978-1-5225-5481-3.ch075	1	0.143

WAAGE S	2014	New Business Decision-Making Aids in An Era of Complexity, Scrutiny, And Uncertainty: Tools for Identifying, Assessing, And Valuing Ecosystem Services	Handbook On the Economics of Ecosystem Services and Biodiversity	10.4337/9781781951514.00040	4	0.364
WAAGE S	2004	High Technology and Turn-Arounds: Impacts of The Past and Options for The Future	Corporate Environmental Strategy		1	0.048
WAAGE S	2017	Conclusion: A Shift Towards Sustainability Within Companies and The Financial Services Sector	Ants, Galileo, And Gandhi: Designing the Future of Business Through Nature, Genius, And Compassion	10.4324/9781351281126-25	0	0
WAAGE S	2005	Unintended Consequences and The Art of Designing Sustainability Strategies	Corporate Environmental Strategy		0	0
WAAGE S	2004	Surf's Up: Can The Hi-Tech Sector Catch the Next Wave?	Corporate Environmental Strategy		0	0

TOP JOURNALS AND THEIR PRODUCTION

Table- 4: Journals and Number of Articles they Produced

Sources	Articles
JOURNAL OF CLEANER PRODUCTION	48
BUSINESS STRATEGY AND THE ENVIRONMENT	12
DEVELOPMENTS IN MARKETING SCIENCE: PROCEEDINGS OF THE ACADEMY OF MARKETING SCIENCE	8
CSR, SUSTAINABILITY, ETHICS AND GOVERNANCE	7
JOURNAL OF BUSINESS ETHICS	6
CORPORATE ENVIRONMENTAL STRATEGY	5
LECTURE NOTES IN BUSINESS INFORMATION PROCESSING	5
FUTURES	4
JOURNAL OF BUSINESS RESEARCH	4
JOURNAL OF SUSTAINABLE TOURISM	4

Table 4 shows that Journal of Cleaner Production has the highest number of articles published i.e. 48 articles in 24 years which is 2 articles per year. The second journal which is Business Strategy and the Environment has only 12 articles published which is three times less than the Journal of Cleaner Production. Futures, Journal of Business Research and Journal of Sustainable Tourism has the least number of document published which is 4 articles each.

Table -5:Top Affiliations

Affiliations	Sum of Articles
JAMES COOK UNIVERSITY	74
LEEDS BECKETT UNIVERSITY	59
TECHNISCHE UNIVERSITÄT DRESDEN	40
UNIVERSITY OF DUISBURG-ESSEN	39
UNIVERSITY OF SOUTHERN DENMARK	31
Grand Total	**243**

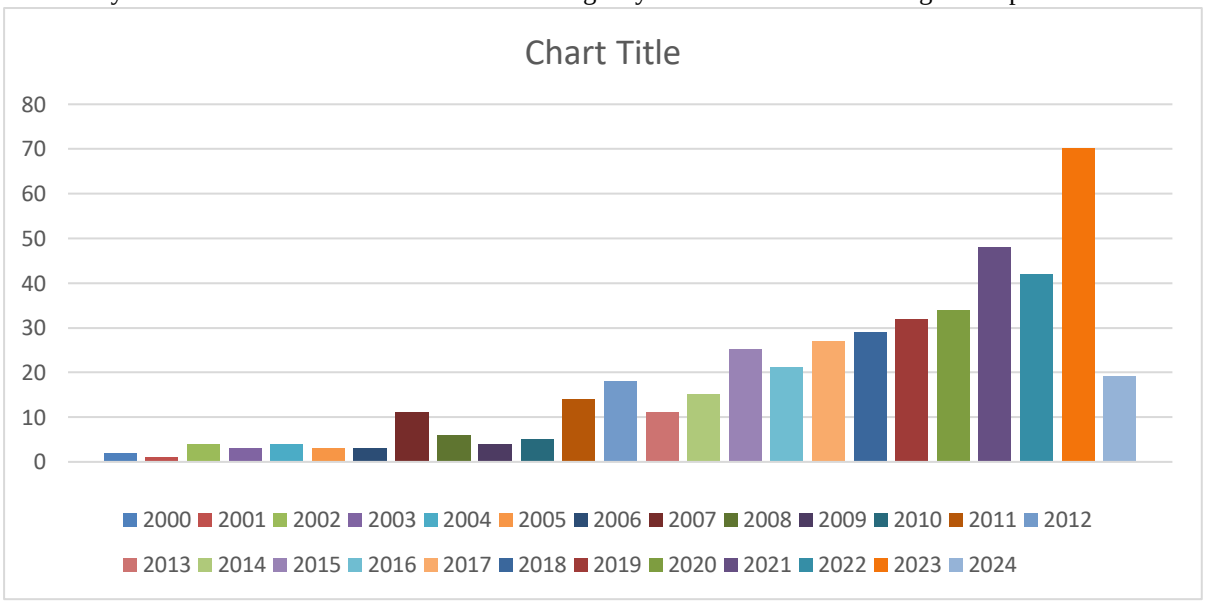
AFFILIATION PRODUCTION OVER TIME

Figure and Table 5 shows that James Cook University has the highest number of articles production with total number of 74 articles produced. Second is Leeds Beckett University with 59 articles produced. University of Southern Denmark has the least number of articles i.e. 31 articles produced and ranks 5th in the top five list of Affiliations.

ANNUAL PRODUCTION OF ARTICLES

Figure-6: Article production over years

Figure 6 shows the annual production of documents by years. The year 2023 was the most productive with 70 articles produced. 2001 is the least productive year with only one document produced. In 2024, nineteen articles are produced till 4th of May. Second highest article production year is 2021 in which 48 article were being published. From 2000 to 2010, only 2007 is the year in which the greatest number of articles were generated i.e. 11 articles. From 2011 to 2020, the year 2020 has produced highest number of articles with 34 documents published.



MOST GLOBAL CITED DOCUMENTS

Table 6 shows top 10 global cited documents of last 24 years in the field of ecological impact on business. The topmost article received total 704 citations which is 41.41 total citations per year. The second global cited Document received 418 total citations but it received per year total citation more than the top document which is 52.25 as compared to 41.41 total citations per year of the 1st document. The title of the article by Broman GI, 2017 which received most total citation per year is 'Framework for Strategic Sustainable Development' and the document who received most total citations is titles as 'An Exploration of Measures of Social Sustainability

and their Application to Supply Chain Decisions' by Hutchins and Sutherland, 2008.

Table-6: Top 10 Global Cited Documents

Paper	DOI	Total Citations	TC per Year
HUTCHINS MJ, 2008, J CLEAN PROD	10.1016/j.jclepro.2008.06.001	704	41.41
BROMAN GI, 2017, J CLEAN PROD	10.1016/j.jclepro.2015.10.121	418	52.25
LINNENLUECKE MK, 2012, BUS STRATEGY ENVIRON	10.1002/bse.708	254	19.54
LUTHRA S, 2016, J CLEAN PROD	10.1016/j.jclepro.2016.01.095	253	28.11
LEONIDOU LC, 2017, J BUS ETHICS	10.1007/s10551-015-2670-9	234	29.25
PAULRAJ A, 2009, BUS STRATEGY ENVIRON	10.1002/bse.612	213	13.31
MATHIYAZHAGAN K, 2014, INT J PROD RES	10.1080/00207543.2013.831190	206	18.73
TESTA F, 2015, BUS STRATEGY ENVIRON	10.1002/bse.1821	189	18.90
FERNHABER SA, 2008, J INT BUS STUD	10.1057/palgrave.jibs.8400342	174	10.24
FRAJ-ANDRÉS E, 2009, J BUS ETHICS	10.1007/s10551-008-9962-2	168	10.50

WORD CLOUD

Figure 6 is showing that the word Environmental Impact is the most used word in research papers and articles. Other main words or keywords used are Environmental Management, Ecology, Decision Making, Supply Chains, Climate Change, Industrial Management, etc.

Figure-6: Most Frequent Used Words as Keywords

Figure-7: Thematic Map 1

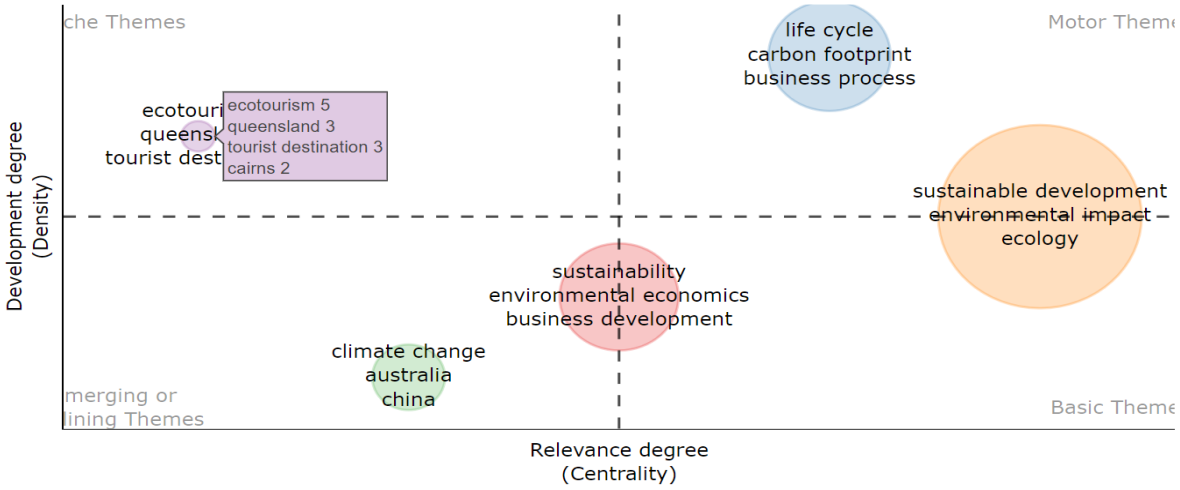


Figure- 8:Thematic Map 2

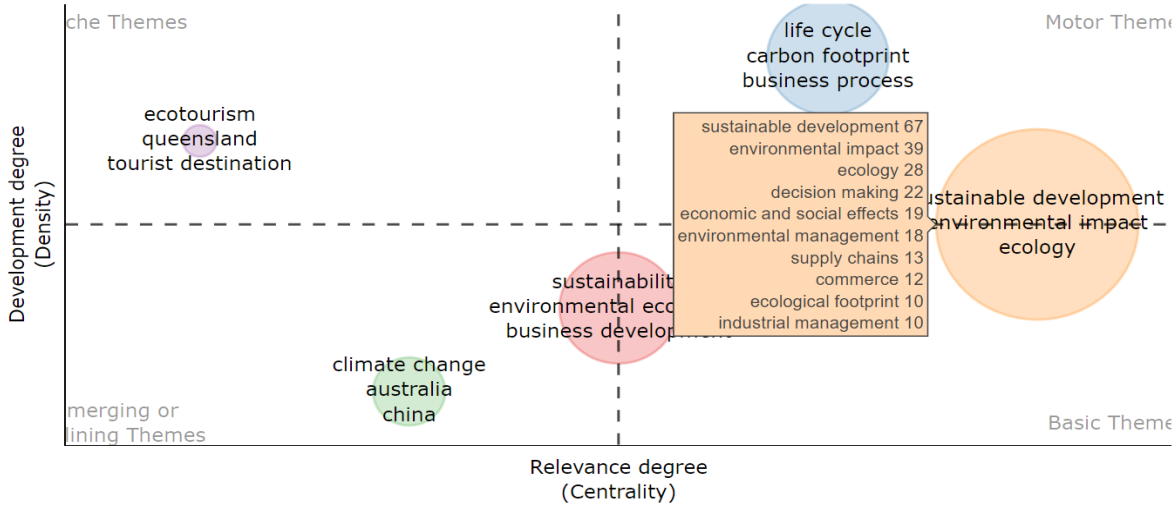


Figure- 7: and 8 is representing thematic map of the words used and their degree of relevance and development. For example, the words shown in Thematic Map 1 which are Ecotourism, Queensland and Tourist Destination in niche themes are developed but have very less relevance taking the point of view of research trends. Climate Change, Australia and China are emerging and developing themes. The themes Sustainable Development, Environmental Impact, Ecology, and Decision Making are more developed and relevant themes upon which enough work has been done. But the themes like Economic and Social Effects, Environmental Management, Supply Chains, Commerce, Ecological Footprints and Industrial Management are more relevant but less developed which means that more work needs to be done on these. If we see Figure number 8, it shows that motor themes like Life Cycle, Carbon Footprints and Business Processes, Environmental Sustainability, Life Cycle Assessment, Land Use, Agriculture, Green House Gases, Marketing and Irrigation are already enough developed themes.

Figure- 9: Co-occurrence Network of Author's Keywords

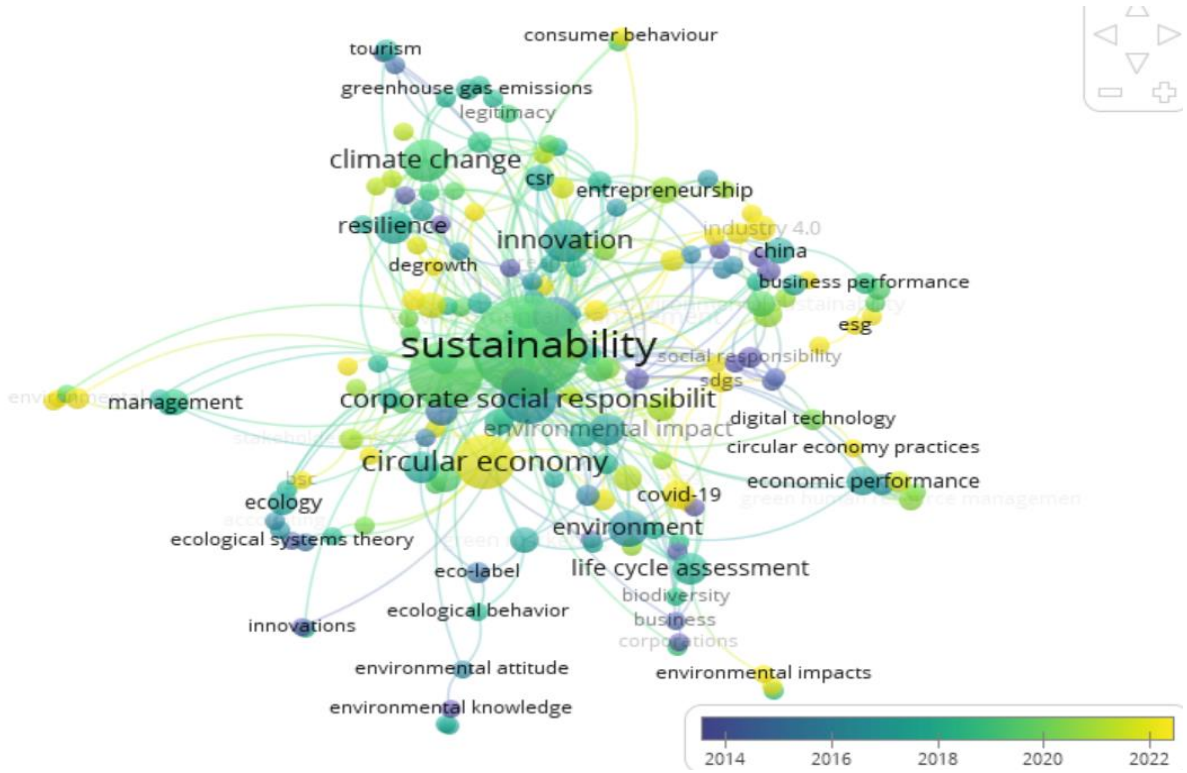


Figure-9. is showing that the word sustainability has co-occurred with circular economy, innovation, socio-ecological system, corporate social responsibility, management, resilience, degrowth, industry 4.0, etc. The word circular economy has co-occurred with eco-innovation, education, innovation and education. The word corporate social responsibility has occurred with sustainability, climate change, management, digital technology, sustainable consumption, etc.

RESULTS AND DISCUSSION

The trends that are currently showing up in papers discussing Ecological Impact on Business are displayed in this bibliometric study. The rising number of publications on the issue that are published annually across several countries suggests that academics and authors are becoming more interested in the environmental impact on businesses for sustainability. The findings showed that from the year 2000 to 2003 there was a dearth of research and later on from the year 2004 there was an increasing trend on this topic. 638 articles were produced in the last five years. Year 2024 had the greatest number of articles published which is 139 articles in a year. The year 2020 has produced highest number of articles with 34 documents published. The most prestigious journal for articles about the ecological impact of business is the Journal of Cleaner Production. After that James Cook University is the most productive affiliation in this field. In addition, the top 10 papers from the Scopus database were included in the analysis. The author most frequently uses the keywords: Sustainability, Sustainable Development, Environmental Impact, Economic and Social Effects, Ecology, Environmental Management. The themes like Economic and Social Effects, Environmental Management, Supply Chains, Commerce, Ecological Footprints and Industrial Management are more relevant but less developed which means that more work needs to be done on these.

However, researcher in India have not given this field as much attention as it deserves. One of the study's limitations is that there is no Indian institution included in the list of most productive affiliation. Another limitation is that it only examined publications published between 2000 to 2024. Therefore, by taking into consideration the study, more research on bibliometric analysis may be done in a more systematic way.

IMPLICATIONS

By looking at the publishing pattern of the published articles, the study highlights the most significant findings on the topic of Ecological Impact on Businesses and adds to the body of information that what is the role of sustainability in businesses. The study will be valuable to researchers since it offers several insights that will help them discover research gaps and close them with more investigations. The most relevant journals' list can help researchers find the most cited journals to publish their studies in, which can promote cooperation with prestigious institutions and writers who are performing good work in this subject. Researchers can use the domain's most published publications as a starting point for future study.

References

Armsworth, P. R., Armsworth, A. N., Compton, N., Cottle, P., Davies, I., Emmett, B. A., ... & Shannon, D. (2010). The ecological research needs of business. Journal of Applied Ecology, 47(2), 235-243.

Beermann, M. (2011). Linking corporate climate adaptation strategies with resilience thinking. Journal of Cleaner Production, 19(8), 836-842.

Broman, G. I., & Robèrt, K. H. (2017). A framework for strategic sustainable development. Journal of cleaner production, 140, 17-31.

Burritt, R. L., & Saka, C. (2006). Environmental management accounting applications and eco-efficiency: case studies from Japan. Journal of Cleaner production, 14(14), 1262-1275.

Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. Accounting, organizations and society, 32(7-8), 639-647.

Cormier, D., Magnan, M., & Morard, B. (1993). The impact of corporate pollution on market valuation: some empirical evidence. Ecological economics, 8(2), 135-155.

Etzion, D. (2007). Research on organizations and the natural environment, 1992-present: A review. Journal of Management, 33(4), 637-664.

Eraj-Andrés, E., Martinez-Salinas, E., & Matute-Vallejo, J. (2009). A multidimensional approach to the influence of environmental marketing and orientation on the firm's organizational performance. Journal of business ethics, 88, 263-286.

Gautam, P., Solkhe, A., & Singh, S. (2022). Workplace Disability: A Retrospective Evaluation using Bibliometric Analysis. Journal of Scientometric Research, 11(1), 130-141.

Houdet, J., Trommetter, M., & Weber, J. (2012). Understanding changes in business strategies regarding biodiversity and ecosystem services. Ecological economics, 73, 37-46.

Krykun, V. (2016). Sustainable development and ecological responsibility of business. Baltic Journal of Economic Studies, 2(1), 65-71.

Lucas, M. T. (2010). Understanding environmental management practices: integrating views from strategic management and ecological economics. Business Strategy and the Environment, 19(8), 543-556.

Olubodun, I. E., & Agbaje, Y. T. (2021). Environmental stewardship and strategy for business sustainability: Evidence from Small and Medium Packaged Water

Enterprises in Nigeria. Management and Economics Review, 6(1), 15-32.

Panwar, R., Ober, H., & Pinkse, J. (2023). The uncomfortable relationship between business and biodiversity: Advancing research on business strategies for biodiversity protection. Business Strategy and the Environment, 32(5), 2554-2566.

Smith, M., & Crotty, J. (2008). Environmental regulation and innovation driving ecological design in the UK automotive industry. Business strategy and the Environment, 17(6), 341-349.

Tchanturia, N., & Dalakishvili, R. (2023). Why Do We Need Sustainable Digital Marketing? In Handbook of Research on Achieving Sustainable Development Goals with Sustainable Marketing (pp. 372-386). IGI Global.

Treweek, J. (1995). Ecological impact assessment. Impact Assessment, 13(3), 289-315.

Wu, K. J., Liao, C. J., Tseng, M. L., & Chiu, A. S. (2015). Exploring decisive factors in green supply chain practices under uncertainty. International Journal of Production Economics, 159, 147-157.