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How does artificial intelligence affect the business context? A bibliometric analysis

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Abstract: We conducted a descriptive bibliometric analysis to examine scientific production, identify the most influential publications, and identify the most and least researched topics in four specific knowledge domains. We used a quantitative, descriptive, and correlational research approach to scientific production to carry out the analysis, which involved extracting 7,937 articles from the Web of Science and distributing them into three search equations. Using SciMAT v1.1.04 software, we processed the data and conducted a descriptive analysis of scientific production, enabling the creation of maps highlighting scientists with the most and least researched topics. The analysis of published articles, author performance, most productive journals, and most cited articles provided a detailed view of the dominant trends and approaches in the fields of Artificial Intelligence and business. The analysis showed that there is a significant evolution in the scholarly output, with themes such as "Value Creation", "Artificial Intelligence", "Business Intelligence", "E-Commerce", "Decision Making" and "Management" emerging as central in different periods, indicating their continued importance. Additionally, we note the inclusion of emerging themes like 'Customer Experience', 'Chatbots', 'Internet of Things', and 'Machine Learning', which reflect the dynamics and evolution of research concerns over time. The results of the analysis have significant implications for business policy and strategy formulation. Understanding emerging trends can help organizations make informed decisions and proactively adapt to changes in the artificial intelligence and sustainability landscape.

Keywords: *Artificial intelligence, Business, E-commerce, Sustainability, Marketing, SciMAT.*

1. Introduction

Currently, Artificial Intelligence (AI) has moved from a mere futuristic promise to a tangible and transformative reality in the business environment [1]. The growing and constant advancement of technology and business industrialization processes has led to significant advancements in the development of the Internet, mobile technologies, electronics, and digital applications, among others [2]. As a result, AI implementation in organizations can create competitive advantages and transform their business models [3].

According to Duan, et al. [4] AI has the ability to improve operational efficiency by automating repetitive tasks while improving the accuracy of organizational decision-making. Similarly, the technology provides new opportunities for growth by enabling a better understanding of data and pattern identification. As a result, as the amount of data grows and computing power dramatically increases, organizations are increasingly turning to artificial intelligence to drive business value [5].

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Soni, et al. [6] argue that AI has the ability to significantly improve business performance by providing new and better capabilities, which can lead to significant changes in organizations and the economic system in general. Moreover, in the business context, AI enables rapid pattern identification in large data sets, new levels of service and agile analytics, improved product design, business expansion, and improved cost structure, among others [7].

Similarly, AI has become a transformative force in the business world, redefining the way companies operate, make decisions, and communicate with customers. By combining advanced algorithms and machine learning, AI applications enable organizations to efficiently analyze large amounts of data, identify complex patterns, and predict future trends. Businesses use artificial intelligence to enhance strategic decisions, streamline operational processes, tailor customer experiences, and create innovative products [8]. However, there are also opinions that AI could be the end of some operational or manual jobs [9]. However, Kim [10] emphasizes that AI, like many other revolutions in history, is an advancement that brings fear and uncertainty.

Therefore, the present work aims to analyze the impact of AI in the business context through the analysis of different research areas. We conduct a descriptive bibliometric analysis for this purpose, examining the most relevant scientific production and influential publications across the three studied fields of knowledge: marketing, e-commerce, sustainability, strategy, and project management. Note that the analysis in these four fields aligns with an extensive previous literature review. We also analyse strategic diagrams to pinpoint the most and least researched topics in these areas, serving as a valuable guide for future research and fostering knowledge exchange between academics and practitioners in the field.

The structure of the article is as follows: following the introduction, we present the methodology, which details the process used and the data sources. The next section presents the findings, both in terms of scientific production and graph analysis. The paper ends with conclusions, recommendations, and limitations.

2. Materials and Methods

We will conduct the present research using bibliometric analysis, which employs a quantitative, descriptive, and correlational approach to scientific production, in light of AI's current popularity and the objectives we aim to achieve [11]. The bibliometric analysis summarises the main publication trends by authors, years of publication, and the most productive journals, among others, enabling the identification of gaps and emerging topics for scientific exploration [12]. To ensure the validity and scientific quality of the data, we worked with the Web of Science (WOS) databases, which allowed access to journal articles, distributed in four search equations presented in Table 1. We conducted a general review of the AI literature to identify the four areas of analysis, identifying these areas as having the greatest influence and impact on AI.

Table 1.
Search indicators.

Database	Web of science		
Search equation	"Artificial intelligence" and "marketing" or "branding"	"Artificial intelligence" and "e-commerce"	"Artificial intelligence" and "sustainability" and "strategic management" and "project management"
Document type	Journal articles	Journal articles	Journal articles
Total articles	4973	450	2514

The Soft Computing and Intelligent Information Systems Research Group at the University Of Granada, Spain, developed the open-source software Sci-MAT, v1.1.04, for the information debugging process and bibliometric analysis development. This software facilitated the analysis of scientific production performance within the studied field, as well as the creation and examination of scientific maps [13, 14].

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The following outlines a three-phase methodological process for adoption:

Initial descriptive analysis: This phase involves conducting a descriptive analysis of scientific production within the studied fields using various metrics such as the number of published articles, citation counts, prominent authors, and the H index Each search equation will be scrutinized.

Keyword normalization and topic grouping: In this phase, keywords will be normalized and then grouped based on topics using the Simple Center algorithm.

Creation of scientific maps: Scientific maps are spatial representations depicting document relationships based on analyzed criteria. These maps enable the location of documents according to their centrality (x-axis) and density (y-axis) [15]. Scientific maps allow for analysis based on centrality, which measures a topic's degree of interaction with other topics, and density, which measures a topic's internal cohesion. We categorize the analyzed topics in the scientific maps as follows:

- Motor Themes: Positioned in the upper right quadrant with high centrality and density, these themes are well-developed and crucial in the research area.
- Highly Developed and Isolated Themes: Situated in the upper left quadrant, these themes exhibit low centrality but high density, indicating marginal importance in the field.
- Emerging or Declining Themes: These topics, located in the lower left quadrant, display low centrality and density.
- Basic and Crosscutting Themes: Located in the lower right quadrant, these themes have high centrality and low density, indicating that they are relevant to other topics but lack development.

3. Results

3.1. Relationship with Marketing or Branding.

3.1.1. Analysis of the Performance of Scientific Production

From the analysis, it can be seen that the number of documents published on the subject of Marketing and/or Branding increased by 74% between the first and second periods and by 95% in the third period (Figure 1).

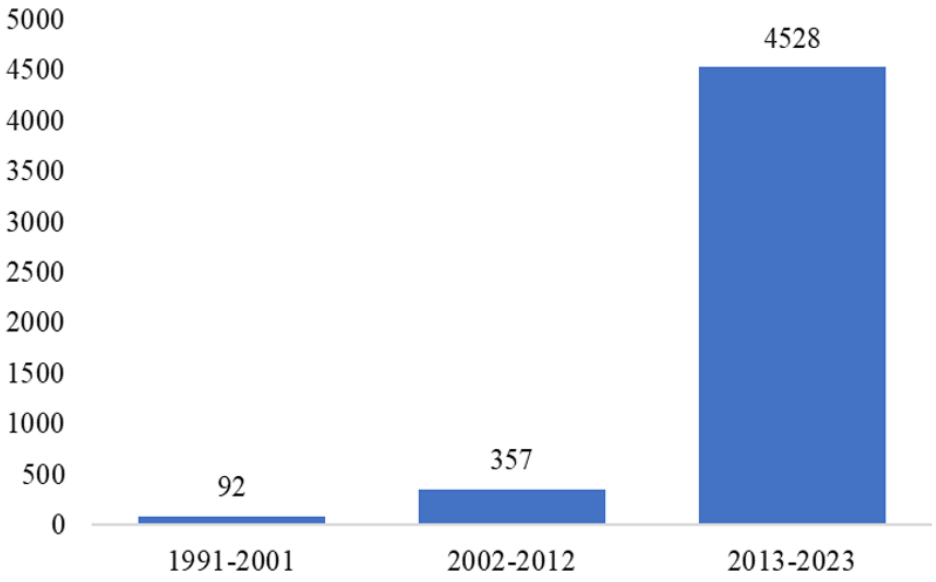

Figure 1.
Number of articles published per time period.

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Regarding the performance of the authors, it can be observed that Jing Qiu was the author with the highest number of publications during the periods analyzed, with a total of 16 articles published, as shown in Table 2.

Table 2.
Authors' performance.

Authors	Publications	Citation
Qiu, Jing	16	118
Zhao, Junhua	16	151
Dwivedi, Yogesh K.	15	1312
Chatterjee, Sheshadri	14	281
Vale, Zita	14	262

Table 3 shows that the IEEE Access journal was the most productive in this area, with a total of 144 articles published on AI and marketing/branding, representing 3% of the total number of journals publishing articles on this topic.

Table 3.
Most productive journals in the area.

Journal	Articles	% of total
IEEE access	144	3%
Engineering applications of artificial intelligence	118	2%
Sustainability	117	2%
Expert systems with applications	90	2%
Journal of business research	65	1%

Finally, Table 4 shows the 5 papers with the highest number of citations. The most cited paper is "Artificial Intelligence in Service", which states that AI is transforming several services, which drives innovation but at the same time is detrimental because it implies the loss of human jobs. In addition, the article suggests that there are four types of intelligence needed to perform service tasks, which are mechanical, analytical, intuitive, and empathic [16].

Table 4.
Most cited articles in the field.

Journal	Title	Authors	Year	Citation
Journal of Service Research	Artificial intelligence in service	Huang, MH, Rust, RT	2018	818
Journal of Service Management	Brave new world: Service robots in the frontline	Wirtz, J, Patterson, PG, Kunz, WH, Gruber, T, Lu, VN, Paluch, S, Martins, A	2018	694
International Journal of Information Management	Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy	Dwivedi, YK, Hughes, L, Ismagilova, E, Aarts, G, Coombs, C, Crick, T, Duan, YQ, Dwivedi, R, Edwards, J, Eirug, A, Galanos, V, Ilavarasan, PV, Janssen, M, Jones, P, Kar, AK, Kizgin, H, Kronemann, B, Lal, B, Lucini, B, Medaglia, R, Le Meunier-FitzHugh, K, Le Meunier-FitzHugh, LC, Misra, S, Mogaji,	2021	604

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Journal	Title	Authors	Year	Citation
		E, Sharma, SK, Singh, JB, Raghavan, V, Raman, R, Rana, NP, Samothrakis, S, Spencer, J, Tamilmani, K, Tubadji, A, Walton, P, Williams, MD		
He National academy of sciences of the United States of America	Computer-based personality judgments are more accurate than those made by humans	Wu, YY, Kosinski, M, Stillwell, D	2015	482
Journal of the academy of marketing science	How artificial intelligence will change the future of marketing	Guha, A, Bressgott, T, Grewal, D, Davenport, T	2020	447

3.1.2. Analysis of Strategic Diagrams

After studying and analyzing the performance of scientific research in the fields of AI and marketing or branding, a study of related topics was developed by identifying keywords that appeared together, considering for the analysis three periods: 1) 1991-2001; 2) 2002-2012; and 3) 2013-2023, to study the evolution of topics in the different periods of analysis.

For the first period, terms with a minimum frequency of one and a minimum co-occurrence frequency of one were taken as references, resulting in the following clusters: Marketing, Artificial Intelligence, Big Data and Internet of Things (Figure 2, Table 5).

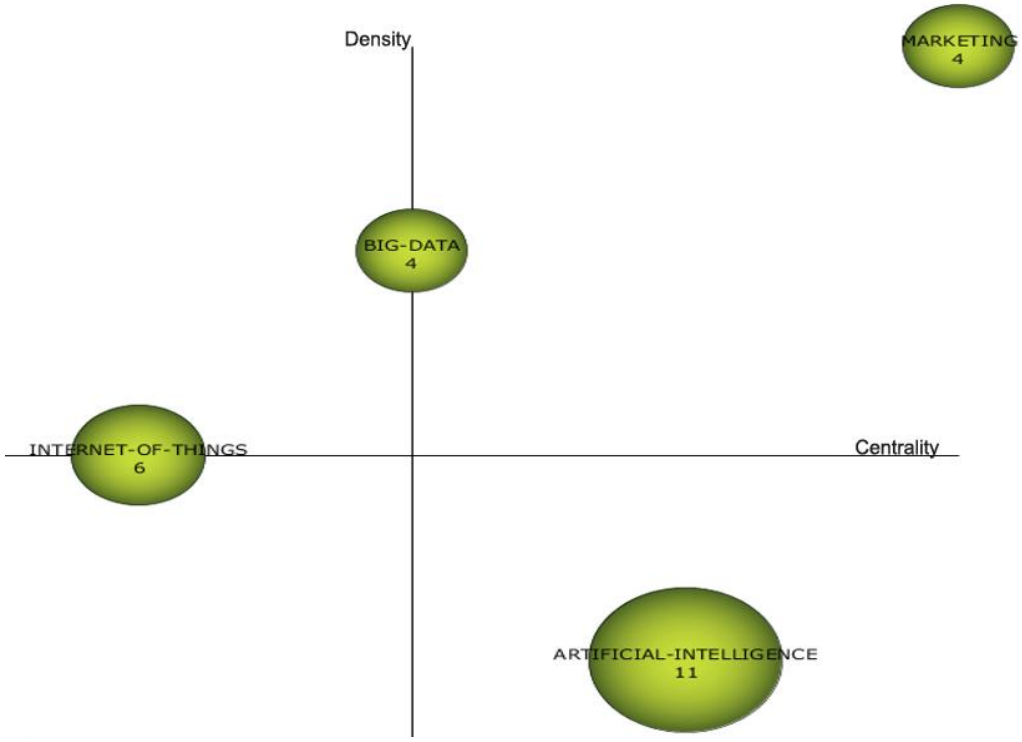

Figure 2.
Strategic diagram 1991-2001.

The following is an analysis of the various themes of the strategic diagram.

Table 5.
Analysis of the themes of the strategic diagram period 1991 – 2001.

Quadrants	Identified topic	Description
Motor topics	Marketing	Clusters such as brand love, consumers, management, and the market directly relate to this theme. In this period, the theme refers to marketing as a means and tool to achieve not only company permanence but also long-term positioning [17].
	Big data	The topic pertains to the clusters of business, finance, information, and natural language processing. Big data refers to a large and complex set of data that is available to the population and is useful in various fields for continuous improvement and business decision-making. In this way, big data combined with artificial intelligence can improve the use of information to achieve efficient and fast analysis compared to traditional methods [18].
Basic and cross-cutting topics	Artificial intelligence	The topic is related to the robotics, behavior, stock market, and decision making clusters. For Angulo and Del Moral [19] artificial intelligence refers to the creation of intelligent machines, in contrast to Buchanan and Shortliffe [20] who suggest that it is a branch of computer science that solves problems using symbolic and non-algorithmic methods. Finally, Nilsson [21] mentions the four basic elements of artificial intelligence, which are heuristic search, modeling and knowledge representation, common sense and logical reasoning, and finally artificial intelligence languages and tools.
Peripheral topics	Internet of things (IoT)	The topic of the period pertains to the fields of computer science, artificial neural networks, machine learning, and personalization. In addition, it is important to mention that the IoT is, in essence, the nervous system that has the power of cloud computing, data dissection, machine learning, and artificial intelligence [22].

After analyzing each of the topics in the strategic diagram, it is imperative to evaluate the productivity and impact of each topic, as shown in the following table (Table 6).

Table 6.
Impact and productivity by topic 1991-2001.

Topic	Number of documents	H-index	Average number of citations
Big-data	4	2	4.5
Marketing	4	3	23
Internet-of-things	6	4	49,83
Artificial-intelligence	11	7	49,36

In Table 6, the topic with the most documents is Artificial Intelligence, which according to the strategic diagram is a fundamental and transversal topic. It also has the highest H index and the highest average citation.

For the second study period, the following clusters were obtained: Decision Making, Artificial Neural Networks and Artificial Intelligence, which can be seen in Figure 3 and are detailed in Table 7.

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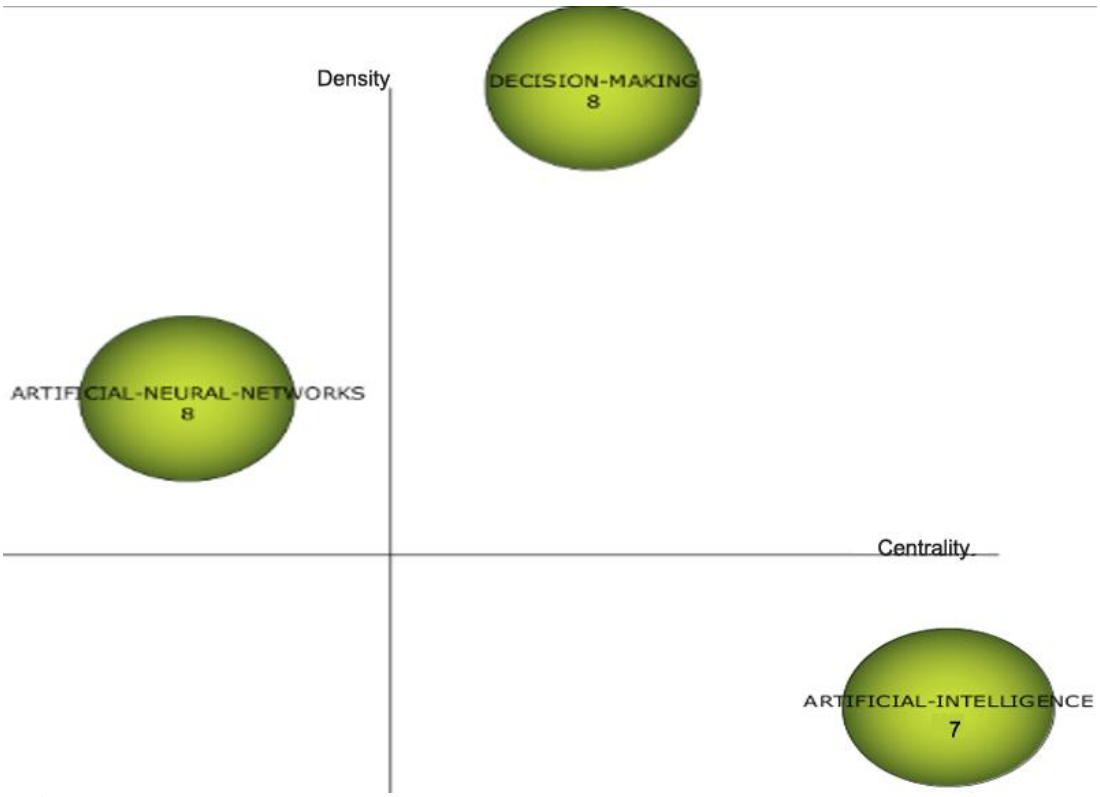

Figure 3.
Strategic diagram 2002-2012.

Table 7 provides a detailed description of each of the Strategic Diagram themes for the second period of analysis.

Table 7.
Analysis of the themes of the strategic diagram for the period 2002 - 2012.

Quadrants	Identified topic	Description
Motor topics	Decision making	The topic is related to the Finance, Optimization, Internet of Things and Market clusters. According to Stone, et al. [23] in the context of marketing, artificial intelligence is a fundamental element that facilitates strategic marketing decision making, as it allows, through the analysis of large amounts of data, the identification of patterns, the prevention of trends, and informed strategic decision making.
Basic and cross-cutting topics	Artificial intelligence	The topic is related to the clusters of information, behavior, management, and business. The topic reappears in this period, and according to Overgoor, et al. [24] artificial intelligence applied to marketing is defined as the development of artificial intelligence agents that recommend and/or perform marketing actions to achieve optimal marketing results based on the information they have about consumers, competitors, and focal firms.
Peripheral topic	Artificial neural network	The topic refers to artificial neural networks, and the period refers to the artificial neural network as a tool to study various parameters of a system. In addition, these neurons perform functions of input collection and output generation, the same functions that are inspired by the information processing in biological nervous systems such as the brain [25].

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It is important to note that Artificial Intelligence is still a fundamental and transversal theme, as it was in the first period. However, unlike the previous period, the topic no longer holds the highest number of documents or citations. Table 8 evaluates the productivity and impact of the themes analyzed.

Table 8.
Impact and productivity by theme 2002-2012.

Topics	Number of documents	H-index	Average number of citations
Decision-making	9	8	36.78
Artificial-neural-networks	10	8	32.1
Artificial-intelligence	9	7	14.22

For the last study period, the following clusters were obtained: Brand Love, Entrepreneurial Orientation, Consumers, Sentiment Analysis, Cluster Analysis, Business and Internet of Things, which can be visualized in Figure 4.

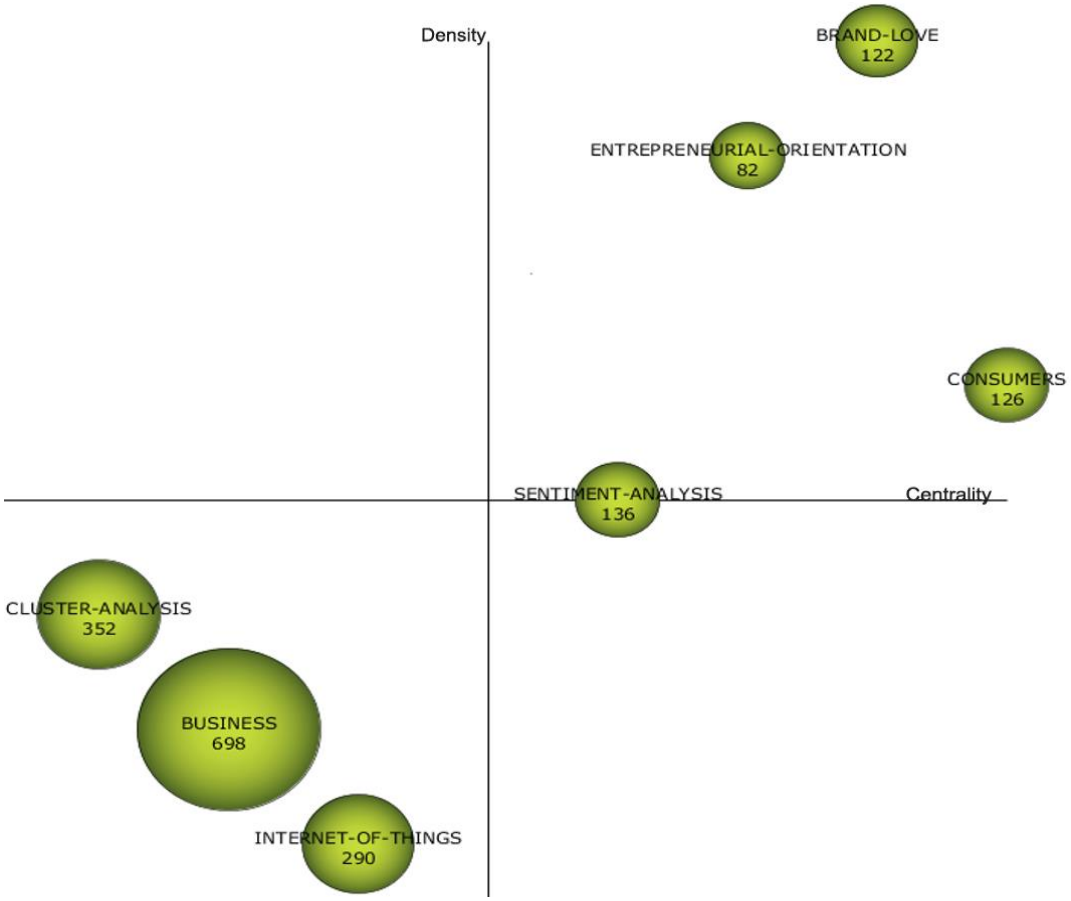

Figure 4.
Strategic diagram 2013-2023.

For a more detailed analysis of each theme, see Table 9.

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Table 9.
Analysis of the themes of the strategy diagram period 2013 - 2023.

Quadrants	Identified topic	Description
Motor topics	Brand love	The topic pertains to the clusters of personalization, customer service, branding, and chatbots. The concept of brand love paved the way for the first brand management theories used today. Additionally, the concept relies on the loyalty and admiration a brand can instill in its customers, thereby fostering their loyalty. This concept, when combined with AI, can have a significant impact on technology-driven marketing [26].
	Entrepreneurial orientation	The theme pertains to the clusters of SME, COVID-19, innovation, and employer branding. Researchers have studied entrepreneurial orientation over time, basing it on the notion of entrepreneurship. Lumpkin and Dess [27] defined it as the propensity to make organisational decisions that benefit business operations. Therefore, it has now been studied in the context of the use of AI, with some studies, such as Saddique, et al. [28] arguing that entrepreneurial orientation has a positive impact on the human resources function by facilitating the management of human activities and reducing human workload.
	Consumers	The topic relates to consumers, who are the main stakeholders in the buying process, and according to Kietzmann, et al. [29] the process of understanding consumers is extremely complex, as consumers express their needs and desires through different channels and search tools, such as searches or blog comments with tweets, 'likes', etc. Marketing, e-commerce, robotics, and future clusters also bear relevance to the topic.
	Sentiment analysis	Various marketing professionals utilize sentiment analysis to gain a deeper understanding of their consumers, and AI enables them to apply machine learning-based techniques or approaches for accurate analysis of these methods. Anjaria and Guddeti [30] and Yiran and Srivastava [31]. Al Sonosy, et al. [32] believe that in order to understand the behaviour of business trends, it is necessary to collect a significant amount of data from different sources.
Emerging topics	Cluster analysis	The topic pertains to big data clusters, data mining, machine learning, and optimization. The topic relates to cluster analysis, a tool used in AI that consists of condensing data into smaller groups or points with the aim of efficiently summarizing the underlying structure of the data. This approach allows analysts to deal with the dataset in a more manageable way, allowing them to make more detailed considerations rather than dealing with the totality of the information [33]. Because of its ability to compress data, cluster analysis has become a fundamental tool for marketers [34].
	Business	The topic pertains to business and encompasses market clusters, artificial neural networks, start-ups, and finance. According to Loureiro, et al. [35] the application of AI in the business environment is at an early stage, but it is experiencing remarkable growth as it is gradually being introduced in the daily activities of companies, from workflow management to trend prediction, and also covers aspects such as customer service and dynamic price optimization [36].
	Internet of things	The topic is related to the Cybersecurity, digitalisation, information and computer science clusters. The internet of things is applicable to all sciences, and, thanks to its fusion with AI, it allows industries to offer intelligent solutions through the massive data available to everyone [37]. Thus, in marketing, as in other fields, IoT offers the opportunity to bring about significant changes in the lives of consumers. According to Velazco Florez, et al. [38] IoT facilitates market research by enabling the identification of usage patterns and geolocation, among others.

The results of the evaluation of the production of each of the clusters analyzed in this period can be seen in Table 10. In this period, the appearance of more topics is noticeable, in that the topic with the most documents is Business, which in turn presents the highest H-index, but the topic with the highest

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average citation is Consumers, with an average citation of 37.3, above the topic Brand Love, with an average of 28.87 citations.

Table 10.
Impact and productivity by theme 2013-2023.

Subjects	Number of documents	H-index	Average number of citations
Brand-love	122	32	28.87
Entrepreneurial-orientation	82	18	13.87
Sentiment-analysis	136	22	14.02
Consumers	126	34	37.3
Business	698	49	15.34
Cluster-analysis	352	37	16.64

It is important to emphasize that, as far as the influence of AI in marketing is concerned, it has been possible to determine that AI has become a fundamental and transversal topic, which, until a decade ago, was used only as an input for marketing campaigns and database generation. However, in the last period, a wide incidence can be observed, incorporating topics such as sentiment analysis, cluster analysis, brand love, and entrepreneurial orientation, among others, which relate to important issues in marketing management, with the use of AI tools. This improves the results and helps companies make timely marketing decisions.

3.2. Artificial Intelligence and E-Commerce.

3.2.1. Analysis of Scientific Production Performance

Figure 5 shows a 94% increase in scientific production on AI and e-commerce topics between the second and third periods, indicating the growing interest of the scientific community in understanding and analyzing these two topics. There was no growth in scientific production between the first and second periods.

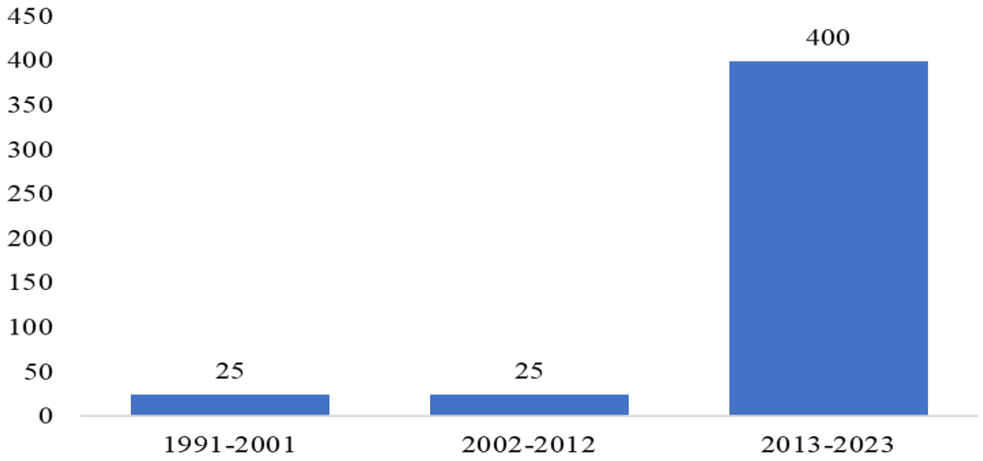

Figure 5.
Number of publications.

On the other hand, regarding the performance of authors, it was found that Yeming Gong is the author with the most publications; however, the author with the highest number of citations is Jian Mou (79 citations). Regarding the most productive journals in the field, Table 11 shows the five journals with the most published articles. The journal Sustainability has the largest number of articles, with 17 published, representing 4% of the total number of journals that publish articles on the topics addressed.

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Table 11.
Most productive journals in the area.

Journal	Published articles	% of total
Sustainability	17	4%
Engineering applications of artificial intelligence	14	3%
Artificial intelligence review	8	2%
International Journal of advanced computer science and applications	8	2%
Electronic commerce research and applications	7	2%

Table 12 displays the articles with the highest citation counts. The most cited article corresponds to Hoyer, et al. [39] which discusses how the different types of AI manifestations, such as Internet of Things (IoT), augmented reality, virtual reality, mixed reality, virtual assistants, chatbots, and robots, facilitate and improve the customer experience in the different sectors in which they are implemented, thus having a positive impact on consumers' purchasing processes by creating experiential value in them. Similarly, the second most cited article (174 citations) in the journal Electronic Markets discusses chatbots or live chats, which enable users to interact and obtain services and information online. These chatbots enable companies to provide immediate customer service in various e-commerce environments. Through experimental factor analysis, the authors suggest that users apply the same social rules to human-chatbot interactions as they do to human-to-human interactions, and that humans recognize chatbots as sources of persuasive messages that are successful because they satisfy an individual's basic social needs, even when users are aware that they are interacting with a chatbot [40].

Table 12.
Most cited articles.

Journal	Title	Authors	Year	Citation
Journal of interactive marketing	Transforming the customer experience through new technologies	Hoyer, WD, Kroschke, M, Schmitt, B, Kraume, K, Shankar, V	2020	184
Electronic markets	AI-based chatbots in customer service and their effects on user compliance	Adam, M, Wessel, M, Benlian, A	2021	174
International journal of information management	Blockchain in the operations and supply chain management: Benefits, challenges and future research opportunities	Wamba, SF, Queiroz, MM	2020	167
Artificial intelligence review	Shilling attacks against recommender systems: a comprehensive survey	Gunes, I, Kaleli, C, Bilge, A, Polat, H	2014	163
Journal of the academy of marketing science	Online relationship marketing	Steinhoff, L, Arli, D, Weaven, S, Kozlenkova, IV	2019	151

3.2.2. Analysis of Strategic Diagrams

After conducting a scientific production evaluation, it is critical to conduct an exhaustive analysis of the performance of scientific research in the fields of AI and e-commerce. To achieve this, a study of related topics was conducted by identifying keywords that appeared together, taking into account three periods of analysis.

Thus, for the first period of analysis, the following clusters were obtained: value creation, artificial intelligence, e-commerce, management, and business intelligence (Figure 6).

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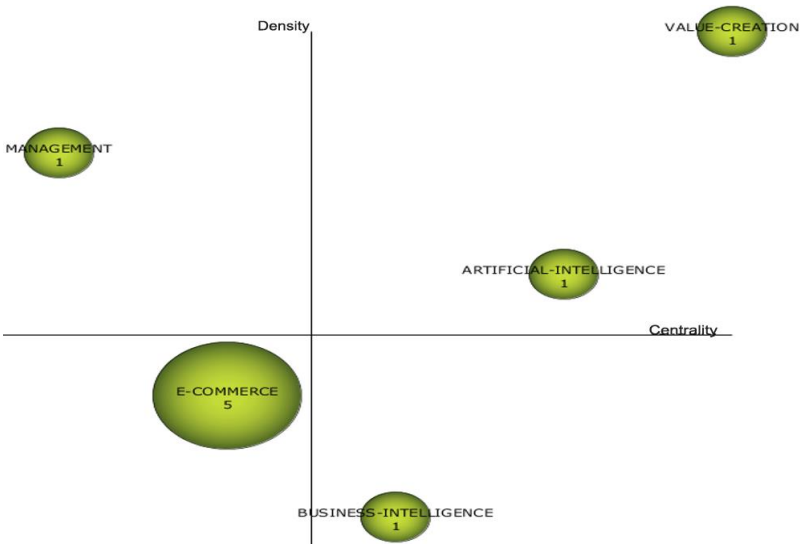

Figure 6.
Strategic diagram 1991-2001.

A detailed analysis of these issues is presented in Table 13.

Table 13.
Analysis of the themes of the strategic diagram period 1991 – 2001.

Quadrants	Identified topic	Description
Motor topics	Value creation	The online marketing cluster directly relates to the theme of value creation. Value creation is present in many areas, but particularly in e-commerce. It is fundamental because it facilitates and allows the implementation of useful strategies that facilitate the transformation of physical markets into sustainable virtual markets, as demonstrated by the research carried out by Zott, et al. [41]. demonstrated through an exploratory study of European e-commerce companies that it is possible to implement two strategies for value creation, which are efficiency and rigidity, both of which propose customer-centric approaches to creating and delivering value with the aim of accelerating and improving customer service.
	Artificial intelligence	For the period under study, the topic refers to the study of intelligent behavior in animals, humans, and machines and attempts to imitate such behavior in any object [42]. Similarly, McCarthy [43] defines AI a the field of study that focuses on the creation of intelligent machines and intelligent computer programs. Furthermore, AI is not limited to mimicking human intelligence using biologically observable methods, but also includes the use of computers to understand human intelligence.
Core and crosscutting topics	Business intelligence	The topic is about business intelligence. Business intelligence systems are those that combine operational data with analytical tools to provide complex and competitive information to those responsible for business planning and decision making [44]. The IoT cluster is the focus of this period's discussion.
Emerging topics	E-commerce	According to Gupta [45] e-commerce refers to the exchange of goods and services through electronic platforms, as well as any form of commercial exchange in which people interact through electronic means rather than in person or through physical exchange. The electronic payments cluster is also associated with it.
Peripheral topics	Management	The topic pertains to management and falls under the digitalization cluster. The process of planning, organizing, directing, and controlling various activities within an organizational entity on a daily basis is known as business management, or commercial management. As technology transforms business in a changing world, understanding its benefits is crucial for a comprehensive approach that supports the achievement of organizational objectives in both the short and long term [46].

It was found that the topic with the most documents is E-commerce, with 5 documents and the highest H-index of 4, as well as the highest citation average of 25.2.

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For the second study period, the following clusters were obtained: Decision Making, Artificial Intelligence, Management and Business Intelligence (Figure 7).

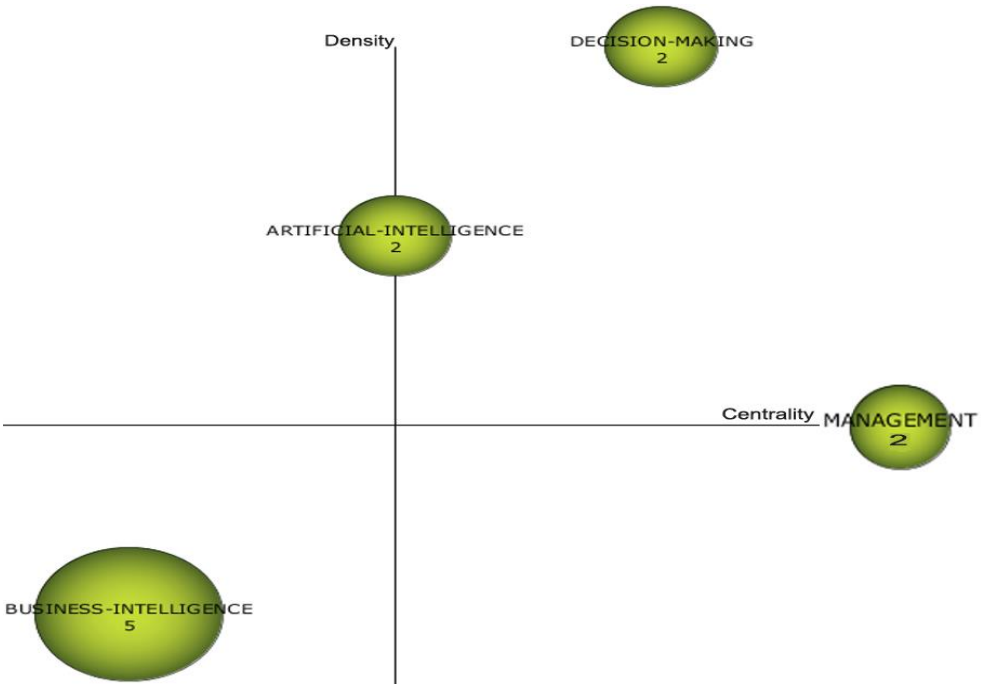

Figure 7.
Strategic diagram 2002-2012.

Table 14 details each of the topics shown in the Strategic Diagram.

Table 14.
Analysis of the themes of the strategic diagram period 2002 – 2012.

Quadrants	Identified topic	Description
Motor topics	Decision making	The topic refers to organizational decision making, considering that AI is now an important tool to achieve more adequate and optimal decision making. In this sense, Pomerol [47] argues that decision making is characterized by two essential aspects: diagnosis and, secondly, prediction. In this way, several authors emphasize that the use of AI for decision making should be based on a correct understanding of its strengths and weaknesses, since the stability of an organization depends on it.Thus, the article by Shrestha, et al. [48] highlights the importance for managers to take into account aspects such as the specificity of the decision search space, the interpretation of the decision process and its results, the size of the set of alternatives, the speed of decision making, and the ability to replicate those decisions when developing hybrid decision systems that involve both humans and AI.
	Artificial intelligence	With the development of information and communication technologies, artificial intelligence is playing an increasingly important role in commerce, so companies are using it to effectively influence their customers by applying various tools, among which e-commerce stands out as a means to digitally market products and services. In this regard, Song, et al. [49] argue that artificial intelligence is an emerging technological discipline dedicated to the development of theoretical methods, technologies, and applications that aim to emulate and extend human intelligence. The branding cluster is the context for this topic.

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Quadrants	Identified topic	Description
	Management	The topic relates to business management and is related to the electronic payments cluster. According to Pallathadka, et al. [50] artificial intelligence plays an important role in e-commerce and financial organisations, as it enables the improvement of business and supply chain management, which significantly improves the performance of the entire organisation [51].
Emerging topics	Business intelligence	The topic relates to business intelligence and has gone from being a basic topic in the previous period to an emerging topic in the current period, which is related to the internet of things cluster. According to Cano [52] in his book titled Business Intelligence: Competing with Information, he emphasises that in such a competitive and changing environment, the correct management of information is a key process for business management and growth. Therefore, the field of business intelligence contributes to organisational decision-making based on information systems that improve business competitiveness.

It was determined that the topic with the greatest impact and productivity for the period is Business Intelligence, since it contains the highest number of documents, H-index and average citation rate.

Finally, for the third period of analysis, the following clusters were obtained as a result: Customer Experience, Value Creation, Chatbots, Internet of Things, E-commerce, Artificial Intelligence, Machine Learning, Business Intelligence, Decision Making and Management. There is a significant increase in the number of topics analyzed.

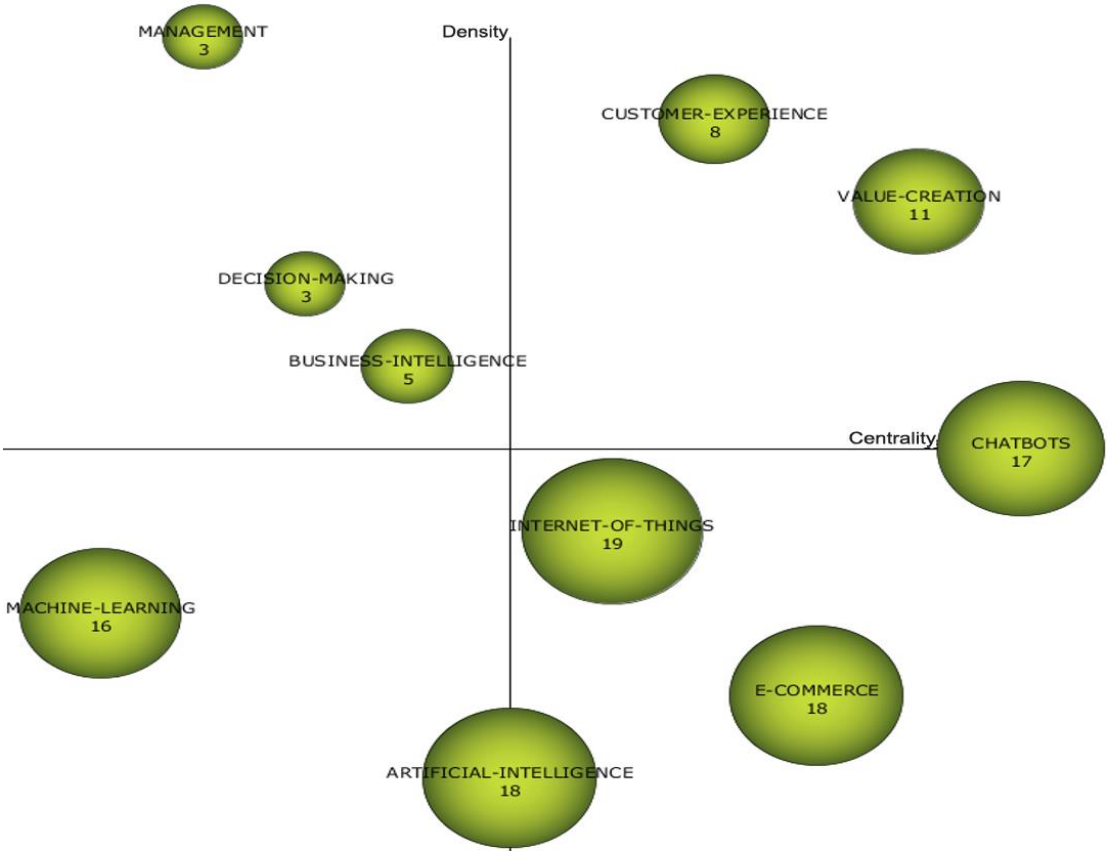

Figure 8.
Strategic diagram 2013-2023.

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Table 15 details each of the themes in the strategy diagram (Figure 8).

Table 15.
Analysis of the themes of the strategy diagram for the period 2013 – 2023.

Quadrants	Identified topic	Description
Motor topics	Customer experience	The theme relates to customer experience and the Purchase Intention cluster. Within the decision-making process and consumption chain, customer experience encompasses feelings, attitudes, and perceptions that involve a coordinated set of interactions with people, objects, procedures, and the environment, resulting in cognitive, emotional, sensory, and behavioral effects [53]. Therefore, the development of new technologies has facilitated the growth of e-commerce to enhance the shopping experience of customers [54].
	Value creation	The cluster, which pertains to the creation of value, has been a recurring theme in the electronic payment cluster since the first period. It did not surface in the second period, but it emerged as a driving theme in the third period. Gronroos [55] posits that the creation of value involves the complete experience of various elements across various stages, with pre-use value, use value, and post-use value standing out.
Cross-cutting and core thopics	Internet of things (IoT)	The topic pertains to the internet of things and is associated with the digitalization cluster. The internet of things is a tool that enables the automation of objects and processes. Pretz [56] characterizes the internet of things as a network of interconnected objects, wirelessly connected through intelligent sensors.
	E-commerce	The theme is related to the Branding cluster. The world economy is in a state of transition, and many companies are moving towards the use of technology and the marketing of products and services through the use of the Internet. Given this growing use of the Internet by businesses, the so-called e-commerce is emerging, which involves the use of an Internet service provider's Web site for the direct sale of products or services to the user, taking into account that the purchasing interface can be a wireless shopping cart or a shopping basket that allows the customer to make payments by credit card, debit card, or electronic funds transfer [57].
	Chatboots	Chatbots are artificial intelligence and machine learning tools currently used by countless financial and e-commerce institutions to facilitate service delivery and customer satisfaction Pallathadka, et al. [50]. According to the Asadi and Hemadi [58], chatbots play a crucial role in e-commerce by empowering customers to make customized purchases that align with their preferences and requirements. The topic pertains to the online marketing cluster..
	Artificial intelligence	The theme for the period is related to the Online Shopping Behavior cluster. Artificial intelligence refers to the creation of artificial systems that have the ability to learn natural language, plan, perceive, or process information. Various industries use this information to design machines that function similarly to humans [59, 60].
Emerging topics	Machine learning	The topic pertains to the neural network cluster. Some authors define machine learning as the scientific study of algorithms and models that enable computers to learn without explicit programming. These algorithms serve a variety of purposes and enable increasingly sophisticated applications [61, 62].
Peripheral topics	Management	The topic is related to the COVID-19 cluster. Management is a process that has existed since ancient times, but with the advent of the Internet and the increasing use of artificial intelligence, it is applied by several companies to carry out their business management processes, and Pallathadka, et al. [50] state that the use of artificial intelligence in business management, e-commerce, and finance has several applications, including: the use of chatbots by financial and non-financial companies, image search, customer data management,

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Quadrants	Identified topic	Description
		recommendation systems, cybersecurity, inventory management, human resource management, and sales, among others.
	Decision making	The theme relates to decision making and is related to the Sustainable Entrepreneurship cluster. Decision-making is a process that involves the use of criteria to choose one option from several with the aim of maximizing the benefits derived from that choice, and in e-commerce, several factors related to the use of the Internet in transactions are involved, one of which is analytics, which, according to Jain, et al. [53] allows companies to transform data into intelligence to organize, review, and comment on customers to facilitate decision-making.
	Business intelligence	The theme is back, and it concerns the small and medium enterprises cluster. Users and companies around the world have been increasingly using the Internet in recent years, but they often lack access to customer data and information that could facilitate the creation and supply of products tailored to their needs. Thus, business intelligence is born as a tool that allows companies to access information about customers, to know their buying patterns, to analyze their behavior, to know the users of online trading platforms, etc. [63].

Finally, when analyzing the productivity and impact of each topic (Table 16), it can be seen that the topic with the most documents is the Internet of Things, with 19 documents for the period 2015-2023, but it is not the topic with the highest average citation rate, as this corresponds to the Value Creation topic with an average of 33.64 citations.

Table 16.
Impact and productivity by topic period 2013-2023.

Topics	Number of documents	H-index	Average number of citations
Management	3	2	28
Customer-experience	8	3	9
Value-creation	11	5	33.64
Decision-making	3	3	5.33
Business-intelligence	5	2	33.8
Chatbots	17	7	17.35
Internet-of-things	19	7	17.58
Machine-learning	16	5	10
E-commerce	18	8	25.39
Artificial-intelligence	18	9	15.89

3.3. Artificial Intelligence and Sustainability, Strategy, and Project Management

3.3.1. Analysis of Scientific Production Performance

Figure 9 shows a significant increase in the number of articles published on sustainability, strategy, and project management topics. It has increased from 2 articles in period 1 to 2458 articles in the third period, i.e., a significant percentage increase of more than one hundred thousand. All of this demonstrates a growing interest in these topics.

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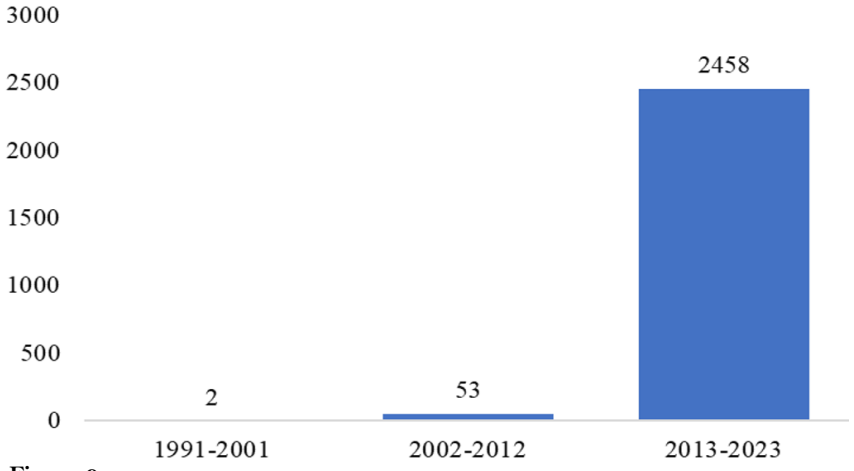

Figure 9.
Number of articles published.

On the other hand, Table 17 shows the authors with the best performances. Amir Mosavi, with 14 publications and a significant number of citations, is the most representative author, followed by Fei-Yue Wang with 11 publications. However, although Zaher Mundher Yaseen does not have a high number of documents, he has the highest number of citations.

Table 17.
Authors' performance.

Author	Publications	Citation
Mosavi, Amir	14	297
Wang, Fei-Yue	11	67
Joshi, Sudhanshu	9	40
Sharma, Manu	9	40
Yaseen, Zaher Mundher	8	576

Table 18 below provides information on the most productive journals in the field. The journal Sustainability stands out as the most representative, with 1093 article publications, accounting for 43% of the total number of publications, or nearly half of all articles published. It is relevant to mention that the magazine Sustainability is a publication of great importance in the field of sustainability and sustainable development. Its main objective is to promote the exchange of knowledge and high-quality research to solve current environmental, social, and economic challenges. The journal adopts an interdisciplinary approach and covers a wide range of topics such as environmental management, renewable energy, circular economy, corporate responsibility, social equity, and conservation of natural resources[64].

Table 18.
Most productive journals in the area.

Journal	Published articles	% of total
Sustainability	1093	43%
Journal of cleaner production	43	2%
Applied sciences-basel	30	1%
Ieee access	28	1%
Energies	25	1%

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Table 19 lists the most cited articles in each field. The most cited article is written by Kusiak [65] and addresses the topic of smart manufacturing in terms of digitalization, sustainability, and service orientation, among others.

It highlights that there are several important supporting initiatives for smart manufacturing, such as cyber-physical systems, Manufacturing USA, Society 5.0, Made in China 2025, and Industry 4.0. In second place is the article "An enhanced extreme learning machine model for river flow forecasting: State-of-the-art, practical applications in the water resource engineering area and future research direction", which focuses on the development of a machine learning model called "extreme learning machine" for river flow forecasting.

This publication discusses the method's state-of-the-art status and identifies its potential practical applications in water resource engineering [66].

Table 19.
Most cited articles.

Journal	Title	Authors	Year	Citation
International journal of production research	Smart manufacturing	Kusiak, A	2023	602
Journal of hydrology	An enhanced extreme learning machine model for river flow forecasting: State-of-the-art, practical applications in water resource engineering area and future research directions	Deo, RC, Yaseen, ZM, Chau, KW, Sulaiman, SO	2019	403
Cities	In terms of big data, artificial intelligence, and smart cities	Allam, Z, Dhunny, ZA	2019	326
Sustainability	Industry 5.0-A human-centric solution	Nahavandi, S	2019	311
International journal of information management	Time to seize the digital evolution: Block chain adoption in operations and supply chain management among Malaysian SMEs	Wong, LW, Leong, LY, Hew, JJ, Tan, GWH, Ooi, KB	2020	266

3.3.2. Analysis of Strategic Diagrams

It is important to examine the performance of scientific research in the field of Artificial Intelligence and Sustainability, Strategy and Project Management. Therefore, a study was conducted to analyze the related topics by identifying keywords. For the analysis, the same three periods were considered, with the aim of understanding how these topics have evolved over the different study periods. The clusters obtained in the first period are Neural Networks and Artificial Intelligence (Figure 10).

The graph (Figure 10) shows two topics, one of which is completely central (Artificial Intelligence), while the other is completely dense (Neural Networks). However, it should be noted that the number of publications during this period was small. Table 20 shows the proposed topics in detail.

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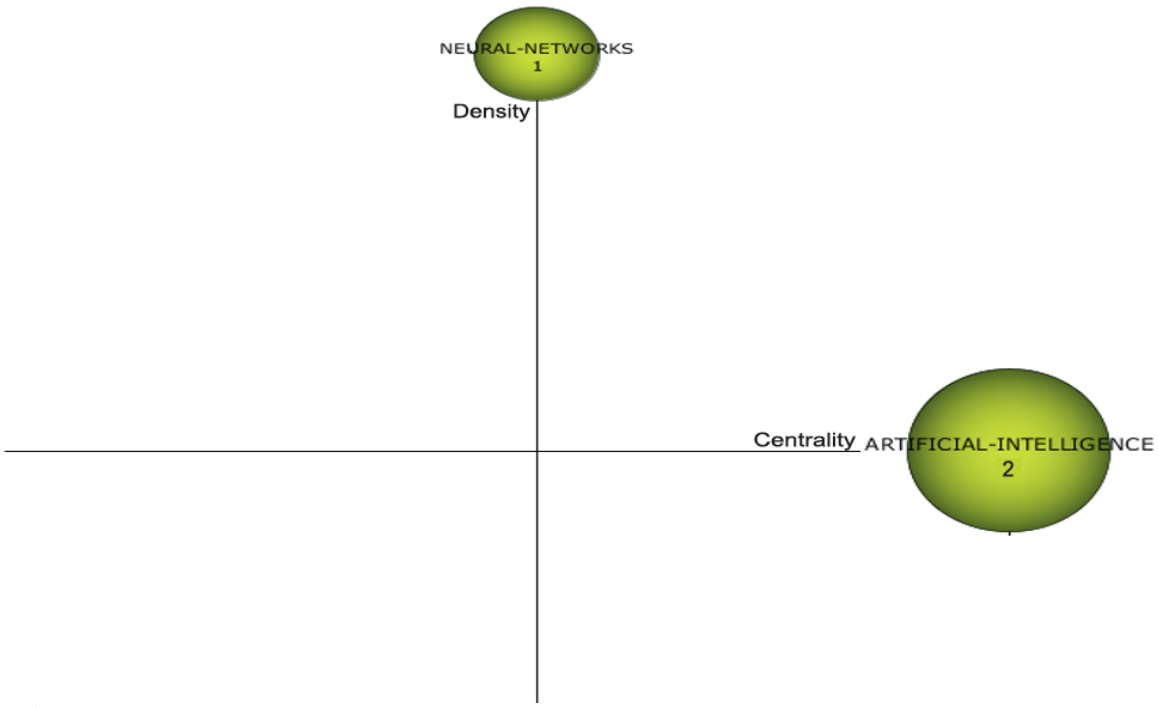

Figure 10.
Strategic diagram 1991-2001.

Table 20.
Analysis of the issues of the strategic diagram period 1991 – 2001.

Quadrants	Identified topic	Description
Motor topics	Neural network	The theme is related to artificial neural networks and the technology cluster. Artificial neural networks are a fundamental component of artificial intelligence and are widely recognized for their efficiency in information processing. According to Olabe [67]. Artificial neural networks are a class of models inspired by the human brain that can learn from data and perform complex tasks with remarkable accuracy.
	Artificial intelligence	The theme relates to the sustainable development cluster and alludes to artificial intelligence. Artificial intelligence has a broad definition and refers to intelligent behavior in artifacts. This behavior includes abilities such as perception, reasoning, learning, communication, and action in complex environments. In the long term, the main goal of artificial intelligence is to make machines capable of performing these tasks as well as humans, and in some cases, even better [68].

Therefore, it is clear that artificial intelligence and its reliance on neural networks largely supported the scientific output during this period. Upon assessing the productivity and influence of each subject, it becomes apparent that only Artificial Intelligence exhibits a greater quantity of documents, a higher H-index, and an average number of citations. Given the limited number of topics within this timeframe, the Artificial Intelligence cluster demonstrates a notable degree of topic advancement and significance in the analysis. On the other hand, the Neural Networks cluster presents a high level of development, but it has not become an important topic in the field of knowledge during this period. For the second period, the following clusters were obtained as a result: Management, Renewable Energies, Artificial Intelligence, Sustainable Development and Neural Networks (Figure 11).

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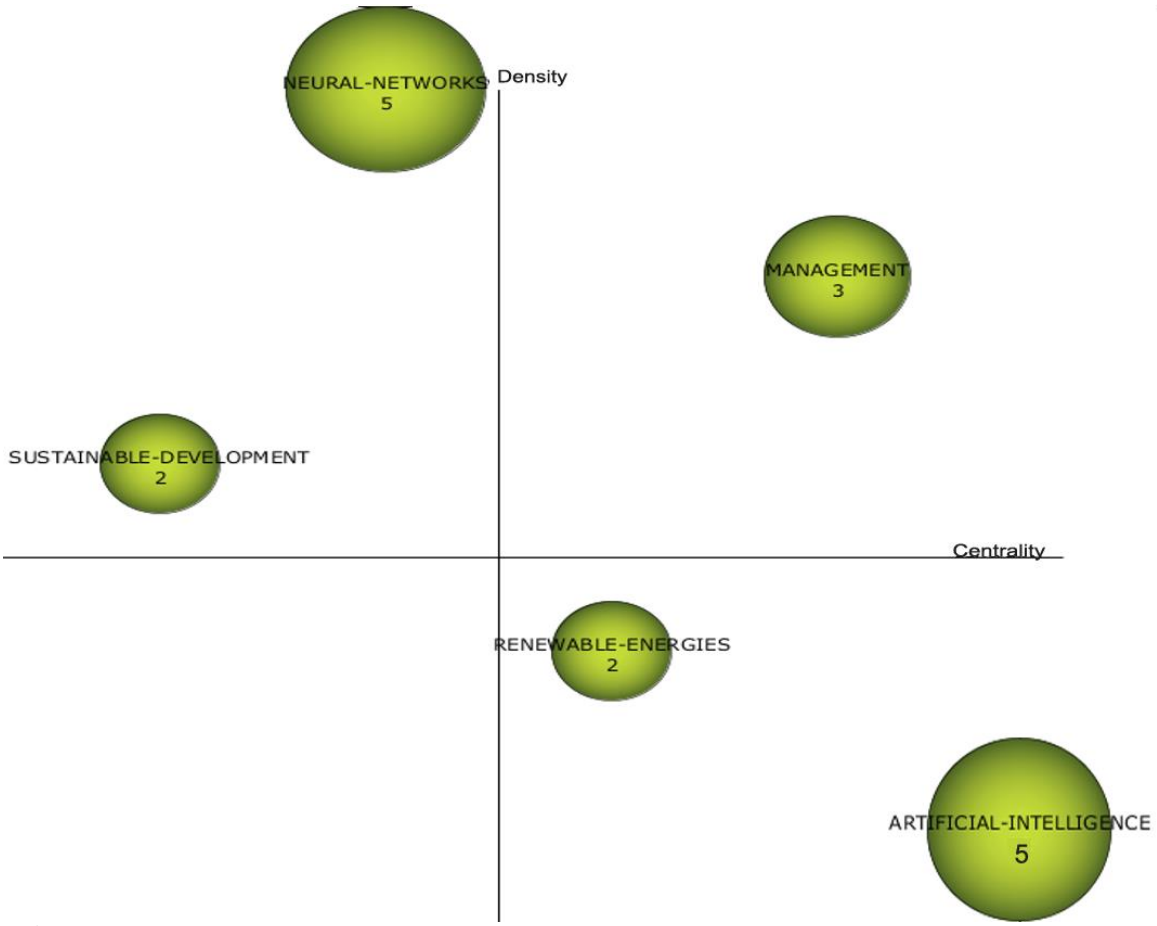

Figure 11.
Estrategic diagram 2002-2012.

The details of each of the themes in the strategy diagram are shown in Table 21.

Table 21.
Analysis of the themes of the strategic diagram period 2002 – 2012.

Quadrants	Identified topic	Description
Motor topics	Management	Business management and the financial performance cluster are central to the theme. The concept of "management" for organizational sustainability describes that organizations act to meet the needs and expectations of stakeholders [69]. According to Foley [70] organizational sustainability goals are achieved when the organization seeks to maximize product quality for customers and their needs and wants are met. The expectations of stakeholders, not customers. Therefore, Gomes, et al. [71] argue that large companies have a high level of adoption of management practices for sustainability and business performance.
Basic and cross-cutting topics	Renewable energies	The topic alludes to renewable energy and relates to the technology cluster. Most people currently hold the belief that sustainable development necessitates renewable energy, with numerous economical and environmentally friendly energy sources available [72]. Therefore, applications and artificial intelligence techniques for renewable energy include strategies to improve safety and reliability, reduce costs, reduce environmental and climate impacts, improve energy efficiency, expand

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Quadrants	Identified topic	Description
		renewable energy markets, and improve integration and production of microgrids and smart grids [73].
	Artificial intelligence	Artificial intelligence offers several benefits to those who use it, and, in the words of Nishant, et al. [74] it can help in the creation of appropriate organizational systems and cultural practices to reduce the consumption of natural resources and energy in human activities. In addition, AI can enable people to reflect, design, and implement solutions to environmental degradation and the climate crisis in a neutral tone and without personal or group motivations. Finally, the topic pertains to the decision-making cluster.
Peripheral topics	Neural networks	The topic pertains to neural networks and their connection to the Internet of Things cluster. According to Wu and Feng [75] artificial neural networks play a central role in the emerging artificial intelligence industry. Each neuron processing unit in an artificial neural network has the ability to represent a variety of objects, including features and letters, concepts, or underlying abstract patterns. There are three types of processing units in the network: input unit, output unit, and hidden unit. The design of the input unit allows it to receive external signals and data [76].
	Sustainable development	The theme pertains to sustainable development and has a direct connection to the green logistics cluster. The concept of sustainable development is a gradual transformation that seeks to enhance the present and future potential of humankind through careful management of resources, matching investments with technological advances, and formulating policies that promote institutional progress [77]. The Sustainable Development Goals (SDGs) have integrated artificial intelligence in various ways, initially through experimental processes and later within the sustainability framework [78].

During this period, it was possible to identify the emergence of new topics making important contributions to sustainability and artificial intelligence, so it is useful to analyze their productivity and impact, which are shown in Table 22.

Table 22.
Impact and productivity period 2002-2012.

Topics	Number of documents	H-index	Average number of citations
Management	3	3	79.33
Neural-networks	5	4	49.4
Sustainable-development	2	1	3
Renewable-energies	2	2	26
Artificial-intelligence	5	5	13.2

During this period, more topics appear, but the number of papers on these topics is still limited, so the topics with the most papers are Neural Networks and Artificial Intelligence. However, the topic with the highest average number of citations is Management.

Finally, in the third period, the following clusters were obtained: Small and medium enterprises, cybersecurity, circular business models, supply chain, digital transformation, green logistics, management, smart cities, sustainable development, artificial intelligence, environment, neural networks, robotics, energy efficiency, economics, chatbot, and consumer behavior (Figure 12).

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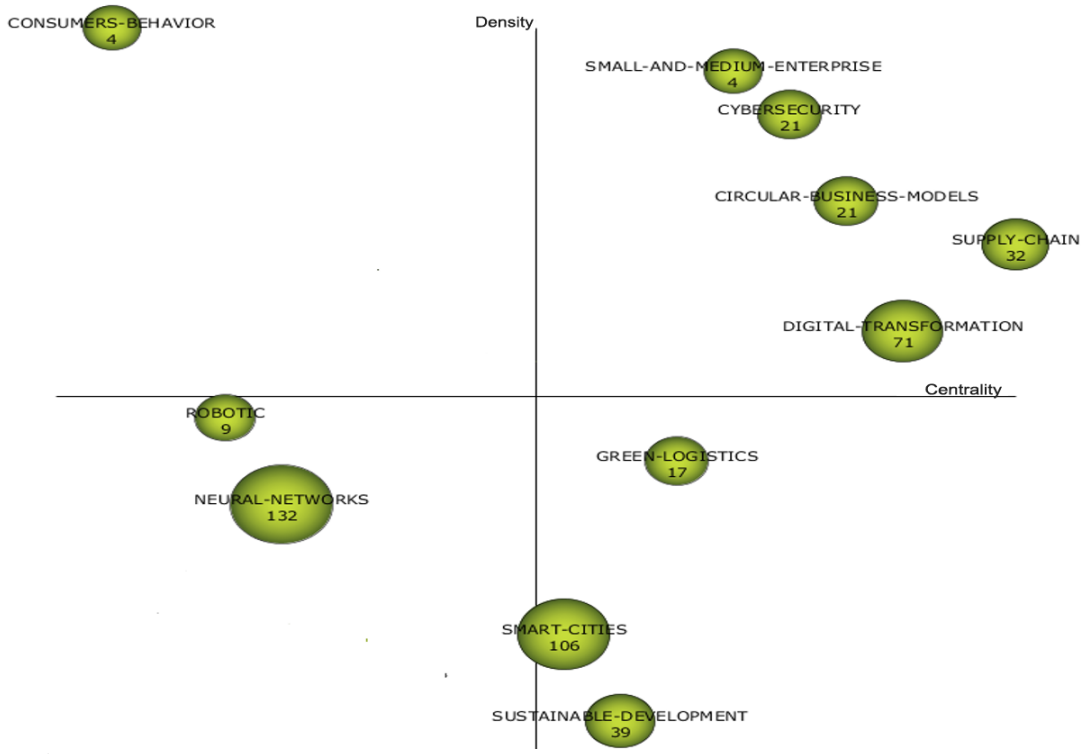

Figure 12.
Strategic diagram 2013-2023.

The details of each of the Strategic Diagram themes for this period are shown in Table 23.

Table 23.
Analysis of the themes of the strategy diagram for the period 2013 - 2023.

Quadrants	Identified topic	Description
Motor topics	Small and medium enterprise	The theme refers to small and medium enterprises and relates to the entrepreneurship cluster. According to Kotelnikov [79] small and medium-sized enterprises, defined as those with fewer than 250 employees, play a crucial role in the economies of countries, contributing significantly to sustainable poverty reduction by promoting economic growth, generating wealth, and creating employment opportunities. Similarly, according to Moore and Manring [80] small and medium-sized enterprises play an important role in managing limited social and environmental resources worldwide. A multi-stakeholder approach to new ideas and trends should form the basis of a systematic approach to careful and proactive situational analysis. Reflective situational analysis, as a basis for business strategy development, should include new global stakeholders and stagnant or reactive aspirations.

Quadrants	Identified topic	Description
	Cybersecurity	The topic pertains to cybersecurity and has a connection to the blockchain cluster. Cybersecurity, which is at the heart of the current green technology revolution, must be considered essential. Investors prioritize security in the constant development of new technologies and processes. It should also be noted that cyber-attacks are constantly evolving, which is why it is so important to take measures (Legal, regulatory, and organizational) to control cybersecurity. Cybersecurity, data management, and resilience will now be key to the digital transformation process in the coming years [81].
	Circular business models	The waste management cluster is associated with the topic of circular business models. Circular business models have been a trend in recent years as they aim to stimulate sustainable economic progress through radical and systemic innovation Antikainen and Valkokari [82]. Pieroni, et al. [83] argue that the circular economy and sustainability are attracting increasing interest from governments, academia, and businesses. Sustainability, in turn, implies achieving an integrated balance between economic performance, social inclusion, and environmental resilience for the benefit of current and future generations. Implementing circularity or sustainability therefore requires companies to change the way they understand themselves, how they operate, and how they create value for their customers [84].
	Supply chain	This topic pertains to the supply chain and is associated with the big data cluster. Due to stricter regulations and increasing pressure from consumers and society, companies need to integrate both environmental and social considerations into their supply chain operations. Because sustainability considers economic, environmental, and social aspects, it transcends organizational boundaries and is directly relevant to operations and supply chain management research [85]. Therefore, research such as that proposed by Harms [86] claims that facilitating knowledge transfer between different departments to promote sustainable practices in the supply chain could improve communication between these departments.
	Digital transformation	The topic alludes to digital transformation and is related to the industry 4.0 cluster. Digital transformation has generated significant interest in business [87] so it allows companies to create an advanced digital business model that can focus on products, business processes, or the business model. Therefore, companies that want to improve the outcomes of the digital transformation process should strive to develop a sustainable business model that can

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Quadrants	Identified topic	Description
		persist over time and evolve over the years to achieve additional sustainability goals embedded in the model [88].
Basic and cross-cutting topics	Green logistics	The topic pertains to green logistics and is closely associated with the decision cluster. According to the definition proposed by Rodrigue, et al. [89] green logistics is understood as supply chain management practices and strategies aimed at reducing the environmental and energy impacts associated with the distribution of goods. This approach focuses on aspects such as material handling, waste management, packaging, and transportation. On the other hand, sustainability deals with three fundamental pillars that have to do with the social, economic, and environmental dimensions and therefore relates to green logistics by ensuring the sustainability of the company because it takes into account each of these dimensions as part of the supply chain in a way that facilitates the achievement of business objectives and long-term business hypothesis [90].
	Smart cities	The theme pertains to smart cities and is associated with the technology cluster. Today, sustainability has become a global issue that requires immediate attention due to the increasing overconsumption of natural resources and environmentally damaging human activities. Building sustainable communities is an effective solution to this challenge [91]. As a result, the concept of smart cities is emerging as an important means to reduce resource consumption, hand in hand with technological progress [92].
	Sustainable development	This theme relates to sustainable development and is linked to the COVID-19 cluster. According to Baker [93] sustainable development deals with multiple methods and approaches to balance the ecological, economic, and social aspects of existence, such as encouraging sustainable agricultural and forestry practices, promoting sustainable production and consumption, establishing good governance systems, and promoting research and technology transfer. Thus, an era of sustainable development is emerging, in which the sustainable development goals (SDGs) are becoming increasingly important [94].
Peripheral topics	Consumer behavior	The theme relates to consumer behavior and is related to the marketing cluster. Rita and Ramos [95] mention that consumer behavior is undergoing significant changes related to sustainability. In this sense, sustainable consumer behavior implies satisfying current needs while seeking to benefit or reduce environmental impact. It is crucial to have an in-depth understanding of this consumer behaviour, as it is fundamental to leading a paradigm shift in the way society deals with environmental challenges [96].
Emerging topics	Robotic	The theme revolves around robotics and its connection to the education cluster. The application of robotics in

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Quadrants	Identified topic	Description
		sustainable development is a challenge to which research, education, and industry from both developed and developing countries can contribute and benefit from each other. In a sustainable economic approach, energy and material resources are scarce. Robotics can be beneficial in production, the food chain, and recycling, but its adaptation to this model is crucial. Currently, industrial robotics and automation play a significant role in increasing the productivity of human workers, which in some cases can have a destabilizing effect on the economy. However, robots can also make a positive contribution to production [97].
	Neural networks	The topic refers to artificial neural networks and is related to the internet of things cluster. The article proposed by Gue, et al. [98] analyzes and evaluates the use of artificial neural networks in the context of sustainable development, exploring applications in natural resource management, urban planning, and energy efficiency. The article argues that artificial neural networks have several sustainable development applications, such as their popularity in clean water and sanitation, clean and affordable energy, sustainable cities and communities (SDG-11), and responsible production and consumption.

The significant evolution of clusters and the increasing interest of the scientific community in pushing the boundaries of this field are notable, given the various themes examined earlier. Hence, it becomes imperative to assess the productivity and influence of each topic, as outlined in Table 24. The analysis includes a look at the number of papers, the h-index, and the average number of citations for each topic across various key articles. Additionally, the centrality and density ranges have also been scrutinized.

Table 24.
Impact and productivity 2013-2023.

Topics	Number of documents	H-index	Average number of citations
Consumers-behavior	4	2	3.75
Small-and-medium-enterprise	4	3	7.5
Cybersecurity	21	8	23.9
Circular-business-models	21	7	21.81
Supply-chain	32	13	22.66
Digital-transformation	71	18	18.45
Robotic	9	3	5.11
Green-logistics	17	10	15.53
Neural-networks	132	22	13.82
Smart-cities	106	20	16.28

For the period, it was possible to observe and analyse a variety of topics related to sustainability and artificial intelligence, so the topic with the most documents was smart cities, which in turn has the highest h-index; however, the topic with the highest average citation rate is supply chain.

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4. Conclusions

The conducted research demonstrates a noteworthy progression in scientific output across three primary domains within the business environment. First, marketing and branding were analyzed over three different time periods (1991–2001, 2002–2012, and 2013–2023). The analysis of published papers, author performance, most productive journals, and most cited articles provides a detailed overview of the dominant trends and approaches in this field.

Regarding the number of published articles, there has been a remarkable growth over the years, from 92 articles in the first period (1991-2001) to 4,528 in the last period (2013-2023), which represents a significant increase of 95%. This increase reflects the growing interest and relevance that marketing and branding have gained in scientific research. Authors such as Jing Qiu, Zhao Junhua, and Yogesh K. Dwivedi have been identified as the most prolific in terms of publications. These researchers have played a critical role in advancing knowledge in marketing and branding and have contributed significantly to the scholarly output. Identifying the most cited articles reveals the areas that have had a significant impact on the scientific community. The relationship between AI and services, as well as the impact of service robots in industry, are examples of topics that have attracted attention and generated ongoing discussion.

The analysis of the strategic diagrams shows the evolution of key themes over the periods analyzed. The first period underscores the significance of marketing, big data, and artificial intelligence. In the second period, decision-making becomes a central theme. Finally, in the third period, themes such as brand love, business orientation, and sentiment analysis emerge as critical. Evaluating the impact and productivity by topic in each period gives a more detailed picture. In the third period, there is an increase in topic diversification, with business being the most productive topic in terms of papers, while consumers stand out for their high average citation rate. The constant presence of topics such as big data, artificial intelligence, and the Internet of Things indicates a continuous integration of new technologies in marketing and branding. This suggests that the scientific community recognizes the importance of adapting to technological innovations in order to understand and address the ever-changing challenges in these fields.

The research highlights the transformation of artificial intelligence into services and its impact on human employment. As these technologies advance, we must ethically and responsibly address significant challenges like job loss. The identification of emerging issues, such as sentiment analysis and entrepreneurial orientation, points to promising areas for future research. Continually adapting to market trends and understanding changes in consumer behavior will be essential to advancing the field of marketing and branding.

As a result, the in-depth analysis of scholarly production in marketing and branding provides a rich and nuanced view of the field's evolution. The combination of traditional approaches with emerging technologies reflects the complexity and dynamism of an ever-changing business environment. Future research should focus on addressing ethical challenges, exploring new synergies between technologies, and continuing to provide valuable insights for continuous improvement in the field of marketing and branding.

The analysis of AI and electronic commerce (EC) shows a significant evolution over three periods, each spanning a decade. We highlight a 94% increase in scientific production between the second and third periods, indicating the growing interest and commitment of the scientific community to this analysis. This increase reflects the relevance and impact of these areas in contemporary research. The lack of growth during the first period suggests a later awakening of interest, possibly driven by technological advances and changes in the commercial landscape.

This study was also based on the examination of scientific publications, prominent authors, influential journals, and the use of strategic diagrams to identify thematic trends over time. According to the analysis of authors, Yeming Gong has the most publications, while Jian Mou is the most cited author, indicating a combination of volume and quality in contributing to the scientific literature. In addition, the identification of more productive journals, such as Sustainability, reflects the diversity of sources of knowledge in the field. The most cited articles, led by "Transforming the Customer Experience through

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New Technologies" and "AI-based chatbots in customer service and their effects on user compliance," highlight the importance of customer experience and the fundamental role of artificial intelligence, especially through chatbots, in improving services and interactions in e-commerce.

The analysis of the strategic diagrams reveals the thematic evolution over time. Themes such as "Value Creation," "Artificial Intelligence," "Business Intelligence," "E-commerce," "Decision Making," and "Management" emerge as central in different periods, indicating their continued importance. In addition, the inclusion of emerging topics such as "Customer Experience," "Chatbots," "Internet of Things," and "Machine Learning" is observed, reflecting the dynamics and evolution of research concerns over time. The analysis of impact and productivity highlights the importance of topics such as "Internet of Things" in terms of document volume, while topics such as "Value Creation" and "Business Intelligence" lead in terms of average citations, underlining their influence in the scientific community.

Overall, the study reveals a dynamic and evolving landscape of research at the intersection of AI and e-commerce. The exponential growth in scientific output, the identification of key players and emerging themes, and the analysis of impact and productivity provide a comprehensive view of the evolution and current state of this area of study. These findings provide a solid foundation for future research and guide both researchers and practitioners in the field to the most relevant and promising areas for the future of artificial intelligence and e-commerce.

On the other hand, we can observe a significant growth in interest and research in sustainability analysis, strategy, and project management over the three periods, as evidenced by the significant increase in the number of published articles. In the first period (1991-2001), the focus was on two key topics: "Neural Networks" and "Artificial Intelligence". These fundamental topics, although limited in number, played a crucial role in laying the foundation for subsequent research. In particular, Artificial Intelligence emerged as a central topic with a high level of development and relevance in analysis.

During the second period (2002-2012), the thematic diversification became evident with the inclusion of new clusters such as "Management", "Renewable Energies" and "Sustainable Development", among others. This period marked a transition towards the integration of artificial intelligence in broader contexts, such as business management and sustainable development. The productivity and impact analysis showed that, although the number of papers was limited, topics such as "Neural Networks" and "Artificial Intelligence" continued to be prominent.

In the third period (2013-2023), we observe an explosion in the diversity of topics, reflecting the evolution and expansion of AI and sustainability research. The inclusion of emerging topics such as digital transformation, smart cities, and circular business models highlights the adaptation of research to societal and technological changes. During this period, there was considerable interest in the intersection of artificial intelligence with aspects such as cybersecurity, circular business models, and digital transformation.

Evaluating the productivity and impact of the topics over these periods, it can be seen that AI, especially in the form of "Neural Networks", has maintained its importance and leadership in terms of number of papers, h-index and average number of citations. However, other topics such as "Supply Chain" and "Smart Cities" have gained importance, indicating an adaptation of research to current needs and challenges. The identification of prominent journals, leading authors, and most cited articles provides additional insight into the direction of research in these areas. The journal "Sustainability" stands out as a leader in publishing articles on these topics, underscoring their importance in the field of sustainability and sustainable development.

To narrow it down, this detailed analysis provides a comprehensive overview of the evolution of AI and sustainability research, highlighting the interconnectedness of these fields and their growing relevance in the scientific community. Looking ahead, research is likely to continue to diversify and address emerging challenges at the convergence of AI and sustainability. Emerging trends suggest the need to address contemporary challenges such as cybersecurity and digital transformation. This article provides a solid foundation for researchers and practitioners, offering a comprehensive overview of developments and key areas that will require attention in the future.

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Lastly, the diversity of topics, from artificial intelligence to green logistics to consumer behavior, underscores the importance of an interdisciplinary approach to research. Collaboration between experts in different disciplines can enrich understanding and address complex problems from multiple perspectives. Companies can benefit from adopting artificial intelligence-based approaches to sustainability and project management issues. The analysis highlights key areas, such as supply chain and digital transformation, where implementing AI-based solutions can improve efficiency and sustainability.

The identification of specialized journals suggests that these platforms play a critical role in the dissemination of knowledge in the field. Researchers should view these journals as important sources for sharing their research and contributing to the field's advancement. As artificial intelligence becomes more integrated into business management areas, there is a need for ethical considerations and accountability in the application of these technologies. Researchers and practitioners must address issues of privacy, fairness, and transparency in the development and implementation of AI-based solutions. In addition, rapidly evolving issues such as cybersecurity and digital transformation highlight the importance of continuing education and skills development for researchers and practitioners. Training in emerging areas of artificial intelligence will ensure that the community is prepared to meet the challenges and capitalize on the opportunities.

Finally, the results of the analysis can have significant implications for business policy and strategy formulation. Understanding emerging trends can help organizations make informed decisions and proactively adapt to changes in the artificial intelligence and sustainability landscape. In conclusion, the analysis provides a valuable roadmap for researchers, practitioners, and decision makers, highlighting key areas of focus and suggesting ways to address challenges and leverage opportunities at the intersection of artificial intelligence and various edges of the business context.

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DOI: 10.55214/25768484.v8i4.1048

References

[1] Y. K. Dwivedi *et al.*, "Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy," *International Journal of Information Management*, vol. 57, p. 101994, 2021. https://doi.org/10.1016/j.sbspro.2015.06.134

[2] C. Dirican, "The impacts of robotics, artificial intelligence on business and economics," *Procedia-Social and Behavioral Sciences*, vol. 195, pp. 564-573, 2015. https://doi.org/10.1016/j.sbspro.2015.06.134

[3] K. Buntak, M. Kovačić, and M. Mutavdžija, "Application of artificial intelligence in the business," *International Journal for Quality Research*, vol. 15, no. 2, pp. 403–416, 2021.

[4] Y. Duan, J. S. Edwards, and Y. K. Dwivedi, "Artificial intelligence for decision making in the era of big data–evolution, challenges and research agenda," *International Journal of Information Management*, vol. 48, pp. 63-71, 2019. https://doi.org/10.1016/j.ijinfomgt.2019.01.021

[5] I. M. Enholm, E. Papagiannidis, P. Mikalef, and J. Krogstie, "Artificial intelligence and business value: A literature review," *Information Systems Frontiers*, vol. 24, no. 5, pp. 1709-1734, 2022. https://doi.org/10.1007/s10796-021-10186-w

[6] N. Soni, E. K. Sharma, N. Singh, and A. Kapoor, "Artificial intelligence in business: From research and innovation to market deployment," *Procedia Computer Science*, vol. 167, pp. 2200-2210, 2020. https://doi.org/10.1016/j.procs.2020.03.272

[7] S.-C. Park, "The fourth industrial revolution and implications for innovative cluster policies," *AI & Society*, vol. 33, pp. 433-445, 2018. https://doi.org/10.1007/s00146-017-0777-5

[8] F. Kitsios and M. Kamariotou, "Artificial intelligence and business strategy towards digital transformation: A research agenda," *Sustainability*, vol. 13, no. 4, p. 2025, 2021. https://doi.org/10.3390/su13042025

[9] F. T. Tschang and E. Almirall, "Artificial intelligence as augmenting automation: Implications for employment," *Academy of Management Perspectives*, vol. 35, no. 4, pp. 642-659, 2021. https://doi.org/10.5465/amp.2019.0062

[10] J. Kim, "Fear of artificial intelligence on people's attitudinal & behavioral attributes: An exploratory analysis of AI Phobia," *Global Scientific Journal*, vol. 7, pp. 9-20, 2019.

[11] J. C. Davis and J. G. Gonzalez, "Scholarly journal articles about the Asian tiger economies: Authors, journals and research fields, 1986-2001," *Asian-Pacific Economic Literature*, vol. 17, pp. 51-61, 2003. https://doi.org/10.1046/j.1467-8411.2003.00131.x

[12] C. H. Limaymanta, H. Zulueta-Rafael, C. Restrepo-Arango, and P. Alvarez-Muñoz, "Bibliometric and scientometric analysis of the scientific production of Peru and ecuador from web of science (2009-2018)," *Información, Cultura y Sociedad*, no. 43, pp. 31-52, 2020. https://doi.org/10.34096/ics.i43.7926

[13] E. C. M. Noyons, H. F. Moed, and M. Luwel, "Combining mapping and citation analysis for evaluative bibliometric purposes: A bibliometric study," *Journal of the American Society for Information Science*, vol. 50, no. 2, pp. 115-131, 1999. https://doi.org/10.1002/(sici)1097-4571(1999)50:2%3C115::aid-asi3%3E3.3.co;2-a

[14] M. J. Cobo, A. G. López-Herrera, E. Herrera-Viedma, and F. Herrera, "SciMAT: A new science mapping analysis software tool," *Journal of the American Society for Information Science and Technology*, vol. 63, no. 8, pp. 1609-1630, 2012. https://doi.org/10.1002/asi.22688

[15] J. Cascon-Katchadourian, J. A. Moral-Munoz, H. Liao, and M. J. Cobo, "Bibliometric analysis of the Spanish documentation Magazine cientifica since its inclusion in the web of science (2008-2018)," *Revista Española de Documentación Científica*, vol. 43, no. 3, pp. 1-16, 2020.

[16] M.-H. Huang and R. T. Rust, "Artificial intelligence in service," *Journal of Service Research*, vol. 21, no. 2, pp. 155-172, 2018.

[17] R. M. González and V. M. De La Torre, *Marketing in the 21st century*, 5th ed. Center for Financial Studies, 2001.

[18] J. C. Beamin and J. Dunstan, "Artificial intelligence and big data, Universidad de Chile; Centro de Comunicación de las Ciencias, Universidad Autónoma de Chile," 2020. https://hdl.handle.net/20.500.12728/3279

[19] J. Angulo and A. Del Moral, "Artificial intelligence." Madrid: Ed. Paraninfo, 1986, pp. 100-101.

[20] B. G. Buchanan and E. H. Shortliffe, *Rule based expert systems: The MYCIN experiments of the stanford heuristic programming project*. Reading, MA: Addison-Wesley, 1984.

[21] N. J. Nilsson, "Artificial intelligence: Engineering, science, or slogan?," *AI Magazine*, vol. 3, no. 1, pp. 2-2, 1982.

[22] S. Madakam, R. Ramaswamy, and S. Tripathi, "Internet of things (IoT): A literature review," *Journal of Computer and Communications*, vol. 3, no. 5, pp. 164-173, 2015.

[23] M. Stone, E. Aravopoulou, Y. Ekinci, G. Evans, M. Hobbs, and A. Labib, "Artificial intelligence (AI) in decision making of strategic marketing: A research agenda," *The Bottom Line*, vol. 33, no. 2, pp. 183–200, 2020.

[24] G. Overgoor, M. Chica, W. Rand, and A. Weishampel, "Letting the computers take over: Using AI to solve marketing problems," *California Management Review*, vol. 61, no. 4, pp. 156-185, 2019. https://doi.org/10.1177/0008125619859318

[25] A. D. Dongare, R. R. Kharde, and A. D. Kachare, "Introduction to artificial neural network," *International Journal of Engineering and Innovative Technologies*, vol. 2, pp. 189-194, 2012.

[26] P. S. Varsha, S. Akter, A. Kumar, S. Gochhait, and B. Patagundi, "The impact of artificial intelligence on branding: A bibliometric analysis (1982-2019)," *Revista de Gestao De La Information Global*, vol. 29, pp. 221-246, 2021.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 4: 358-389, 2024
DOI: 10.55214/25768484.v8i4.1048

[27] G. T. Lumpkin and G. G. Dess, "Clarifying the entrepreneurial orientation construct and linking it to performance," *Academy of Management Review*, vol. 21, no. 1, pp. 135-172, 1996. https://doi.org/10.5465/amr.1996.9602161568

[28] F. Saddique, M. Usman, M. Nawaz, and N. Mushtaq, "Entrepreneurial orientation and human resource management: The mediating role of artificial intelligence," *Ilkogret en Lín*, vol. 19, pp. 4969-4978, 2020.

[29] J. Kietzmann, J. Paschen, and E. Treen, "Artificial intelligence in advertising: How marketers can leverage artificial intelligence along the consumer journey," *Journal of Advertising Research*, vol. 58, no. 3, pp. 263-267, 2018. https://doi.org/10.2501/jar-2018-035

[30] M. Anjaria and R. M. R. Guddeti, "A novel sentiment analysis of social networks using supervised learning," *Social Network Analysis and Mining*, vol. 4, pp. 1-15, 2014. https://doi.org/10.1007/s13278-014-0181-9

[31] Y. Yiran and S. Srivastava, "Aspect-based sentiment analysis on mobile phone reviews with LDA," in *Proceedings of the 2019 4th International Conference on Machine Learning Technologies 2019*, 2019, pp. 101-105.

[32] O. Al Sonosy, S. Rady, N. L. Badr, and M. Hashem, "A study of spatial machine learning for business behavior prediction in location based social networks," presented at the 2016 11th International Conference on Computer Engineering & Systems (ICCES). IEEE, 2016.

[33] R. K. Blashfield and M. S. Aldenderfer, "The literature on cluster analysis," *Multivariate Behavioral Research*, vol. 13, no. 3, pp. 271-295, 1978.

[34] T. Reutterer and D. Dan, *Cluster analysis in marketing research. In Handbook of Market Research 2021.* Cham: Springer International Publishing, 2021.

[35] S. M. C. Loureiro, J. Guerreiro, and I. Tussyadiah, "Artificial intelligence in business: State of the art and future research agenda," *Journal of Business Research*, vol. 129, pp. 911-926, 2021. https://doi.org/10.1016/j.jbusres.2020.11.001

[36] R. Akerkar, "Artificial intelligence for business." Noruega: Springer International Publishing, 2018, pp. 1-81.

[37] S. Gupta and M. Khattar, "Internet of things and artificial intelligence, in towards smart world," 1st ed.: Chapman and Hall/CRC, 2020, pp. 99-118.

[38] S. Y. Velazco Florez, R. Ferro Escobar, and K. Cuartas, "Integrated transport systems supported on the internet of things," *Redes De Ingenieria-Rompiendo Las Barreras Del Conocimiento*, vol. especial, pp. 84-96, 2016. https://doi.org/10.14483/2248762X.11995

[39] W. D. Hoyer, M. Kroschke, B. Schmitt, K. Kraume, and V. Shankar, "Transforming the customer experience through new technologies," *Journal of Interactive Marketing*, vol. 51, no. 1, pp. 57-71, 2020. https://doi.org/10.1016/j.intmar.2020.04.001

[40] M. Adam, M. Wessel, and A. Benlian, "AI-based chatbots in customer service and their effects on user compliance," *Electronic Markets*, vol. 31, no. 2, pp. 427-445, 2021. https://doi.org/10.1007/s12525-020-00414-7

[41] C. Zott, R. Amit, and J. Donlevy, "Strategies for value creation in e-commerce: Best practice in Europe," *European Management Journal*, vol. 18, no. 5, pp. 463-475, 2000. https://doi.org/10.1016/s0263-2373(00)00036-0

[42] B. Whitby, "Artificial intelligence." New York: The Rosen Publishing Group, Inc, 2009, pp. 1-153.

[43] J. McCarthy, "What is artificial intelligence?, Stanford, computer science department," Stanford University, 2007, pp. 1-14.

[44] S. Negash, "Business intelligence," *Communications of the Association for Information Systems*, vol. 13, no. 1, p. 15, 2004.

[45] A. Gupta, "E-commerce: Role of E-commerce in today's business," *International Journal of Computing and Corporate Research*, vol. 4, no. 1, pp. 1-8, 2014.

[46] M. D. C. S. Sierra, "Artificial intelligence in corporate financial management," *Think & Management*, vol. 1, pp. 153-186, 2007.

[47] J.-C. Pomerol, "Artificial intelligence and human decision making," *European Journal of Operational Research*, vol. 99, no. 1, pp. 3-25, 1997.

[48] Y. R. Shrestha, S. M. Ben-Menahem, and G. Von Krogh, "Organizational decision-making structures in the age of artificial intelligence," *California Management Review*, vol. 61, no. 4, pp. 66-83, 2019. https://doi.org/10.1177/0008125619862257

[49] X. Song, S. Yang, Z. Huang, and T. Huang, "The application of artificial intelligence in electronic commerce," presented at the Journal of Physics: Conference Series. IOP Publishing, 2019.

[50] H. Pallathadka, E. H. Ramirez-Asis, T. P. Loli-Poma, K. Kaliyaperumal, R. J. M. Ventayen, and M. Naved, "Applications of artificial intelligence in business management, e-commerce and finance," *Materials Today: Proceedings*, vol. 80, pp. 2610-2613, 2023.

[51] I. M. S. Guevara, M. R. T. Jiménez, and I. M. J. Lara, "Organizational behavior and its role in business management," *Rev Pub*, vol. 7, no. 24, pp. 1-8, 2020.

[52] J. L. Cano, "Business intelligence: Competir con información." Banesto: Fundación Cultur, 2007, pp. 1-393.

[53] R. Jain, J. Aagja, and S. Bagdare, "Customer experience–a review and research agenda," *Journal of Service Theory and Practice*, vol. 27, no. 3, pp. 642-662, 2017.

[54] A. Bilgihan, F. Okumus, K. Nusair, and M. Bujisic, "Online experiences: Flow theory, measuring online customer experience in e-commerce and managerial implications for the lodging industry," *Information Technology & Tourism*, vol. 14, pp. 49-71, 2014. https://doi.org/10.1007/s40558-013-0003-3

[55] C. Gronroos, "Adopt a service logic for marketing," *Mark Theory*, vol. 6, pp. 317-333, 2006.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 4: 358-389, 2024
DOI: 10.55214/25768484.v8i4.1048

[56] K. Pretz, "The next evolution of the internet," Retrieved: http://theinstitute.ieee.org/technology-focus/technology-topic/the-next-evolution-of-the-internet. 2013
[57] J. F. Rayport and B. J. Jaworski, *E-commerce*. Sydney: McGraw-Hill/Irwin, 2001.
[58] A. R. Asadi and R. Hemadi, "Design and implementation of a chatbot for e-commerce," *Information Communication Technology and Doing Business*, pp. 1-10, 2018.
[59] P. P. and A. Neelamegam, *Improving business intelligence based on frequent itemsets using k-means clustering algorithm. In: Meghanathan N., Nagamalai D., Rajasekaran S. (Eds.), Networks and Communications (NetCom2013). Lecture Notes in Electrical Engineering*. Cham: Springer. https://doi.org/10.1007/978-3-319-03692-2_19, 2014.
[60] R. Manne and S. C. Kantheti, "Application of artificial intelligence in healthcare: Chances and challenges," *Current Journal of Applied Science and Technology*, vol. 40, no. 6, pp. 78-89, 2021. https://doi.org/10.9734/cjast/2021/v40i631320
[61] A. L. Samuel, "Machine learning," *The Technology Review*, vol. 62, pp. 42-45, 1959.
[62] B. Mahesh, "Machine learning algorithms-a review," *International Journal of Science and Research*, vol. 9, no. 1, pp. 381-386, 2020.
[63] T. Ferreira, I. Pedrosa, and J. Bernardino, "Business intelligence for e-commerce: Survey and research directions," *Recent Advances in Information Systems and Technologies*, vol. 1, pp. 215-225, 2017.
[64] MDPI, "Sustainability," Retrieved: https://www.mdpi.com/journal/sustainability. 2023.
[65] A. Kusiak, *Smart manufacturing. In Springer Handbook of Automation*. Cham: Springer International Publishing, 2023.
[66] Z. M. Yaseen, S. O. Sulaiman, R. C. Deo, and K.-W. Chau, "An enhanced extreme learning machine model for river flow forecasting: State-of-the-art, practical applications in water resource engineering area and future research direction," *Journal of Hydrology*, vol. 569, pp. 387-408, 2019. https://doi.org/10.1016/j.jhydrol.2018.11.069
[67] X. B. Olabe, "Artificial neural networks and their applications." Spain: Publications of the School of Engineering of Bilbao, 1998, pp. 1-76.
[68] N. J. Nilsson, *Artificial intelligence: A new synthesis*. Palo Alto: Morgan Kaufmann, 1998.
[69] R. Garvare and P. Johansson, "Management for sustainability–a stakeholder theory," *Total quality Management*, vol. 21, no. 7, pp. 737-744, 2010.
[70] K. Foley, *Meta-management: A stakeholder/quality management approach to whole-ofenterprise management*. Sydney: SAI Global, 2005.
[71] C. M. Gomes, J. M. Kneipp, I. Kruglianskas, L. A. B. da Rosa, and R. S. Bichueti, "Management for sustainability: An analysis of the key practices according to the business size," *Ecological Indicators*, vol. 52, pp. 116-127, 2015. https://doi.org/10.1016/j.ecolind.2014.11.012
[72] P. Ray, "Renewable energy and sustainability," *Clean Technologies and Environmental Policy*, vol. 21, pp. 1517–1533, 2019. https://doi.org/10.1007/s10098-019-01739-4
[73] M. A. Hannan *et al.*, "Impact of renewable energy utilization and artificial intelligence in achieving sustainable development goals," *Ener Rep*, vol. 7, pp. 5359–5373, 2021. https://doi.org/10.1016/j.egyr.2021.08.172
[74] R. Nishant, M. Kennedy, and J. Corbett, "Artificial intelligence for sustainability: Challenges, opportunities, and a research agenda," *Intern Journ of Inform Manag*, vol. 53, p. 102104, 2020. https://doi.org/10.1016/j.ijinfomgt.2020.102104
[75] Y. Wu and J. Feng, "Development and application of artificial neural network," *Wir Pers Commun*, vol. 102, pp. 1645-1656, 2017. https://doi.org/10.1007/s11277-017-5224-x
[76] J. L. Balcázar, R. Gavalda, and H. T. Siegelmann, "Computational power of neural networks: A characterization in terms of Kolmogorov complexity," *IEEE Transactions on Information Theory*, vol. 43, no. 4, pp. 1175-1183, 1997. https://doi.org/10.1109/18.605580
[77] World Commission on Environment and Development, "Report of the world commission on environment and development: Our common future UN documents gathering a body of global agreements," Retrieved: http://www.un-documents.net/wced-ocf.htm. [Accessed 13-12-2023], 1987.
[78] R. Vinuesa *et al.*, "The role of artificial intelligence in achieving the sustainable development goals," *Nature Communications*, vol. 11, no. 1, pp. 1-10, 2020.
[79] V. Kotelnikov, "Small and medium-sized businesses and ICT." Thailand: ONU-APCICT/CESPAP, 2007, pp. 1-40.
[80] S. B. Moore and S. L. Manring, "Strategy development in small and medium sized enterprises for sustainability and increased value creation," *Journal of Cleaner Production*, vol. 17, no. 2, pp. 276-282, 2009. https://doi.org/10.1016/j.jclepro.2008.06.004
[81] A. Sulich, M. Rutkowska, A. Krawczyk-Jezierska, J. Jezierski, and T. Zema, "Ciberseguridad y desarrollo sostenible," *Proc Inform*, vol. 192, pp. 20-28, 2021.
[82] M. Antikainen and K. Valkokari, "A framework for sustainable circular business model innovation," *Technology Innovation Management Review*, vol. 6, no. 7, pp. 1-8, 2016. https://doi.org/10.22215/timreview/1000
[83] M. P. Pieroni, T. McAloone, and D. A. Pigosso, "Business model innovation for circular economy and sustainability: A review of approaches," *Journal of Cleaner Production*, vol. 215, pp. 198-216, 2019. https://doi.org/10.1016/j.jclepro.2019.01.036
[84] M. Geissdoerfer, P. Savaget, N. M. Bocken, and E. J. Hultink, "The circular economy–A new sustainability paradigm?," *Journal of Cleaner Production*, vol. 143, pp. 757-768, 2017.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 4: 358-389, 2024
DOI: 10.55214/25768484.v8i4.1048

[85] D. Marshall, L. McCarthy, C. Heavey, and P. McGrath, "Environmental and social supply chain management sustainability practices: Construct development and measurement," *Production Planning & Control*, vol. 26, no. 8, pp. 673-690, 2015. https://doi.org/10.1080/09537287.2014.963726

[86] D. Harms, "Environmental sustainability and supply chain management—a framework of cross-functional integration and knowledge transfer," *Journal of Environmental Sustainability*, vol. 1, no. 1, pp. 121-141, 2011. https://doi.org/10.14448/jes.01.0009

[87] S. Chanias, M. D. Myers, and T. Hess, "Digital transformation strategy making in pre-digital organizations: The case of a financial services provider," *The Journal of Strategic Information Systems*, vol. 28, no. 1, pp. 17-33, 2019. https://doi.org/10.1016/j.jsis.2018.11.003

[88] E. Katsamakas, "Digital transformation and sustainable business models," *Sustainability*, vol. 14, no. 11, p. 6414, 2022.

[89] J. P. Rodrigue, B. Slack, and C. Claude, "Green logistics, in handbook of logistics and supply-chain management. Eds. A. M. Brewer, K. J. Button and D. A. Hensher." Pergamon, 2001, pp. 339-350.

[90] A. Kumar, "Green logistics for sustainable development: An analytical review," *IOSRD Intern Journ of Bus*, vol. 1, pp. 7-13, 2015.

[91] L. Bătăgan, "Smart cities and sustainability models," *Informatica Economică*, vol. 15, no. 3, pp. 80-87, 2011.

[92] M. Bouskela, M. Casseb, S. Bassi, C. De Luca, and M. Facchina, *The route towards smart cities: Migrating from traditional management to the smart city*. Washington D. C: Inter-American Development Bank, 2016.

[93] S. Baker, *Sustainable development*. London, UK: Routledge, 2015.

[94] J. D. Sachs, *The age of sustainable development*. New York: Columbia University Press, 2015.

[95] P. Rita and R. F. Ramos, "Global research trends in consumer behavior and sustainability in E-Commerce: A bibliometric analysis of the knowledge structure," *Sustainability*, vol. 14, no. 15, p. 9455, 2022. https://doi.org/10.3390/su14159455

[96] R. Trudel, "Sustainable consumer behavior," *Consumer Psychology Review*, vol. 2, no. 1, pp. 85-96, 2019. https://doi.org/10.1002/arcp.1045

[97] G. Bugmann, M. Siegel, and R. Burcin, "A role for robotics in sustainable development?," *IEEE Afr*, vol. 2011, p. 11, 2011. https://doi.org/10.1109/afrcon.2011.6072154

[98] I. H. V. Gue, A. T. Ubando, M. L. Tseng, and R. R. Tan, "Artificial neural networks for sustainable development: A critical review," *Clean Technologies and Environmental Policy*, vol. 2020, no. 22, pp. 1449-1465, 2020.

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