

Application of Artificial Intelligence (AI) and Machine Learning (ML) in The Muslim Modest Fashion Industry: A Bibliometric Review

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ABSTRACT

Objective: This study aims to analyze the trends and developments of Artificial Intelligence (AI) and Machine Learning (ML) in the fashion industry, with a particular focus on their potential application in the Muslim fashion sector, which remains underexplored. **Background:** The emergence of AI and ML has become a transformative force across industries, including fashion, offering opportunities to enhance design innovation, production efficiency, and competitiveness in international markets. However, research specific to the Muslim fashion industry is still limited, creating a significant knowledge gap. **Method:** This study adopts the PRISMA systematic review method to identify and analyze relevant literature. Data were sourced from the Scopus database, with 62 out of 100 selected articles from 2011–2025 meeting the inclusion criteria. The data were further processed and visualized using Microsoft Excel, Biblioshiny, and VOSviewer to map key trends, themes, and collaborations. **Results:** The findings highlight that AI and ML have been increasingly applied in areas such as trend prediction, supply chain optimization, personalized marketing, and sustainable fashion innovation. **Novelty:** This study provides valuable insights and practical recommendations for Muslim fashion manufacturers to adopt AI and ML technologies, thereby enhancing innovation, competitiveness, and global market presence.

INTRODUCTION

Artificial intelligence (AI) and machine learning (ML) are transformative technologies that influence many aspects of various fields [1]. So this technology is developing rapidly to meet various industrial needs and encourage innovation [2]. In the Muslim fashion industry, Artificial Intelligence (AI) and Machine Learning (ML) provide significant potential for future industrial growth and development, increasing the ability of the Muslim fashion industry to compete effectively in the global market [3]. The application of AI and ML in the Muslim fashion industry provides benefits to increase marketing efficiency and help the creative design process so that it can become an opportunity to make new, innovative breakthroughs in the Muslim modest fashion industry sector [4].

The emergence of artificial intelligence (AI) and machine learning (ML) in the Muslim fashion industry has made marketing operations easier by automating various tasks that were previously manual and time-consuming, making them more efficient [5]. Wisely utilized technological developments have a positive impact on all parties in the economic ecosystem. A concrete example is the use of AI systems in production decision-making. By utilizing the latest technological innovations, companies can optimize their

production processes, thereby enabling substantial reductions in production costs. This efficiency has a positive impact on the supply chain and allows manufacturers to set more competitive selling prices to consumers. Research conducted by Dalimunthe, Sinulingga, and Ginting (2023) explains that advances in artificial intelligence technology have the potential to reduce supply chain management costs and produce more accurate forecasts. [6]. By utilizing machine learning algorithms, this technology can analyze user behavior, preferences, and interactions in real-time, enabling more accurate consumer targeting and expanding consumer reach [7]. This technological advancement helps the Muslim fashion industry to increase sales, build brand awareness and grow brand loyalty, enabling Muslim fashion industry companies to continue to grow in the global market [8].

According to the Indonesia Halal Markets Report (2021/2022), Indonesia has the potential to increase halal product exports to \$3.6 billion annually to CIC and non-CIC markets across various halal industry sectors. The report ranks the modest fashion industry as the second-highest priority export category, with a potential value of \$0.44 billion. This demonstrates Indonesia's potential to develop the modest fashion market globally. Data shows that Iran, Turkey, and Pakistan top the list as countries with the highest levels of modest fashion consumption based on Muslim consumer spending. This is a promising indicator for Indonesia to expand its export market, especially with the top five countries being potential target markets for the modest Muslim fashion industry.



Figure 1. The top five countries in Muslim fashion consumer spending

The high level of consumption and purchasing power of Muslim consumers in these countries has significantly driven the growth of the modest fashion industry. Modest fashion ranks second as the sector with the largest Muslim consumer spending in the global halal economy, with a value reaching \$279 billion in 2020 and is expected to increase to \$375 billion in 2025 (DinarStandard, 2022).

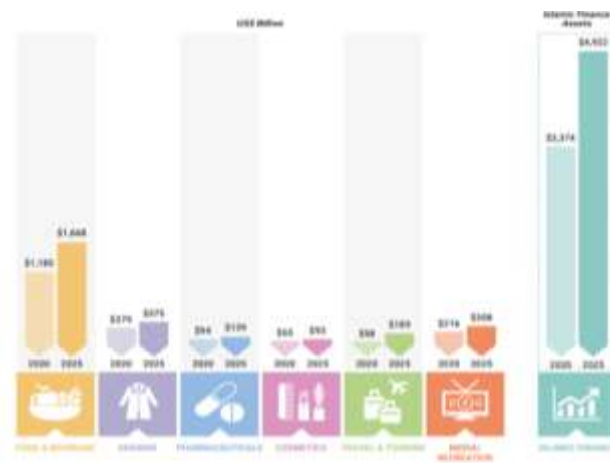


Figure 2. Global Muslim consumer spending chart by key halal economic sectors

As the modest Muslim fashion industry continues to grow, artificial intelligence (AI) has become a crucial strategy for local companies to optimize their business potential. AI not only helps facilitate trade promotions and increase international exposure, but it is also revolutionizing the way designers design modest fashion collections. Through machine learning algorithms, AI is able to more accurately align designs with market demand. This technology works by analyzing data sets from various sources, such as social media, e-commerce platforms, and fashion forums, to identify emerging trends and preferences within the modest Muslim fashion industry [9]. This technology helps Muslim fashion designers simplify their creative design process, accurately predict market demand and create collections that are in line with Muslim culture [10]. Designer efficiency can now be increased by producing appropriate patterns, color combinations and optimizing clothing proportions [11]. So that Muslim designers can create attractive modest clothing to encourage innovation and growth of the modest halal fashion industry in global competition [12].

Research on the use of artificial intelligence (AI) and machine learning (ML) technologies in the Muslim fashion industry remains very limited, creating a significant knowledge gap in this sector. Given the significant potential of AI and ML technologies in various industries, the question arises as to how these technological developments can be optimized in the modest Muslim fashion industry to increase competitiveness in international business. This study aims to analyze trends in the application of AI and ML to business development for economic actors in the Muslim fashion industry.

With these rationales in mind, this article will provide a comprehensive bibliometric analysis of the literature related to the application of artificial intelligence (AI) and machine learning (ML). This research aims to provide insights into trends and developments in AI and ML applications in the fashion industry and offer practical recommendations for manufacturers seeking to leverage technological advancements to strengthen their position in the international market. Therefore, this research not only fills the existing knowledge gap but also has the potential to significantly contribute to the advancement of the Muslim fashion industry in the digital era.

RESEARCH METHOD

This bibliometric literature review is based on an explicit methodical approach, known as mind mapping, which highlights the boundaries of knowledge using a five-stage methodology [13].



Figure 3. Five-stage bibliometric analysis

Determine search keywords

The literature search activity took place in December 2024. Scopus-indexed journals were selected because they provide reliable and relevant information about scientific works, and are most frequently used for bibliometric analysis [14]. A literature search was conducted using the keywords "artificial intelligence", "machine learning", and "fashion industry". These related terms and phrases were chosen as keywords to expand the network of articles that the researcher would obtain. The aim was that the scope of the This article focuses solely on articles and reviews, with 100 articles found in the initial search. No specific timeframe was specified in the literature search; the article data covers the entire period. However, due to the fact that the first publication in the analyzed field appeared in 1996, the timeframe was narrowed to 1996–2024.

Search results refinement

Then the researcher used the PRISMA (Preferred Reporting Items for Systematic Review and Meta Analyses) systematic method to conduct a systematic review as a literature search strategy relevant to the inclusion and exclusion criteria [14]. The first filtering uses filters on Scopus which include subject filters, document type, language filter, screening valid author information and If title, abstract and keywords indicate relevance to the scope of study. The inclusion and exclusion criteria in this study are presented in Table 1 below which produces 62 articles through the identification, screening and inclusion process using the PRISMA protocol, then the results are compiled in CSV (Comma-Separated Values) format to include all the main components of the article consisting of the article title, author name, abstract, keywords, and references.

Compiling initial data statistics

The collected data was stored in CSV (Comma Separated Values) format and underwent a refinement process. The data was then organized to classify the articles

based on several criteria. The CSV file was imported into Microsoft Office Excel for data analysis, categorizing the articles by publisher, year of publication, and publication source. This process ensured that the data used in the research was well-organized and ready for further analysis.

Data Analyst

Bibliometric analysis in this study uses Scopus to search for relevant data [15]. However, to analyze data and visualize bibliometric networks using Microsoft Office Excel, VOSviewer and Biblioshiny. Microsoft Excel is used to analyze data based on year of publication, number of citations, and place of journal publication [16]. The use of VOSviewer and Biblioshiny for practical bibliometric data analysis and visualization allows easier exploration of networks, co-citation patterns, and intellectual structures of scientific publications in a particular field of study [17]. Articles published and indexed by Scopus are reviewed using the PRISMA protocol to obtain relevant articles for further analysis using the search criteria and article selection in **Table 1** below.

Table 1 Presents the systematic process undertaken to reach a final corpus of 62 articles for review.

Filtering criteria	Accept	Reject
Search date: 02-12-2024		
Search engine: <i>Scopus</i>		
Search string:	100	
<i>"artificial AND intelligence AND machine AND learning AND of AND industry AND fashion"</i>		
Subject filters:	99	1
(1) <i>Computer Science</i>		
(2) <i>Engineering</i>		
(3) <i>Mathematics</i>		
(4) <i>Decision Sciences</i>		
(5) <i>Business, Management and Accounting</i>		
(6) <i>Social Sciences</i>		
(7) <i>Materials Science</i>		
(8) <i>Energy</i>		
(9) <i>Economics, Econometrics and Finance</i>		
(10) <i>Arts and Humanities</i>		
Document type :	83	16
<i>Articles, conference papers and reviews only</i>		
Language filter	78	5
<i>English</i>		
Erroneous record screening:	77	1
<i>Valid author information</i>		
Content screening:	62	15
<i>If title, abstract and keywords indicate relevance to scope of study</i>		

RESULTS AND DISCUSSION

Results

Research output analysis was conducted using several complementary software tools. The R program, with the help of Biblioshiny, was used to identify and analyze keyword frequency, with the number of keywords analyzed adjusted to the needs and objectives of data collection. Furthermore, to obtain a comprehensive bibliometric map visualization, VOSviewer software was used, which presents the analysis results in three different visualizations. These three visualizations include a network visualization that illustrates the relationships between elements, an overlay visualization that displays additional layers of information, and a density visualization that shows the level of relationship density between components in the bibliometric map.

An initial search through the Scopus database yielded 100 articles relevant to the research topic. The search was conducted using the keywords "Artificial Intelligence, Machine Learning, Fashion Industry" for the period 1996-2024. These initial results yielded a total of 1,851 citations, with an average of 63.83 citations per year. After a more rigorous filtering process, the number of articles meeting the research criteria was reduced to 62. This refinement also impacted the number of citations, with the total number of citations reaching 1,588, with an average of 113.43 citations per year. A complete comparison of the metric data between the initial and refined search results can be seen in detail in **Table 2**.

Table 2 Comparison matrix

Metric Data	Initial Search	Refinement Search
Source	Scopus	Scopus
Keywords	Artificial Intelligence, Machine Learning, Fashion Industry.	Artificial intelligence, Machine Learning, Fashion Industry
Year of publication	1996-2024	2011-2025
Quote	1851	1588
Citations/year	63.83	113.43
Quotes/Papers	18.51	25.61
Authors	347	239
Document Type	100	62
(1) Article	39	29
(2) Book	3	-
(3) Book Chapter	12	-
(4) Conference Paper	42	30
(5) Conference Review	1	3
(6) Review	3	-

To present the most relevant contributions to this research, researchers conducted an in-depth analysis of 62 selected articles using the PRISMA method. From the articles obtained using the keywords "Artificial Intelligence, Machine Learning, Fashion Industry", researchers identified ten articles with the highest citation values for further

study. The results of the analysis of these most cited articles are then presented systematically in **Table 3**, providing a comprehensive overview of the most significant contributions in this research field.

Table 3 Top ten cited articles on this topic

No	Year Publication	Writer	Title	Journal	Quote	Publisher
1	2020	Liye Ma, Baohong Sun.	Machine learning and AI in marketing – Connecting computing power to human insights	International Journal of Research in Marketing	313	Elsevier
2	2016	Kris Johnson, Ferreira, Bin Hong, Alex Lee, David Simchi Levi.	Analytics for an online retailer: Demand forecasting and price optimization	Manufacturing and Service Operations Management	296	INFORMS Inst. for Operations Res. and the Management Sciences
3	2023	Annamma Joy, Ying Zhu, Camilo Peña, Myriam Brouard.	Digital future of luxury brands: Metaverse, digital fashion, and non-fungible tokens	Strategic Change	140	John Wiley and Sons Inc
4	2022	Yong Yu, Tsan-Ming Choi, Chi-Leung Hui.	An intelligent fast sales forecasting model for fashion products	Expert Systems with Applications	93	Elsevier

No	Year Publication	Writer	Title	Journal	Quote	Publisher
5	2011	Chandadev i Giri, Sheenam Jain, Xianyi Zeng, Pascal Bruniaux .	A Detailed Review of Artificial Intelligence Applied in the Fashion and Apparel Industry	IEEE Access	90	Institute of Electrical and Electronics Engineers Inc.
6	2019	Yao Xiong, Lan Luo , Jiahong Yang.	Scalable spinning, winding, and knitting graphene textile TENG for energy harvesting and human motion recognition	Nano Energy	62	Elsevier
7	2019	Xiaoling Gu, Fei Gao, Min Tan, Pai Peng.	Fashion analysis and understanding with artificial intelligence	Information Processing and Management	57	Elsevier
8	2016	Jaehyuk Park, Giovanni Luca Ciampaglia , Emilio Ferrara.	Style in the age of Instagram : Predicting success within the fashion industry using social media	Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW	40	Association for Computing Machinery
9	2020	Yashar Deldjoo , Fatemeh Nazary, Arnau Ramisa,	A Review of Modern Fashion Recommender Systems	ACM Computing Surveys	17	Association for Computing Machinery

No	Year Publication	Writer	Title	Journal	Quote	Publisher
		Thommaso Di Noia.				
10	2016	Eurydice Papachristou, Antonios Chrysopoulos, N. Bilalis .	Machine learning for clothing manufacturing as a means to respond quicker and better to the demands of clothing brands: a Greek case study	International Journal of Advanced Manufacturing Technology	16	Springer Science and Business Media Deutschland GmbH

Table 4. Top seven publishers that publish topics relevant to the keyword

No	Publisher	Article
1	Institute of Electrical and Electronics Engineers Inc.	18
2	Elsevier	7
3	Springer Science and Business Media Deutschland GmbH	6
4	Association for Computing Machinery	4

Based on data from the top four publishers most productive in publishing articles on this topic (**Table 4**), the researchers present the contribution of each publisher to the development of the field of study. The 35 article titles published by these four publishers (**Tables 5-8**) provide a clearer picture of research trends and developments on this topic.

Table 4 Eighteen article titles from the Institute of Electrical and Electronics Engineers Inc.

No	Article Title	No	Article Title	Publisher
1	A Fuzzy Inference System for Sustainable Outfit Recommendations in the Fashion Industry	10	Review on Fashion Trend Analysis and Forecasting Techniques - A Machine Learning Approach	Institute of Electrical and Electronics Engineers Inc.

No	Article Title	No	Article Title	Publisher
2	Hands-Free Virtual Try-On using Untethered AR Glasses for Everyday Shopping Experiences	11	Application of Artificial Intelligence for Improving Internal Logistics in the Garment Industry: A Literature Review	Institute of Electrical and Electronics Engineers Inc.
3	A Survey of Artificial Intelligence in Fashion	12	A scalable virtual try-on system based on cloud computing	Institute of Electrical and Electronics Engineers Inc.
4	The Role of Artificial Intelligence in Enhancing Sustainability in the Fashion Industry: A 2012-2022 Review	13	Artificial Intelligence and Machine Learning in Fashion: Reshaping Design, Production, Consumer Experience and Sustainability	Institute of Electrical and Electronics Engineers Inc.
5	Role of Fashion in Artificial Intelligence in Digital Age	14	AVATRY: Virtual Fitting Room Solution	Institute of Electrical and Electronics Engineers Inc.
6	The Art of Machine Learning as Stylish Fashion for Designing Clothes	15	A Preprocessing Approach to Improve the Performance of Inception v3-based Face Shape Classification	Institute of Electrical and Electronics Engineers Inc.
7	FedCSA : Boosting the Convergence Speed of Federated Unlearning under Data Heterogeneity	16	An Artificial Intelligence-Based Approach for Classification of Personal Color	Institute of Electrical and Electronics Engineers Inc.
8	A Case Study of Myntra™ Enhancing E-Commerce Retailing with Multiple AI Solutions	17	Blockchain-Based Two-Stage Federated Learning With Non-IID Data in IoMT System	Institute of Electrical and Electronics Engineers Inc.
9	A Detailed Review of Artificial Intelligence Applied in the Fashion and Apparel Industry	18	Data-Driven Forecasting and Inventory Optimization using Machine Learning Models and Methods	Institute of Electrical and Electronics Engineers Inc.

Table 5 Seven article titles from Elsevier publishers

No	Article Title	No	Article Title	Publisher
1	Machine learning and AI in marketing – Connecting computing power to human insights	5	Machine learning framework for predictive maintenance in milling	Elsevier
2	Demand forecasting for fashion products: A systematic review	6	Scalable spinning, winding, and knitting graphene textile TENG for energy harvesting and human motion recognition	Elsevier
3	Personalized Supply Chain Solutions for Sustainable Fashion: Leveraging Social Media Insights and Machine Learning	7	Fashion analysis and understanding with artificial intelligence	Elsevier
4	Launching smart circular supply chain practices toward sociotechnological synergy: An integrative influential fast fashion model			Elsevier

Table 6 Six article titles from the publisher Springer Science and Business Media Deutschland GmbH

No	Article Title	No	Article Title	Publisher
1	Challenges and Opportunities in Deep Learning Driven Fashion Design and Textiles Patterns Development	4	Machine learning for clothing manufacturing as a means to respond quicker and better to the demands of clothing brands: a Greek case study	Springer Science and Business Media Deutschland GmbH
2	The Role of Big Data in Color Trend Forecasting: Scope and Challenges-A Systematic Literature Review	5	Data Analytics and Application Challenges in the Childrenswear Market - A Case Study in Greece	Springer Science and Business Media Deutschland GmbH
3	Human Intelligent Machine Teaming in	6	An AI pipeline for garment price projection using computer vision	Springer Science and Business

No	Article Title	No	Article Title	Publisher
	Single Pilot Operation: A Case Study			Media Deutschland GmbH

Table 7 Four article titles published by the Association for Computing Machinery

No	Article Title	No	Article Title	Publisher
1	Transactional auto scaler: Elastic scaling of replicated in-memory transactional data grids	3	Implementing IoT-adaptive fuzzy neural network model enabling service for supporting fashion retail	Association for Computing Machinery
2	Style in the age of Instagram : Predicting success within the fashion industry using social media	4	A Review of Modern Fashion Recommender Systems	Association for Computing Machinery

Bibliometric Visualization/ Biblioshiny

62 articles were processed in (R Program) which produced the graphical display presented in (Figures 4 - 6) to identify topic trends and research networks.

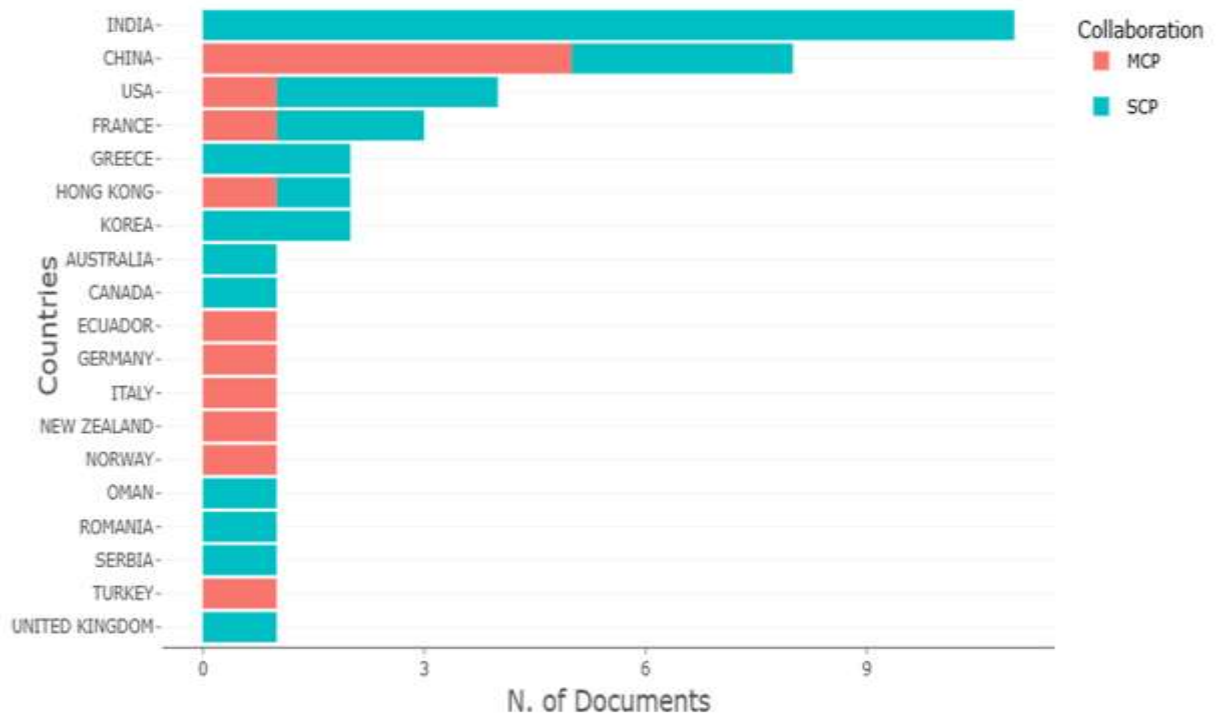


Figure 1 Distribution of countries based on research collaboration

Figure 4 displays a horizontal bar chart showing the number of documents by country and the type of research collaboration on this topic. Multiple Country Publication

(MCP) refers to publications or documents involving collaboration between multiple countries, and Single Country Publication (SCP) refers to publications or documents involving only one country.

India shows significant dominance with around 11 documents all being SCPs, indicating a strong focus on domestic research. China is in second place with a balanced combination of MCPs and SCPs, totaling around 7 documents, reflecting a more open approach to international collaboration. The United States (USA) is in third place with a larger proportion of MCPs than SCPs, indicating a tendency to collaborate with researchers from other countries. France and Greece each have around 3 documents, with different collaboration patterns – France has a mix of MCPs and SCPs, while Greece focuses on SCPs.

Other countries such as Hong Kong, Korea, Australia, and Canada each contributed one to two documents. Meanwhile, a group of countries including Ecuador, Germany, Italy, New Zealand, Norway, Oman, Romania, Serbia, Turkey, and the United Kingdom each contributed one document, with variations between MCP and SCP. This pattern reflects the diversity in approaches to research collaboration across countries, with some countries favoring independent research while others are more open to international collaboration. This distribution also reflects global dynamics in research, with developing countries such as India demonstrating strong independence in research production, while developed countries tend to have a more balanced approach between independent research and international collaboration.

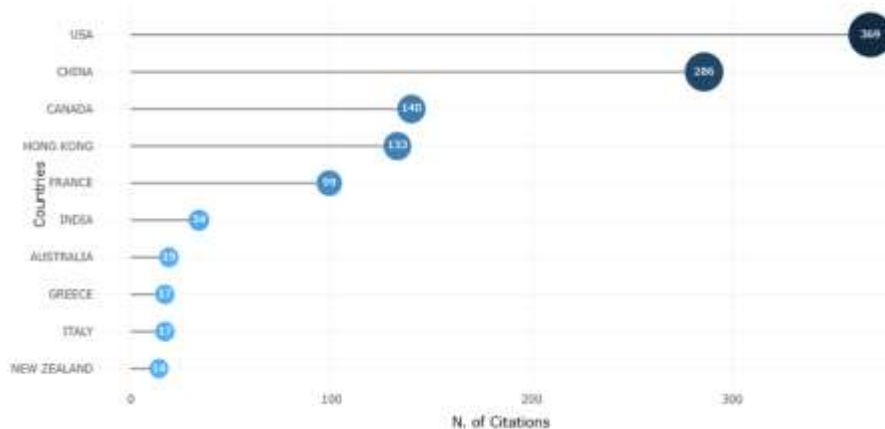


Figure 2 Most cited countries

Figure 5 presents the distribution of citations on this topic by country of origin (Most Cited Countries). This visualization shows that the United States (US) is the country with the highest number of citations, reaching 369 citations. China is in second place with 286 citations, followed by Canada with 140 citations. Other countries such as Hong Kong, France, India, Australia, Greece, Italy, and New Zealand have relatively lower citation counts.

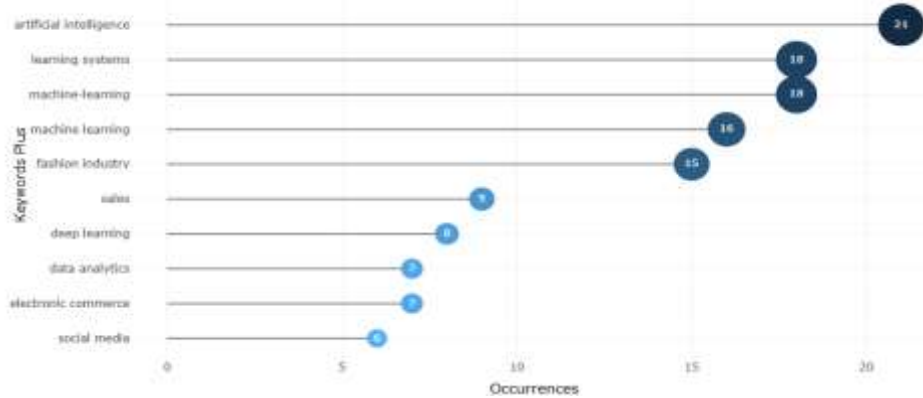


Figure 3. Most frequent words (trend topic)

Figure 6 displays a data visualization of the frequency of keyword occurrences on this topic. It can be seen that the distribution of keywords in the study shows a significant dominance of the theme of artificial intelligence and machine learning. "Artificial intelligence" emerged as the most frequently used keyword with 21 occurrences, followed by "learning systems" and "machine-learning" with 18 occurrences each. Furthermore, keyword variations such as "machine learning" appeared as a separate variation with 16 occurrences, while "fashion industry" recorded 15 occurrences, indicating a strong integration between AI technology and the fashion sector. Commercial and technological aspects are represented through the keywords "sales" with 9 occurrences, "deep learning" with 8 occurrences, and "data analytics" and "electronic commerce" with 7 occurrences each. "Social media" came in last with 6 occurrences.

This distribution pattern reflects a research trend incorporating artificial intelligence and machine learning components within the fashion and e-commerce industries. The frequency of these keywords also reflects a strong research focus on the application of AI technology in the digital transformation of the retail and fashion sectors, with an emphasis on data analytics and deep learning as key supporting components.

VOSviewer Bibliometric Visualization

The results of the Scopus data network visualization analysis on the topic of "Artificial Intelligence, Machine Learning, Fashion Industry" are displayed in three different forms. The network visualization showing the relationship between keywords can be seen in Figure 7. Furthermore, the evolution pattern and relationship between research topics are displayed through overlay visualization in Figure 8. Meanwhile, the level of density and concentration of research in this topic is illustrated through density visualization in Figure 9.

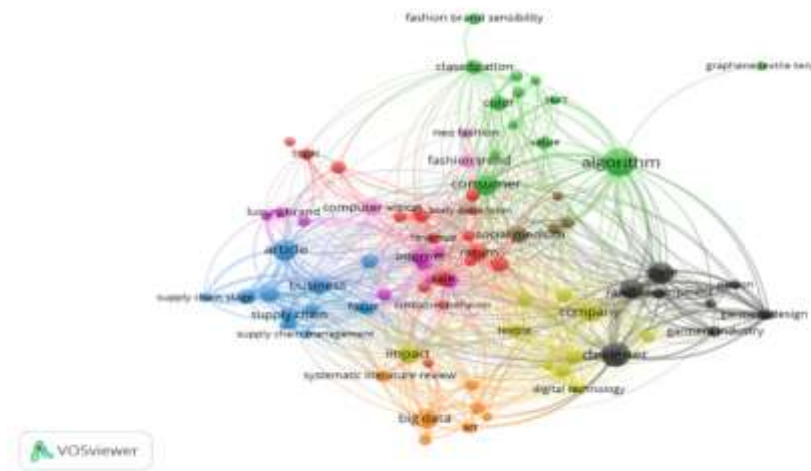


Figure 4 Network Visualization

The visualization in Figure 7 illustrates the relationship between the fashion industry and modern technology, encompassing various aspects such as the design process, supply chain management, consumer behavior, and the implementation of big data and artificial intelligence. This analysis is based on data extraction from titles, keywords, and abstracts with a minimum occurrence criterion of three. Of the 3,066 items examined, 87 met this criterion, with the exception of irrelevant common words. Each item is represented by a node whose size indicates the frequency of co-occurrence of the keywords. The analysis identified five clusters. main, and the distribution of keywords representing the topic "Artificial Intelligence, Machine Learning, Fashion Industry" is divided into 9 clusters which can be seen in detail in **Table 9**.

Table 8 Keywords representing each cluster

No	Cluster	Element
1	Cluster First (Red)	Body Dimension (5), Customer Behavior (12), E-Commerce (28), Evaluation Metric (17), Face Shape Classification (1), Fashion Recommendation System (1), Fashion Retail (1), Online Retailer (11), Retailer (37), Return (21), Revenue (20), Sale (33), Store (19), Survey (20), Topic (15), Type (15), Waste (24).
2	Cluster Second (Green)	Algorithm (49), Classification (25), Color (21), Consumer (51), Daily Life (16), Fashion Brand Sensibility (1), Graphene Textile Teng (1), Personalizes Experience (9), Personalized Recommend (14), Sales Forecasting (8), Skirt (6), Support Vector Machine (12), Value (16)
3	Cluster Third (Dark Blue)	Apparel Industry (24), Article (34), Business (40), Data Analytics (18), Domain (24), Fa Industry (9), Focus (20), Literature (27), Research Paper (9),

No	Cluster	Element
		Stakeholder (17), Supply Chain (27), Supply Chain Management (16), Supply Chain Stage (11)
4	Cluster Fourth (Yellow)	Automation (27), Childrenswear (9), Company (43), Cost (36), Digital Technology (15), Digital Transformation (13), Fashion Company (22), Impact (42), Investment (19), Machine Learning Technology (18), Manufacturer (35), Textile (28)
5	Cluster Fifth (Purple)	Academic (19), Blockchain (6), Era (21), Future Research Direction (10), Internet (24), Luxury Brand (4), Personal Data (2), Perspective (28), Risk (24)
6	Cluster Sixth (Black)	Aesthetic (16), Clothing (29), Designer (31), Garment Design (14), Garment Industry (20), Person (16), Personalization (13), Rapid Development (20), Style (32)
7	Cluster Seventh (Orange)	Art (14), Big Data (22), Color Forecasting (8), Contribution (25), Fashion Sector (10), Innovation (22), Systematic Literature Review (25)
8	Cluster Eighth (Brown)	Marketing (14), Marketing Campaign (7), Social Media Platform (18), Social Medium (18)
9	Cluster Ninth (Light Blue)	Computer Vision (34), Fashion Trend (17), Neo Fashion (4)

The analysis identified nine key interconnected clusters in contemporary fashion research. (1) The first cluster (red) focuses on consumer aspects, encompassing body dimensions, consumer behavior, and various aspects of e-commerce including metric evaluation and fashion recommendation systems. (2) The second cluster (green) concentrates on algorithms and classification, with an emphasis on personalized consumer experiences, fashion brand sensibility, and sales forecasting. (3) The third cluster (dark blue) addresses business and supply chain aspects, integrating data analytics with supply chain management in the fashion industry. (4) The fourth cluster (yellow) combines technological elements such as automation and machine learning with aspects of manufacturing and digital transformation in the garment industry. (5) The fifth cluster (purple) includes academic research exploring blockchain, the data era, and future research directions in the fashion industry. (6) The sixth cluster (black) focuses on design and aesthetic aspects, including garment design, the garment industry, and personalization with rapid development. (7) The seventh cluster (orange) integrates art and big data with a systematic literature review in the context of fashion. (8) The eighth cluster (light brown) concentrates on marketing and social media aspects in the fashion

Figure 9 is a density visualization analysis using VOSviewer that reveals a significant concentration of research within the fashion industry. Bright yellow areas indicate a primary focus on algorithms, sales, and design, demonstrating the deepening integration of technology into the fashion world. Topics such as fashion trends, consumer behavior, digital technology, and supply chain management also receive moderate attention, indicated by green. Dark blue areas at the edges of the map represent less researched topics. This pattern illustrates the complex landscape of contemporary fashion research, with technology, sales, and design intertwined.

Discussion

The results of this study indicate that Artificial Intelligence (AI) and Machine Learning (ML) play a role in developing the fashion industry globally. In research [18] adopting AI can increase the competitiveness of the fashion industry through increased efficiency and innovation. In addition, AI and ML technology not only help consumers determine their clothing style, but also provide an overview of the latest Muslim fashion trends worldwide. In line with the study conducted [19] shows that AI has also proven effective in helping fashion designers create visually appealing designs, producing ready-to-wear products that meet the functional, expressive, and aesthetic needs of consumers, in accordance with predetermined design criteria.

In line with this, research [20] also highlights the potential of AI as a very valuable tool for fashion companies in the future. This technology can help in the design and promotion of clothing that is in line with the latest fashion trends. At the same time, it contributes to encouraging purchases and usage for consumers. This finding is supported by research [21] which cited more than 300 studies. In his research entitled "Machine learning and AI in marketing - Connecting computing power to human insights" discusses AI and ML in the context of marketing, how AI and ML influence the purchasing interests of modern consumers, from product searches to purchases and various experiences on social media.

In this context, the most relevant aspect to the research focus is the identification of publishers with the highest frequency of publishing articles related to the topic. Of the 62 published articles, 18 articles were published from the top publishers who are most productive in publishing articles related to this topic, namely the Institute of Electrical and Electronics Engineers Inc. Followed by Elsevier with 7 articles, Springer Science and Business Media Deutschland GmbH with 6 articles and the Association for Computing Machinery with 4 articles.

Biblioshiny visualization analysis using the R program produces 3 graphic images on this topic, figure 4 regarding the distribution of countries based on research collaboration, India shows significant dominance with around 11 documents all of which are SCP, indicating a strong focus on domestic research. Figure 5 displays the highest number of citations on this topic based on the country of origin of the publication, showing that the United States (US) is the country with the highest number of citations, reaching 369 citations. and then figure 6, namely topic trends, illustrates a strong research focus on the application of AI technology in the digital transformation of the retail and

fashion sectors, with an emphasis on data analysis and machine learning as the main supporting components.

The VOSviewers visualization analysis produces three visual images: Network Visualization, Overlay Visualization, and Density Visualization. Network Visualization is a network analysis that illustrates the identification of author authority. It produces nine clusters with different colors, indicating the grouping of nodes based on certain characteristics related to other keywords. (1) Red Cluster (Consumer): Focuses on understanding consumers, such as body type, shopping behavior, and the use of technologies such as e-commerce (2) Green Cluster (Algorithms): Focuses on the use of algorithms and data classification for personalization, brand understanding, and sales prediction (3) Dark Blue Cluster (Business and Supply Chain): Combining data with supply chain management to improve efficiency in the fashion industry (4) Yellow Cluster (Technology and Manufacturing): Combining technologies such as automation and machine learning with the apparel production process (5) Purple Cluster (Future Research): Exploring new technologies such as blockchain and future research trends in the fashion industry (6) Black Cluster (Design): Focuses on apparel design, personalization, and innovation in the fashion industry (7) Orange Cluster (Art and Data): Combining art and big data to analyze fashion trends (8) Brown Cluster (Marketing): Focuses on the use of social media and digital marketing in the fashion industry (9) Light Blue Cluster (Computer Vision): Using computer vision technology to predict and analyze fashion trends. This indicates that research developments in this field are complex and encompass various aspects.

Finally, density visualization is an analysis used to identify themes in each article, this is done to measure the co-occurrence of keyword pairs. This visualization map provides a clear picture of the research landscape in the fashion industry, where technology, sales, and design are the three main pillars that drive innovation and development in this field. (1) Main focus: Most research centers on algorithms, sales, and design. This shows that technology is increasingly dominating the fashion industry, especially in terms of product personalization, sales optimization, and innovative design development. (2) Other important topics: In addition, topics such as fashion trends, consumer behavior, digital technology, and supply chain management are also quite significant concerns in research. (3) Less researched topics: There are several topics that are still rarely researched or have not been studied in depth in the fashion industry, as shown by the dark blue area.

Overlay visualization is an overlay analysis that shows research developments. Resulting in 3 periods of research trends in the fashion industry ranging from adaptation to technology, consumer focus and digital transformation. (1) Early period (2021): Research focuses more on the basics of the fashion industry such as supply chains and general topics (2) Middle period (2022-2023): Focus shifts to technology integration such as algorithms and computer vision (3) Latest period (2023-2024): Research is increasingly consumer-oriented, such as fashion trends and consumer behavior.

CONCLUSION

Fundamental Finding : The bibliometric analysis reveals that Artificial Intelligence (AI) and Machine Learning (ML) have played a transformative role in reshaping the modest Muslim fashion industry over the past decade. Their applications – ranging from supply chain optimization, personalized design, sales forecasting, waste reduction, to data-driven decision-making – demonstrate a clear trend toward the digitalization and automation of fashion processes. **Implication** : This finding underscores that the integration of AI and ML technologies provides manufacturers with significant competitive advantages by enhancing operational efficiency, improving product innovation, and enabling consumer-driven design personalization. Furthermore, it suggests that technological adoption aligns with the increasing global demand for **modest fashion**, helping industry players strengthen their international market presence while adhering to cultural and ethical principles. **Limitation** : However, current research remains dominated by contributions from developed countries (e.g., the United States, China, and Canada), leading to an underrepresentation of emerging Muslim fashion markets such as Southeast Asia and the Middle East. Moreover, the limited empirical evidence on AI implementation challenges – such as data privacy, cultural adaptation, and resource readiness – restricts a holistic understanding of technology adoption in developing contexts. **Future Research** : Future studies should explore cross-regional comparative analyses to evaluate how AI and ML can be adapted to local market conditions and consumer behaviors. Research should also investigate ethical AI frameworks, sustainable production practices, and collaborative innovation models that balance technological advancement with cultural integrity and environmental responsibility in the global modest fashion ecosystem.

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