

Innovative Handicraft Embroidery Dress Marketing with Artificial Intelligence (AI): Analysing Effectiveness and Customer Engagement with Sustainable Model

Md Shamim Gaddi¹, Mohd Zafeer¹, Mohammad Musab², Shivani Kain³,
Ramiz Raza⁴, and Ajhar Hussain*⁵

¹Department of Commerce, Aligarh Muslim University, Aligarh, UP, India

²School of Management and Business Studies, Jamia Hamdard, New Delhi India

³School of Management and Commerce, K. R. Manglam University, Gurugram, Haryana, India

⁴Department of Business Administration, Aligarh Muslim University, Aligarh, UP, India

⁵Department of Geology, Aligarh Muslim University, Aligarh, UP, India

Received 13 January 2026 | Revised 16 February 2026 | Accepted 12 March 2026 | Available Online 11 April 2026

*Corresponding Author: **Ajhar Hussain** | Email Address: glyazhar@gmail.com

Citation: Md Shamim Gaddi, Mohd Zafeer, Mohammad Musab, Shivani Kain, Ramiz Raza, and Ajhar Hussain (2026). Innovative Handicraft Embroidery Dress Marketing with Artificial Intelligence (AI): Analysing Effectiveness and Customer Engagement with Sustainable Model. *Social Science Reports*. DOI:<https://doi.org/10.51470/SSR.2026.10.01.98>

Abstract

The field of handicraft embroidery dresses is of crucial importance in terms of cultural heritage, skilled artisans, sustainable earnings, and fashionable looks. Regardless of all mentioned factors, there are still problems with limited market coverage, lack of understanding of customer needs, poor branding, and strong competition from manufactured fashion products. In recent years, Artificial Intelligence (AI) the basis for innovations in the area of marketing by providing opportunities for personalization, predicting customer behavior, automating processes, and engaging buyers. This research paper aims the use of AI in marketing innovations of handicraft embroidery dresses with a particular emphasis on effectiveness and customer engagement. Based on a thorough literature review, this research identifies several AI-based instruments used in the marketing process: recommendation systems, chatbots, visual searches, social media analytics, and demand forecasting. According to the results of the paper, AI-powered marketing positively influences customer engagement, conversion, brand communication, and sustainability while causing the issue of digital illiteracy and loss of authenticity. The proposed fuzzy model further contributes by addressing uncertainty in consumer behaviour and providing a structured framework to evaluate the interplay between technological intelligence, cultural value, and engagement outcomes.

Keywords: Handicraft embroidery, Artificial Intelligence, digital marketing, customer engagement, sustainable fashion, personalization

1. Introduction

1.1 General Statements

Handmade embroidered dresses embody a rich blend of cultural legacy, creativity, and tradition handed down through generations. Traditional crafts in a country like India, where embroidery arts like Chikankari, Phulkari, Kantha, Zardozi, and Kutch embroidery play an integral part in the local cultures of various regions, go far beyond mere decoration but constitute a major socio-economic resource. The fact is that embroidery has been a major source of income for thousands of people in India, and primarily for those women who reside in rural and semi-urban parts of the country. As labor-intensive technique, it can help to develop an economy inclusively [1]. Unfortunately, in the present-day world, traditional sectors involved in creating embroidered clothing have faced numerous difficulties. With the processes of globalization being rapidly developed and industrialization taking its toll on the fashion industry, mass manufacturing has come to the fore leaving handmade items

lagging behind. Fast fashion is known to be characterized by low prices and fast production. As a result, traditional artisans frequently struggle to compete in terms of pricing, scalability, and market visibility. Additionally, intermediaries in the supply chain often capture a large share of profits, leaving artisans with minimal financial returns and limited direct access to consumers [2].

On the other hand, there have been significant shifts in consumer behavior in relation to the fashion industry. The new generation of consumers, especially Millennials and Generation Z, are increasingly focusing on factors such as sustainability, ethical sourcing, authenticity, and personalization in relation to their purchases. The trend nowadays is towards the purchase of products that have some level of cultural value and uniqueness, as opposed to mass products. In addition to that, digital technologies, which include social media and other e-commerce platforms, are playing a critical role in changing consumer behavior.

© 2026 by the authors. This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

It means that today's consumers are better-informed and socially conscious, meaning that they focus on products that reflect their social and environmental values. The current state of consumer behavior presents both challenges and opportunities for the handicraft embroidery industry. First, there is increasing demand for unique, sustainable, and authentic products, thus reflecting the nature of this particular handicraft business. On the other hand, artisans lack adequate digital technologies and marketing skills that could help them cater to modern consumers.

In this regard, Artificial Intelligence (AI) can be considered as a revolutionary tool that would help overcome some of these limitations. AI technologies allow companies to utilize large amounts of consumer data to find trends and predict buying behavior more effectively. Moreover, AI helps personalize marketing campaigns, use chatbots for customer engagement, and optimize the process of managing the supply chain. Despite the widespread implementation of these techniques in the realm of fashion retail, their adoption within the field of handicraft embroidery is rather limited. Inclusion of AI in this segment would allow artisan companies to use data more efficiently while increasing their market presence and establishing better communication with their customers, thus ensuring sustainability of operations [3]. Implementation of AI algorithms and their ability to utilize fuzzy logic allows for handling the uncertainty involved in consumer tastes, thus allowing for greater adaptability [4]. Finally, AI technologies such as personalization and predictive analytics help increase targeting efficiency and consumer engagement. In conclusion, the model provides a comprehensive framework for analyzing AI-enabled marketing strategies in handicrafts. It emphasizes the need for a balanced approach that combines innovation with cultural authenticity. This approach not only strengthens market competitiveness but also supports the sustainable growth of traditional artisan-based industries.

1.2 Research Problem

Despite the cultural value of handicraft embroidery dresses, limited research exists on how AI can be strategically employed to enhance marketing effectiveness and customer engagement without compromising authenticity and sustainability. This research seeks to bridge this gap by systematically analysing AI-driven marketing approaches within the handicraft embroidery dress sector.

1.3 Objectives of the Study

The primary objectives of this research are to:

1. Examine the role of AI in transforming handicraft embroidery dress marketing.
2. Analyse the effectiveness of AI-based marketing tools in improving customer engagement.
3. Identify challenges and ethical considerations in AI adoption for handicraft marketing.
4. Propose strategic recommendations for sustainable and inclusive AI-driven marketing models.

2. Literature Review

2.1 Handicraft Embroidery and Cultural Economy

Craft embroidery is an important part of the cultural economy since it helps to preserve intangible heritage while simultaneously ensuring economic growth in rural communities [1].

Embroideries are labor-intensive activities that incorporate cultural values through motifs, color combinations, and various skills, thereby reflecting identity and tradition [5]. Unfortunately, such crafts face increasing un-competitiveness on account of weak branding practices, lack of innovation, and lack of access to online portals for marketing [2]. In this regard, digitalization through e-commerce and storytelling can be considered as one of the most effective ways, as it allows for reaching international markets and ensuring economic sustainability [6].

2.2 Digital Marketing in Fashion and Handicrafts

The digital marketing approach has become a revolutionary tool within the fashion and handicraft industries, utilizing various techniques such as social media marketing, content marketing, influencer marketing, search engine optimization, and e-commerce. In the fashion industry, the use of these digital tools is essential in forming consumers' purchasing decisions and increasing brand awareness. The interactive nature of these platforms allows brands to interact directly with customers, thus building brand loyalty and affecting purchasing decisions [7].

For the handicraft industry, digital marketing involves much more than just selling products. The process has been used as an effective tool for safeguarding and disseminating cultural heritage through the narrative that is presented by the producers of these goods. Through the use of digital marketing, the producers can tell the story of their products, highlighting the quality of craftsmanship and ethical production processes [8]. Also, online platforms ensure that rural craftsmen gain access to larger markets without relying on middlemen, thus increasing income generation opportunities. Even though there are several benefits associated with digital marketing, it has its drawbacks when used to analyze complicated and extensive consumer behavior patterns. Traditional methods of digital marketing usually fail in analyzing huge data sets and drawing predictive conclusions. The above limitation justifies the need for incorporating advanced technology like artificial intelligence (AI) in digital marketing. AI can be used to determine consumer preferences and design efficient marketing strategies.

2.3 Artificial Intelligence in Marketing

Artificial Intelligence (AI) consists of sophisticated computing systems used to complete actions requiring human intelligence such as reasoning, decision-making solving, and learning [9]. In the current context of marketing, the advent of AI has become critical as it allows companies to process large volumes of data, make predictions about consumer behaviors, and create experiences. Among several uses of AI in marketing, one of the most notable is the use of recommendation systems that recommend items and services based on user choices and interactions. Another application of AI is predictive analytics. Chatbots and virtual assistants with AI capabilities have positively impacted customer services through immediate replies and increased interactivity. In addition, technology like visual and voice searches is changing the way consumers find their items, making the process easier and more streamlined. Sentiment analysis is another useful tool that enables companies to determine consumers' perceptions and feelings about their products based on their online activities, which helps formulate effective marketing tactics.

Dynamic pricing uses AI to continuously change prices depending on market demands, competitive environments, and consumer behaviors. According to empirical evidence, customer satisfaction and engagement benefit immensely from personalized content provided by companies using AI. Personalized content not only makes customers feel more connected but also increases loyalty to brands [10].

2.4 Customer Engagement in Digital Commerce

Consumer engagement in electronic commerce is essentially the degree of cognitive, emotional, and behavioral commitment that customers invest in a brand, influencing their behavior and relationship with the brand [11]. In an environment characterized by intense competition, high engagement has proven to be a decisive factor in fostering customer loyalty, encouraging positive word-of-mouth marketing, and increasing the lifetime value of a customer. In the case of cultural products and artisan goods, including handicrafts, consumer engagement does not arise from the functional attributes of the products alone; it is also significantly influenced by factors like authenticity, cultural storytelling, and ethical manufacturing practices. The inclusion of AI technologies has added another dimension to customer engagement dynamics in e-commerce transactions. With AI-based applications, companies can engage customers with immediate interactions based on data-driven insights, delivering customized recommendations, effective communications, and proactive customer services. Besides, AI helps create immersive and interactive environments that help in engaging customers and improving their satisfaction levels. Examples of such AI-enabled applications include virtual try-ons, chatbots, and recommendation engines. In sum, AI is critical for enhancing customer relationships because it ensures adaptive, contextual, and customer-centric interactions.

3. Research Methodology

3.1 Research Design

This study adopts a qualitative and conceptual research design, supported by secondary data analysis. The approach integrates literature review, industry reports, and conceptual frameworks to examine AI-driven marketing practices in handicraft embroidery dresses.

3.2 Analytical Framework

The analysis focuses on:

- AI tools used in marketing
- Impact on marketing effectiveness
- Customer engagement outcomes
- Sustainability and ethical considerations

4. AI Applications in Handicraft Embroidery Dress Marketing

4.1 AI-Driven Personalization and Recommendation Systems

The use of AI-based recommendation systems is critical to boosting consumer engagement through data analysis that involves customer information such as browsing history and past purchases. The system uses advanced algorithms and machine learning methods to provide personalized product recommendations, hence ensuring that consumers enjoy a pleasant shopping experience.

In the case of marketing handicraft embroidery, personalization not only entails providing personalized recommendations but also encompasses culturally and visually appealing factors, such as the embroidery design, craftsmanship in different regions, color combinations, materials used, and occasion-specific designs. Intelligent systems prove effective in the handicraft industry due to its high variety of products and the subjectivity of consumer tastes. Recommendation engines make the choice easier by selecting options that match personal preferences and needs. Thus, customers who appreciate regional embroidery can receive recommendations about products that incorporate special patterns or techniques characteristic of particular regions, making the shopping experience more efficient and enjoyable. The use of AI technology in e-commerce positively impacts business performance, as proven by empirical evidence on digital marketing. Personalized recommendations are capable of increasing conversion rates by as much as 20% [10]. As far as embroidery dresses are concerned, AI-driven recommendation engines enable not only the selection of items by consumers but also help preserve the uniqueness of handicraft products by matching them with consumer tastes and expectations. Therefore, the use of AI in marketing proves valuable in retaining customers and ensuring better sales results while supporting traditional handicrafts in the modern digital marketplace.

4.2 Visual Search and Image Recognition

The implementation of visual search and image recognition technology has revolutionized the interaction between customers and digital markets, especially in image-centric industries like embroidery fashion. The technology allows users to upload images and find visually similar items in the digital space, thus replacing the old text-based approach with an innovative image-based approach. Visual search is particularly useful for embroidery fashion due to its emphasis on aesthetics, designs, and textures that influence customer choices [12]. AI-enabled visual search systems make use of highly sophisticated machine learning algorithms along with computer vision methods to analyze the input visual and find similar products from large databases. In doing so, search friction is greatly reduced because there is no need for people to explain a design that might be intricate. The consequence of this development is that the consumer can easily discover products that fulfill his/her aesthetic preferences. Apart from making the search process convenient and engaging for the consumer, visual search helps in offering personalized results too. Visual search allows artisans and small-scale manufacturers to offer unique hand-crafted embroidery products that would give them an edge over mass-produced goods. In other words, visual search helps in promoting sustainable consumption behavior among consumers.

4.3 Chatbots and Conversational AI

Chatbots and conversational AI have become game-changing tools in the field of digital marketing especially for handicrafts where personal interaction and storytelling essential factor. These tools help businesses to give immediate, correct, and consistent answers to customer inquiries regarding aspects such as the size of the product, fabric, customization, delivery time, and handling of the goods. This type of assistance greatly contributes to making the customer experience better since customers can easily and quickly get all the information they need during their purchase.

However, when it comes to marketing of handicrafts through chatbots, apart from providing transactional assistance, stories about the artisans and their craft help make purchases more interesting and valuable to consumers [13].

Moreover, the use of conversational AI enables operational efficiency because of its ability to conduct several customer engagements at once. This aspect helps small-scale artisans and businesses with fewer human resources. From empirical data, it is evident that not only does the use of chatbots increase customer satisfaction but also helps significantly lower the rates of cart abandonment as they address any worries the customer might have during their decision-making process [14]. Additionally, the incorporation of chatbots in both e-commerce sites and social media networks creates greater accessibility. Therefore, using chatbots and conversational AI for handicraft marketing allows for an efficient and effective way of blending technology with culture.

4.4 Predictive Analytics and Demand Forecasting

The implementation of predictive analysis with the assistance of AI has become an important approach in the forecasting of consumer demand in modern times in various industries, including handicraft industry. The application of past sales figures, seasonality, festivals and social media trends will make it possible to estimate the demand that can be expected in the future. With such predictions, producers will be able to organize production so that there not be any surplus and any waste of resources. In relation to handicrafts like embroidery which takes quite much time and work, it will become easier to optimize supply chains. Predictive analysis also helps in making informed decisions based on accurate data about changing demands of consumers. Furthermore, demand forecasting is beneficial to sustainable development since it minimizes production and reduces waste of raw materials, thus having a positive impact on the environment. As stated by McKinsey & Company [15], such use of AI allows improving operations and contributing to sustainable development. AI-based predictive analytics enable businesses to anticipate demand patterns based on seasonality, festivals, and social media trends. Accurate forecasting reduces overproduction and supports sustainable practices—an essential consideration in handicraft production [15].

5. Effectiveness of AI in Handicraft Marketing

Artificial Intelligence (AI) has emerged as a transformative tool in enhancing the effectiveness of marketing strategies, particularly within niche sectors such as handicraft and embroidery-based enterprises. The integration of AI into handicraft marketing has enabled businesses to leverage data-driven insights, optimize performance metrics, and expand their market reach both domestically and globally.

5.1 Marketing Performance Metrics

AI helps improve the most important KPI such as click-through rates, conversion rates, customer retention rate, and average order value. By means of advanced data analysis, machine learning models, and prediction, AI systems can process huge amounts of data about the behavior of consumers and their preferences. Thus, AI makes it possible for handicraft brands to develop individual marketing strategies that will be more effective with targeted audiences, resulting in higher click-through rates [16].

In addition, AI technologies allow recommending items to customers according to their preferences and purchase history. The use of recommendation engines contributes to enhancing the experience of customers and their willingness to buy certain items. As a result, this helps to achieve better results in terms of conversions [13]. Also, AI assists in retaining customers by allowing for instant communication between customers and brands through chatbots and customer management applications, providing prompt help and increasing customer satisfaction [17]. Finally, another vital aspect of AI contribution lies in its ability to increase the average value of orders. This upselling and cross-selling capability helps handicraft enterprises maximize revenue from existing customers. Moreover, AI enables efficient allocation of marketing budgets by identifying high-performing channels and eliminating ineffective strategies, thereby improving return on investment (ROI) [18].

5.2 Brand Visibility and Market Expansion

The use of AI technology has changed how brand visibility and marketing strategies work. With the help of AI social media analytics, businesses can find out the best time to post on social media platforms and understand the trends related to what kind of content generates the most interest among people. Such information will be useful for developing engaging content that helps enhance the visibility of the brand [19]. Additionally, AI can help craft brands collaborate with suitable influencers who target the same demographic as the brand. Sentiment analysis can help brands identify the right influencers, which will add to credibility [20]. Craft products are more about quality and artistry, and that makes it all the more important for the brands to target such audiences. Furthermore, AI helps in the expansion of market by recognizing trends and unexplored customer bases in different geographic locations. By analyzing consumer sentiments through NLP and sentiment analysis, AI can assist handicraft business organizations in formulating effective marketing strategies to target customers across the globe. This is particularly advantageous for handicraft SMEs willing to establish themselves in niche markets on a global level with their handmade, unique products [21]. Therefore, it can be seen that artificial intelligence is playing an important part in helping handicraft marketing perform effectively in terms of its results and helping the companies expand their market scope.

6. Customer Engagement and Experience

6.1 Emotional and Cultural Engagement

Emotional engagement and cultural relevance have become vital aspects influencing customer behavior in the current market environment, especially when it comes to certain industries such as handcrafting and sustainability. Artificial Intelligence (AI) has proven to be an effective technology for increasing emotional and cultural engagement among customers by using personalized storytelling techniques and creating engaging consumer experiences. In particular, AI storytelling solutions can process consumers' interests, cultural backgrounds, and other relevant data in order to create personal stories that will engage them in a conversation about a certain product.

This kind of storytelling is likely to include heritage, traditions, and even artisan craftsmanship. All of this allows the consumer to connect emotionally with the product and creates an atmosphere of authenticity.

The modern era is associated with experiential consumption rather than transactional consumption [22]. In terms of experiential consumption, emotional engagement is one of the essential components of the consumer experience. Through the combination of AI with cultural narratives, brands can create distinctive experiences that will help them stand out in the competitive environment. In addition, through AI, brands can deliver dynamic content through digital channels, making it possible for them to adjust their storytelling approaches accordingly. As an example, AI-based recommendation engines can recommend items based on cultural considerations or previous engagements, which will increase consumer satisfaction and involvement. Not only does this help to develop stronger ties between brands and consumers, but it also ensures the conservation of culture through the promotion of indigenous crafts and systems of knowledge.

6.2 Trust, Transparency, and Ethical Values

Beyond emotion, however, trust and transparency have emerged as decisive factors for customer experience, especially with the rise of ethical consumption. In response to growing knowledge on environmental and social matters, there is an increased need among customers for brands to be more responsible with their sources and modes of production as well as their approach to labor. In this regard, AI is instrumental in ensuring the required transparency and tracing the supply chain to identify any ethical problems along the way. The use of AI technologies in this case ensures that the customer knows the source of the materials used as well as who made the products using which techniques. This transparency not only instills a sense of trust within the consumer but also adds value to the item in question. Indeed, the use of block chain-integrated AI technologies helps to authenticate handcrafted products and ensure that ethical standards are adhered to at all times. This is particularly applicable in the field of handicrafts due to instances of counterfeiting and exploitation. Increasingly, consumers have a bias towards companies that exhibit social responsibility and environmental sustainability. The use of AI to communicate the company's values and practices will assist in aligning with consumer preferences to create loyal customers. Aligning with consumer expectations on corporate social responsibility and sustainability is crucial in developing a trusted brand in the current environment when information is freely available and consumers are skeptical about brands. Additionally, the application of AI in fostering transparency and trust is key in empowering consumers to make ethical decisions. According to [8], there is a rising trend in consumers preferring ethical and sustainable fashion brands. Thus, AI plays a vital role in enabling ethical production and consumerism, enhancing the consumer experience.

7. Challenges and Ethical Considerations

The integration of Artificial Intelligence (AI) into artisanal and handicraft sectors presents transformative opportunities, yet it simultaneously raises a range of structural, ethical, and socio-cultural challenges. Addressing these concerns is essential to ensure that technological advancement aligns with inclusivity, sustainability, and cultural preservation.

7.1 Digital Divide and Skill Gaps

One of the biggest challenges in the integration of AI in the handicraft industry is the existence of the digital divide.

Most craftsmen do not have access to modern technological innovations like internet connectivity, smartphones, and even consistent power supply in their areas. These limitations make it difficult for the craftspeople to access AI-enabled tools that can be used to improve marketing and production. Additionally, there is a lack of skills and knowledge to take advantage of technological innovations. The problem not only lies with technology but also with social factors since many marginal groups are not aware of training programs that offer necessary information about technological advancements and their uses. Initiatives to bridge the gap should include efforts aimed at improving the technical and digital literacy of handicraft artisans. These measures will ensure that the artisans become more technologically adept in using tools that can help them compete in international markets. Studies show that digital transformation must go hand in hand with skill development [21].

7.2 Authenticity vs. Automation

Another significant challenge would be related to the balance between automation and the maintenance of cultural authenticity. On one hand, the application of AI technologies for designing and mass customizing products may bring greater efficiency into production. On the other hand, the overuse of automation tools may deprive artisan products of their unique features, making them more similar to mass-produced goods. Thus, the application of algorithmic approaches to replicating crafts can lead to the loss of cultural heritage and its meaning. Scholars recommend embracing the concept of "human-centered AI", which presupposes the role of AI in augmenting the abilities of artisans rather than replacing them with machines. This approach is aimed at emphasizing that AI should not be regarded as a substitute for human creativity but as its complementary element. As Huang and Rust [13] note, firms need to introduce AI into the production process without diminishing the authenticity of the process and the value that artisans give to it.

7.3 Data Privacy and Ethical AI

Data gathering, processing, and usage of algorithms are some of the key features of the application of artificial intelligence in marketing activities and analyzing consumers' preferences. However, these factors contribute greatly to issues such as data privacy, security, and the consent of consumers. Small businesses that involve artisans in their operations might be unaware of best practices in data management; thus, there is a possibility of the exploitation and manipulation of consumers' personal data. Algorithmic bias is another ethical issue associated with the use of artificial intelligence because an AI system might be developed based on the data obtained from specific group of people, resulting in the development of discriminative algorithms. In this case, measures should be taken in order to prevent algorithmic bias through promoting the implementation of ethical AI systems and protecting personal data. Thus, regulatory compliance becomes a way to ensure the protection of consumer interests as well as foster mutual relationships and long-term cooperation between organizations and consumers.

8. Fuzzy Model

The incorporation of Artificial Intelligence into marketing has led to changes in consumer engagement and decision-making.

AI-based recommendation systems, prediction methods, and chatbots personalize their actions and make marketing efforts more effective by considering consumers' preferences [17]. In the case of handicrafts in particular, such an interaction between technology and culture plays a vital role in shaping customers' perception and willingness to buy. The concept of fuzzy logic modeling is well-known for its use in tackling the problems related to uncertainties and vagueness in consumer behavior analysis, thus allowing for the consideration of non-quantitative variables such as satisfaction, engagement, and perceived value [4]. Modern research shows that integrating AI and fuzzy inference makes it possible to create a more advanced framework for studying marketing challenges that are associated with human emotions [24]. Hence, the use of the fuzzy logic method in the current study will help assess the marketing effectiveness of artificial intelligence in the handicraft industry.

To analyse the effectiveness of AI-based marketing strategies and customer engagement in the handicraft embroidery dress sector, a Fuzzy Inference System (FIS) can be developed. This model addresses uncertainty and subjectivity in consumer behaviour, perception, and technological adoption.

1. Model Structure

The proposed fuzzy model consists of three layers:

A. Input Layer (Determinants)

Three major fuzzy input variables are considered:

1. Technological Intelligence (TI)

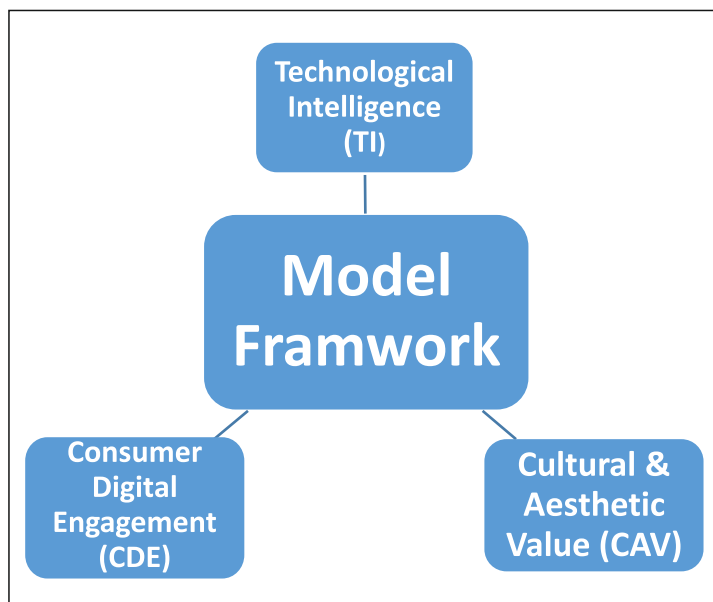
- Represents the extent of AI integration in marketing (recommendation systems, chatbots, personalization).
- Linguistic Variables: *Low, Medium, High*

2. Cultural & Aesthetic Value (CAV)

- Reflects uniqueness, authenticity, and emotional appeal of embroidery designs.
- Linguistic Variables: *Weak, Moderate, Strong*

3. Consumer Digital Engagement (CDE)

- Measures interaction level (clicks, shares, time spent, feedback).
- Linguistic Variables: *Low, Medium, High*



B. Fuzzification Process

Each input variable is converted into fuzzy sets using triangular or trapezoidal membership functions.

Example:

TI = 0–10 scale

- Low (0–3), Medium (2–7), High (6–10)

C. Rule Base (Knowledge System)

The system uses IF–THEN fuzzy rules derived from expert knowledge and consumer behaviour theory.

Sample Rules:

1. IF TI is High AND CAV is Strong AND CDE is High → Output is *Very High Effectiveness*
2. IF TI is Medium AND CAV is Strong AND CDE is Medium → Output is *High Effectiveness*
3. IF TI is Low AND CAV is Moderate AND CDE is Low → Output is *Low Effectiveness*
4. IF TI is High AND CAV is Weak → Output is *Moderate Effectiveness*
5. IF CDE is High AND CAV is Strong → Output is *Very High Engagement*

D. Output Layer

Two key outputs are defined:

1. Marketing Effectiveness (ME)

- Linguistic Variables: *Low, Moderate, High, Very High*

2. Customer Engagement Level (CEL)

- Linguistic Variables: *Low, Medium, High*

E. Inference Engine

The model applies the Mamdani Fuzzy Inference Method, which aggregates rules using:

- AND → Minimum operator
- OR → Maximum operator

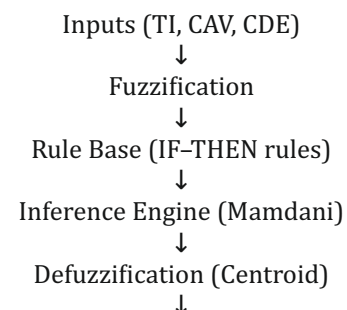
F. Defuzzification

The final crisp output is obtained using the Centroid Method:

$$ME^* = [\sum \mu(x) \cdot x] / \sum \mu(x)$$

This converts fuzzy outputs into measurable effectiveness and engagement scores.

2. Model Framework (Conceptual Flow)



Outputs (Marketing Effectiveness, Customer Engagement)

3. Model Significance

- Captures uncertainty in consumer perception of handicrafts
- Integrates AI capabilities with cultural value
- Helps policymakers and marketers optimize digital strategies
- Supports sustainable and personalized marketing frameworks

This fuzzy model provides a robust analytical framework for evaluating how AI-driven innovations influence the marketing success and engagement levels of handicraft embroidery dresses under uncertain and dynamic market conditions.

8. Discussion

From the above results, there is a high potentiality of adopting artificial intelligence technologies in order to boost the effectiveness of handicraft embroidery dresses marketing. If adopted carefully, AI would complement the craftsmanship of the industry through increased visibility, personalization, and sustainable development. Nonetheless, the key to success here is the ability to maintain the balance between technical efficiency and cultural values and ethics. As suggested by the fuzzy logic model, AI plays a major role in improving marketing effectiveness and customer satisfaction within the handicraft embroidery industry. Combining technical intelligence with cultural and aesthetic value of products, the fuzzy model is designed to incorporate both quantitative and qualitative aspects of consumers' behavior. In general, this paper proves that Artificial Intelligence (AI) represents a powerful tool in the marketing of handicraft embroidery dresses. With the application of AI technologies such as recommendation engines, predictions, chatbots, and image searches, the handicraft embroidery dresses marketing becomes much more effective and efficient. The findings indicate that AI enables data-driven decision-making, allowing businesses to better understand consumer preferences, personalize offerings, and optimize marketing strategies, thereby increasing conversion rates and customer retention [17, 10].

It is important to note that the current research brings attention to the fact that consumer engagement in the crafts industry goes far beyond any transactional contact and that it is grounded in culture, emotion, and ethics. AI, coupled with story-telling and cultural narratives, can enhance these factors by building an immersive and enriching experience for the consumers. Another contribution made by the fuzzy model under discussion is in tackling the uncertainties associated with consumer behavior and offering a systematic method of assessing the relationships between technology, culture, and consumer engagement [4, 24]. At the same time, the integration of AI into the handicraft industry is not free from difficulties. Factors like digital illiteracy, infrastructural issues, privacy concerns, and threats to the cultural authenticity of artisans should be taken into account. In conclusion, AI holds immense potential to drive sustainable growth and innovation in the handicraft embroidery sector. Strategic collaboration among policymakers, artisans, and marketers is crucial to ensure inclusive, ethical, and culturally sensitive adoption. Such an approach will not only enhance economic viability but also preserve the rich heritage and identity of traditional crafts in the evolving digital economy.

9. Conclusion

In this regard, this study has provided strong evidence that AI serves as a catalyst in transforming the marketing processes within the industry of handicraft embroidery apparels. Recommendation systems, predictive analysis tools, chatbots, and visual search engines not only increase efficiency of the marketing process but also allow companies to achieve greater customer engagement and broaden marketing efforts to both local and international levels.

With the use of AI technologies, businesses are able to learn more about consumer preferences and make better decisions related to marketing strategies and approaches to improve customer retention rates and conversion outcomes. Moreover, this study shows that consumer engagement in this field heavily depends on cultural and ethical aspects. In case of combining storytelling and heritage features with AI, brands may obtain better results. Overall, the developed fuzzy model provides good grounds for making decisions while allowing considering uncertainties in consumer behaviour. Nevertheless, certain challenges should also be mentioned including digital illiteracy, lack of infrastructure, and others.

10. Recommendations and Future Research

10.1 Recommendations

Considering the increasing application of AI in the fields of marketing and consumer interactions, a number of strategic considerations could be considered in order to boost handicrafts in today's market environment. For starters, it is important to design capacity-building and training programs dedicated to AI in order to help artisans gain sufficient knowledge about various aspects related to this technology, which would include understanding of AI tools such as recommendation system or predictive analytics. These efforts will definitely help to narrow down the gap and enable artisans to be competitive on the global market [25].

At the same time, there should be an emphasis on creating hybrid marketing campaigns involving both data analysis based on artificial intelligence and the use of storytelling techniques aimed at emphasizing the cultural value of these products. Although the potential for customer segmentation and personalized marketing is immense when using AI tools, handicrafts still need storytelling due to their nature [17]. Third, increased government and institutional support is crucial for fostering digital transformation in the handicraft sector. Policymakers should encourage the development of dedicated digital platforms and e-commerce ecosystems for handicrafts, supported by AI tools for marketing and logistics. Financial incentives, subsidies, and public-private partnerships can further accelerate the adoption of technology among rural artisans [26].

10.2 Future Research

Future research needs to concentrate on empirical studies to examine the practical influence of AI in the handicraft sector. Surveys among consumers with a large sample size can reveal changes in consumer preference, level of trust in AI-based systems, and readiness to buy handicrafts online. Moreover, experimental research concerning the efficiency of certain AI techniques, including chatbots, recommendation systems, and visual search systems, can be conducted across various handicraft clusters within regions to derive meaningful insights. In addition, cross-disciplinary research combining aspects of management, technology, and cultural studies can assist in developing sustainable AI models that support the continuation of traditional craftsmanship practices and increase competitiveness.

References

1. UNESCO. (2018). *Handicrafts and the intangible cultural heritage*. UNESCO Publishing.
2. Bairagi, S., & Mishra, S. (2020). Sustainability challenges in the Indian handicraft sector. *Journal of Rural Development*, 39(2), 245–260.
3. Kotler, P., Kartajaya, H., & Setiawan, I. (2021). *Marketing 5.0: Technology for humanity*. Wiley.
4. Zadeh, L. A. (1965). Fuzzy sets. *Information and Control*, 8(3), 338–353.
5. Jain, R. (2019). Embroidery traditions of India: Cultural continuity and change. *Textile History*, 50(2), 185–202.
6. House, J., & Diz, A. (2019). Digital transformation and handicraft marketing. *International Journal of Cultural Economics*, 43(4), 601–618.
7. Kim, A. J., & Ko, E. (2012). Do social media marketing activities enhance customer equity? *Journal of Business Research*, 65(10), 1480–1486.
8. Nayak, R., & Sahoo, D. (2021). Ethical and sustainable fashion: Consumer awareness and challenges. *Journal of Fashion Marketing and Management*, 25(3), 456–472.
9. Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson.
10. Davenport, T. H., Guha, A., Grewal, D., & Bressgott, T. (2020). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, 48(1), 24–42.
11. Brodie, R. J., Hollebeek, L. D., Juric, B., & Ilic, A. (2011). Customer engagement: Conceptual domain and fundamental propositions. *Journal of Service Research*, 14(3), 252–271.
12. Li, X., Wu, L., & Xie, Y. (2021). Visual search and consumer decision-making in online fashion retail. *Electronic Commerce Research and Applications*, 46, 101028.
13. Huang, M. H., & Rust, R. T. (2021). A strategic framework for artificial intelligence in marketing. *Journal of the Academy of Marketing Science*, 49(1), 30–50.
14. Gnewuch, U., Morana, S., & Maedche, A. (2017). Towards designing cooperative and social conversational agents. *Proceedings of the International Conference on Information Systems*.
15. McKinsey & Company. (2022). *The state of fashion 2022*. McKinsey Global Institute.
16. Chaffey, D., & Ellis-Chadwick, F. (2019). *Digital marketing* (7th ed.). Pearson.
17. Dwivedi, Y. K., Hughes, L., Ismagilova, E., et al. (2021). Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57, 101994.
18. Wedel, M., & Kannan, P. K. (2016). Marketing analytics for data-rich environments. *Journal of Marketing*, 80(6), 97–121.
19. Tuten, T. L., & Solomon, M. R. (2020). *Social media marketing* (3rd ed.). Sage Publications.
20. Lou, C., & Yuan, S. (2019). Influencer marketing: How message value and credibility affect consumer trust. *Journal of Interactive Advertising*, 19(1), 58–73.
21. Kaplan, A. M., & Haenlein, M. (2019). Siri, Siri in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business Horizons*, 62(1), 15–25.
22. Pine, B. J., & Gilmore, J. H. (2007). *The experience economy: Work is theatre and every business a stage*. Harvard Business School Press.
23. World Bank. (2021). *World development report 2021: Data for better lives*. World Bank Publications.
24. Chen, S. M., & Lee, C. H. (2020). Fuzzy systems and their applications in marketing decision-making. *Expert Systems with Applications*, 159, 113–125.
25. Kumar, V., & Rajput, N. (2022). Digital transformation in rural entrepreneurship: Role of AI and skill development. *Journal of Rural Development*, 41(2), 145–160.
26. Mehta, R., & Pandey, S. (2023). Policy framework for promoting digital handicrafts in India. *Asian Journal of Business and Technology*, 8(1), 55–67.