Integrating artificial intelligence into digital marketing strategies for the textile industry: enhancing customer engagement and sustainability

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ABSTRACT – REZUMAT

Integrating artificial intelligence into digital marketing strategies for the textile industry: enhancing customer engagement and sustainability

The textile industry is experiencing a rapid paradigm shift with the growing application of artificial intelligence in the processing, marketing, and consumption trends related to the textile industry. The objective of this research is to analyse the way the integration of artificial intelligence in digital marketing can result in enhanced customer engagement and sustainable practices. The worldwide market for artificial intelligence related to textiles is predicted to grow exponentially by 2033, portraying the increasing digitisation of the textile industry. There is a conceptual gap highlighted between artificial intelligence marketing trends and sustainable trends related to textiles. A model of balance between the textile industries for responsible use of artificial intelligence has therefore been incorporated within this research related to the textile industries as Balanced AI Adoption Framework (BAAF). A conceptual framework analysis was employed to review literature regarding the opportunities, challenges, and ethical risks of AI adoption in the textile industry. It was discovered through the results of this study that, through the gradual increase in the use of AI alongside human efforts, better outcomes may be achieved regarding industry efficiency and market responsiveness, with preserved creativity, transparency, and ethical viability.

Keywords: *artificial intelligence, digital marketing, textile industry, customer engagement, sustainability, Industry 4.0*

Integrarea inteligenței artificiale în strategiile de marketing digital pentru industria textilă: îmbunătățirea implicării clienților și a sustenabilității

Industria textilă trece printr-o schimbare rapidă de paradigmă, odată cu aplicarea tot mai extinsă a inteligenței artificiale în procesele de producție, marketing și tendințele de consum din acest sector. Obiectivul acestui studiu este de a analiza modul în care integrarea inteligenței artificiale în marketingul digital poate conduce la o implicare sporită a clienților și la practici sustenabile. Piața mondială a inteligenței artificiale în domeniul textilelor prevede o creștere exponențială până în 2033, ceea ce reflectă digitalizarea tot mai accentuată a industriei textile. Se evidențiază o discrepanță conceptuală între tendințele de marketing bazate pe inteligența artificială și tendințele sustenabile din industria textilă. Prin urmare, în cadrul acestui studiu dedicat industriei textile a fost integrat un model de echilibru între sectoarele textile pentru utilizarea responsabilă a inteligenței artificiale, denumit „Balanced AI Adoption Framework" (BAAF). S-a utilizat o analiză a cadrului conceptual pentru a examina literatura de specialitate privind oportunitățile, provocările și riscurile etice ale adoptării IA în industria textilă. Rezultatele acestui studiu au arătat că, prin creșterea treptată a utilizării IA alături de mijloacele umane, se pot obține rezultate mai bune în ceea ce privește eficiența industriei și capacitatea de reacție a pieței, păstrându-se în același timp creativitatea, transparența și viabilitatea etică.

Cuvinte-cheie: *inteligență artificială, marketing digital, industria textilă, implicarea clienților, sustenabilitate, industria 4.0*

INTRODUCTION

One of the most important turning points in the world of textiles and fashion has now come with the digital revolution. This is because the textile industry has seen a shift in the manner in which it accesses and communicates with consumers because of better social media platforms and communication equipment [1, 2]. It is not simply technological; it is strategic. It alters the functioning of businesses, production methods, and marketing patterns in developed and developing nations. Textile businesses have managed to adopt digital marketing tools to discover new approaches to communicate with consumers, optimise the speed of the supply chain of textile products, and increase the prominence of these businesses globally [1, 2]. In fact, current research has not yet identified the relationship between digital marketing supported by artificial intelligence and the sustainability performance of the textile industry.

In this case, the role of AI has become a tool that enables marketers to collect, analyse, and utilise data in ways that were previously unimaginable. AI-powered tools like predictive analytics, ML-based consumer profiling, automated content creation, and image recognition systems today enable marketers to make instantaneous decisions [3]. However, the level of acceptance in the textile industry remains varied. Large multinational firms are experimenting with AI-powered personalisation and recommendation

engines. SMEs typically use AI only in a narrow sense, mostly for chatbots or automation [4].

The global textile industry is a large and growing market and is projected to continue expanding toward 2030 [5]. The global textile fibre market is projected to continue expanding toward 2030, indicating sustained growth in the broader textile value chain [6]. In parallel, the market for AI in the textile industry is expected to grow rapidly during the forecast period from 2024 to 2033 (with 2023 as the base year), suggesting strong acceleration in AI adoption across textile operations [7]. However, evidence in the literature suggests that digital technology adoption remains uneven across the textile value chain, and marketing-related applications often lag behind advances in production technologies [8].

Nevertheless, besides regional findings, worldwide industrial analyses are showing a more complex digitisation gap; while almost 70% of the textile industry leaders emphasise digitisation as a priority issue, fewer have managed to develop their AI on a wider scope rather than as a pilot application owing to legacy system limitations and data line fragmentation [9, 10]. This inequality is again accentuated within specialised texts on the topic; as pointed out within specialised sources, even within industries with a greater extent of automatized processes, the harmonisation degree of marketing with Industry 4.0 concepts is again too low [1, 2, 11]. More specifically, Špiler et al. [11] have noted that there is a missing comprehensive commitment regarding digitised support within the Serbian textile sector, while the European Commission (2021) [12] pointed out that digital marketing integration within the EU textile sector is often a patchwork effort with a reactive scope.

More recently, research within the very same journal suggested that textile exporters from developing countries increasingly rely on social media analytics as a means for improved sustainability communication; yet again, their use of digital media is limited to its role as support regarding content analysis within social networks [13].

From a larger perspective, the impact of AI in the realm of digital marketing goes far beyond the efficiency of its operations. AI is also credited with inspiring consumer engagement, differentiation, as well as sustainability awareness, specifically with the rise in consumer demands for transparency and sustainability from manufacturers [14]. Online marketing, with the aid of AI analysis, enables the textile industry to tailor their content according to the demands of the consumers, taking into account the feedback maintained on an ongoing basis, to train the consumers on the marketing campaigns by the manufacturers that align with the principles of ethical consumerism [15]. Over-reliance on AI may undermine creativity, authenticity, and the human touch, which have been the key to the success of the marketing process in the textile industry [16].

Thus, a balanced and staged integration of AI within textile digital marketing is required. The paper proposes the following:

- analyse the application of AI technologies in improving digital marketing efficiency and sustainability within the textile industry;
- determine organisational and technological challenges that impede the embrace of AI technology, especially by SMEs;

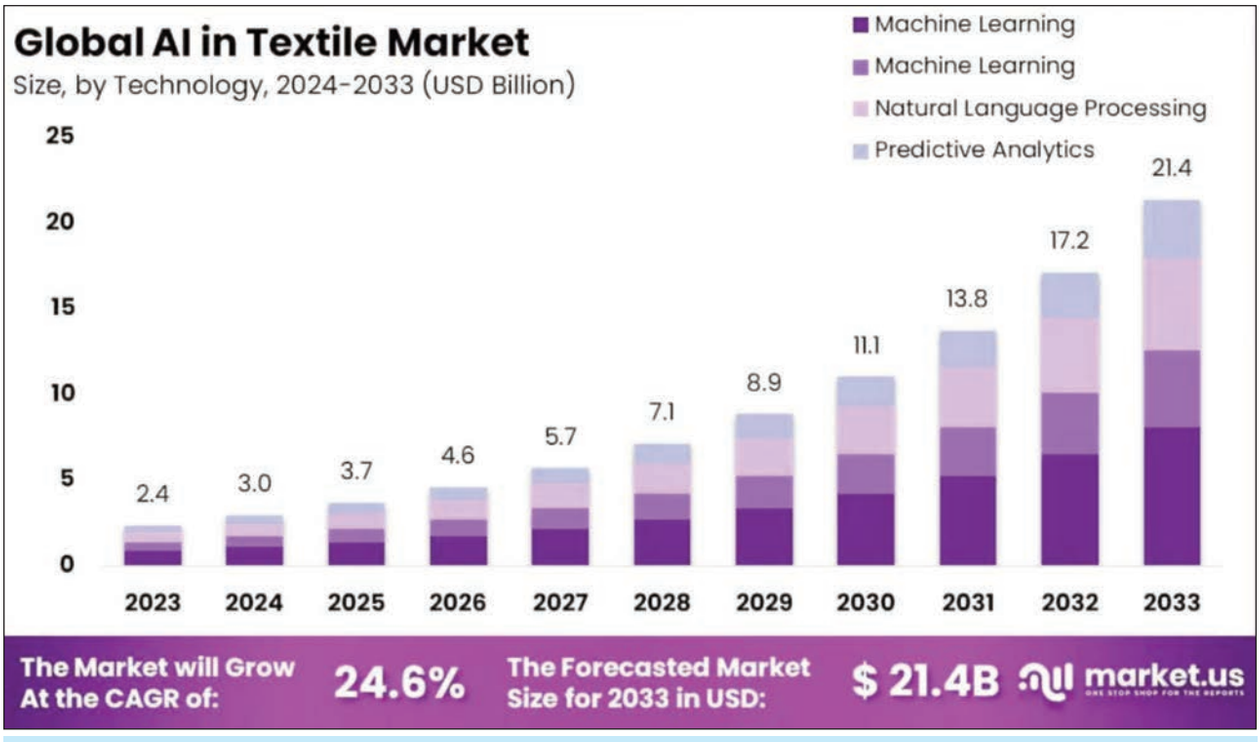


Fig. 1. Global AI in Textile Market Size Projection and Growth Trend [7]

- make recommendations on the BAAF that would facilitate gradual, ethically responsible, and humanistic implementation.

In light of these objectives, this research makes a valuable contribution to the current debate on digital transformation, as it pertains to textile and fashion management.

Another complementary forecast by Market.US predicts the global AI market in textiles to reach about USD 21.4 billion in 2033, growing at a CAGR of 24.6% as shown in figure 1. Indeed, this forecast confirms the hypothesis of this study, since artificial intelligence represents one of the main factors motivating the digital revolution within the textile sector [7]. Differences in the estimates result from the characteristics of the approach adopted in different market studies.

LITERATURE REVIEW

Digital marketing in the textile sector

Online marketing resources have become the driving force in the textile sector, particularly for SMEs in the export-oriented sectors [1, 2]. Online commerce, online social media, as well as the implementation of CRM, have been proven to improve internationalisation as well as the efficiency of communications by the study carried out by the Industria Textila journal [1, 2, 11, 17, 18].

Špiler et al. observed that firms that invest in digital marketing capabilities like analysis and social e-commerce perform better than firms that use offline marketing methods [11]. Likewise, Caescu et al. observed that combined online marketing activities such as SEO, SEM, e-mail, and social networking influence consumer decisions regarding textile packaging [17]. A study involving more than 250 textile SMEs indicated that these digital capabilities directly influence firm performance. Moreover, their effects can be better achieved by the integration of CRM systems [4].

Conversely, digital participation mechanisms will lead to an increase in brand trust, such as co-creation and interactive content practices [18].

These, combined, suggest that the role of digital marketing is no longer just to support, but to some extent, it is also responsible for facilitating competitiveness. Nevertheless, there are certain areas that lack analytical literacy, data, and channel competencies.

Artificial intelligence in textile marketing

Artificial intelligence has traditionally been common in inspection and predictive maintenance in quality control, and now a trend is emerging to explore the use of AI in more front-end-related projects, such as marketing. Textile businesses can use the marketing potential of artificial intelligence through the use of tools like chatbots, recommenders, and predictive analytics apps to personalise interactions with consumers while optimising the timing of marketing.

Zhang & Li observed that the upgrading of digital technology in textile enterprises is increasingly based on AI analysis for demand forecasting and 'green marketing' synchronisation [19]. Worldwide fashion and textile examples prove that AI helps minimise campaigning cycles and creative expenditure; for example, Zalando's generative AI picture solution reduced content development cycles from 6–8 weeks to 3–4 days and decreased expenditure by approximately 90% without sacrificing human control and oversight [20]. Such augmented intelligence strategies have also been practised in luxury clienteling, for example, Zegna, wherein sales consultants leverage recommendation algorithms for personalised engagement without sacrificing personal contact [21]. Despite this progress, over-automation could potentially challenge authenticity and creative freedom [12]. Hence, it has been recommended that human-in-the-loop approaches be considered, which could efficiently combine efficiency with brand identity management [3, 21, 22].

Gaps and research justification

There is limited literature on the quantitative impact of AI in the marketing domain for the textile industry. There is also a limited focus on the marketing domain of AI [19]. Implementation status ranges from continent to continent. Textile companies in the EU have the most mature state of analytics, while small companies in developing parts of the world have remained in the pilot stage [11, 19].

Some common constraints include:

- data quality and integration issues, limiting model reliability [3];
- lack of AI-literate marketing staff, which hinders operationalisation;
- ethical and brand-authenticity concerns, especially in creative automation [12, 20].

These gaps justify the "balanced integration" perspective of this paper: the positioning of AI in this industry as an enhancer and not a replacement for human expertise. Current industrial priorities, reported by Industria Textila, would then be gradual digital transformation, reskilling of the workforce, and marketing aligned with sustainability issues [11, 19, 21].

Table 1 compiles some of the relevant research on the integration of digital marketing and AI in the textile industry. Three things emerge from the literature: on one hand, it is generally acknowledged that digital marketing competencies such as social networking, CRM, or analytics have become game-changers for textile SMEs [1, 2, 11, 17, 18]; on the other, AI-powered solutions like chatbots, recommendation engines, or generative content platforms are starting to transform traditional marketing operations by enabling greater personalization, along with cost savings [3, 19, 21]; on the other, it is also acknowledged, despite these advantages, that integration is thus far a step-by-step affair, limited by concerns related to data integrity, human resources, or protecting authenticity [3, 12, 17, 20]. In short, what is clear is that it is necessary to reaffirm, through this research, a methodology of balance and complementarity

Table 1

SUMMARY OF REPRESENTATIVE LITERATURE ON DIGITAL MARKETING AND AI IN TEXTILES

Author(s) / Year	Source	Focus	Method	Digital-marketing element	AI component	Key findings	Ref
Caescu et al. 2021	*Industria Textila*	Online marketing impact	Comparative analysis	SEO/SEM/ email	N/A	Online marketing influences consumer acceptance	[17]
Ozbek & Tor-Kadıoğlu, 2022	*Industria Textila*	Engagement → brand loyalty	Questionnaire	Interactive content	N/A	Engagement positively affects brand loyalty	[18]
Bertola & Teunissen, 2018	*Res. J. Textile & Apparel*	Fashion 4.0 innovation	Literature review	Digital transformation	Industry 4.0 automation	Digital transformation reshapes the fashion industry	[1]
Dimitrijević et al., 2023	*Tekstilna Industrija*	Digital marketing in SMEs	Review paper	Multi-channel marketing	N/A	E-marketing improves competitiveness	[2]
Špiler et al., 2023	*Industria Textila*	Digital tech investment	Empirical study	Social commerce, analytics	Emerging AI	Digital readiness varies; marketing under-invested	[11]
Guilbault, 2023	Vogue Business	Zegna clienteling	Case study	Luxury marketing	AI recommender	AI augments personal service	[21]
Akter et al., 2023	*Industrial Marketing Mgmt.*	AI marketing analytics	Conceptual	Analytics integration	Machine learning	AI improves bias management	[3]
Zhang & Li, 2025	*Industria Textila*	Digital tech & green upgrading	Multi-case study	Marketing dynamics	Big data/AI	Analytics link marketing with sustainability	[19]
Reuters, 2025	Industry report	Zalando AI campaign	Case study	Image production	Generative AI	Production time reduced from 6-8 weeks to 3-4 days (approx. 90%), cost ↓ ≈ 90%; human oversight key	[20]

between AI systems and human creativity in textile marketing.

CONCEPTUAL FRAMEWORK AND MODEL

Conceptual background

When it comes to the digital transformation of the textile industry, the digital revolution is not only related to production techniques, but also to other consumer-related fields such as marketing, branding, and communication. It is clear that in this emerging scenario, digital marketing is no longer just a marketing technique, but is gradually becoming an integrated process, including factors such as brand, analytics, and sustainability communication.

Thus, among the changes that are occurring in the textile sector, AI plays a significant supporting role in improving decision-making using data [22].

However, full automation of marketing is neither possible nor required. Textile branding involves a lot of aesthetic, cultural, and emotional elements, which require creative and moral capabilities that cannot be substituted by AI systems. Hence, AI can be conceived of as a support tool that improves human judgment capabilities, and it does not have the potential to act as a complete replacement for human expertise in textile branding [11].

Based on concepts from modern literature, as well as case studies from the sector, this proposed work offers the BAAF, which is a conceptual framework that illustrates how AI can be incrementally integrated into the marketing of textiles. This model supports an incremental, feedback-driven, and human-focused approach, which corresponds with the principles of digital progressive maturity, along with the methodology outlook explained in the 4th section.

The Balanced AI Adoption Framework (BAAF)

BAAF (figure 2) breaks down the adoption process for AI into an evolutionary process with five stages, ranging from the Digital Baseline (Stage 1) to strategic co-creation (Stage 5).

Every level embodies a combination of tech smarts, people engagement, and management knowledge. All this helps textile companies optimise their own digital maturity through experimenting along with a different organisational setup.

The staged design corresponds directly to the methodology of concept analysis, synthesis, and logical verification, as mentioned in the 4th section, in

which literature synthesis, mapping, and logical verification were used for determining stage transitions. Thus, in this design, every stage corresponds to a reasoning inference point of methodological inference between the adoption of AI and efficiency, responsiveness, or sustainability focus.

Framework components

1. Technological Readiness: Technological readiness represents the very base of AI-enabled marketing. It includes infrastructure readiness, data management capacity, and system interoperability between marketing and enterprise functions. Since most textile firms are running operations on fragmented legacy systems, integration capability becomes a very crucial enabler of transformation [11].
2. Human–AI Collaboration: This means that creative and interpretive tasks of maintaining oversight of insights coming from AI-generated outputs are a job for marketing professionals. Within this conceptual framework, AI is seen as a co-creative tool, the output of which requires contextual refinement by a human expert to maintain brand identity and cultural sensitivity [3, 21].
3. Data Governance and Ethics: Integrates responsible data usage, transparency, and accountability of algorithms. Ethical data practices build trust, ensure equity, and are sustainable in the long run, guaranteeing that global standards of digital responsibility are upheld.
4. Performance Measurement and Feedback: It sets clear, quantifiable criteria of ROI, engagement, customer satisfaction, and sustainability impact to assess the effectiveness of AI. These indicators also form feedback loops that help organisations identify when to scale up the adoption of AI from one stage to another [20].

Together, these components form the analytical base upon which the Balanced AI Adoption Framework was constructed during the second stage of the methodology.

Theoretical contribution and practical relevance

The BAAF contributes theoretically by bridging AI marketing analytics and digital transformation research in textiles, two previously fragmented domains.

The framework integrates the Technology–Organisation–Environment (TOE) model with Dynamic Capabilities Theory (DCT) to explain how firms build, adapt, and renew digital competencies through incremental learning and experimentation [23, 24].

The BAAF assumes the incorporation of artificial intelligence in textile marketing can be achieved through five successive stages as conceptualised by the BAAF (figure 2).



Fig. 2. The Balanced AI Adoption Framework (BAAF): A Five-Stage Evolutionary Roadmap for Textile Marketing

As far as management practices, BAAF acts as an effective guideline for textile market practitioners, especially small and medium-scale enterprises, on how they can apply AI effectively and responsibly.
It advises firms to begin with something small, such as using tools such as chatbots or rule-based automation, and to gradually migrate to more sophisticated tasks such as predictive modelling or generative AI as they become more prepared.
Thus, this staged process, which was conceptually validated by methodological triangulation discussed in the 4th section, reduces risk, inspires institutional employees to develop new skill sets, and aligns digital innovation with the sustainability and environmental focus of the textile industry. From a managerial context, BAAF provides an effective roadmap for textile marketers, including SMEs, on responsible staged innovation of AI [11, 22, 24].

Implications for future research

The BAAF provides a foundation for future testing and comparative study. Future research may use Structural Equation Modelling for testing the suggested correlations between digital capability, the AI adoption process, and performance indicators for organisations on three counts: economic, social, and environmental.
Cross-regional studies, for instance, the comparison of the textile market ecosystem in the EU and the Asia-Pacific regions, can help understand the role of institutional backing, data protection, and cultural focus in shaping the adoption curve of AI in different regions.
Thus, in respect to what The BAAF believes in making sustainable progress in textile marketing, this means more than just relying on automated approaches in terms of a symbiotic co-evolution between humans and artificial intelligence that begins with strong foundations in terms of rigour and conceptualisation, specifically in relation to the adoption of AI technology.

METHODOLOGY

Research design

This paper adopts the conceptual-analytical methodology to comprehend the contribution of data-driven solutions in online marketing transformation within the textile industry. Based on the findings from several peer-reviewed journal articles, among other sector-relevant documents, our approach consolidates original research into a complex framework analysis. The method utilises the technique from the Balanced AI Adoption Framework (BAAF), whose incremental approach considers human factors when implementing new technology in society [11, 23].

Conceptual scope and analytical procedure

The analytical procedure had three related steps:
1. Structured Literature Synthesis: Although the review has been conducted based on journals that are peer-reviewed, some trade journals have also been taken into consideration. The keywords were: artificial intelligence, digital marketing, textile industry, automation, and sustainability. The prepublications of a cumulative total of relevant publications revealed the pattern, variables, and critical dimensions from the perspective of marketing transformation by AI [1–3, 11, 19–22].
2. Building the Framework: The Balanced AI Adoption Framework (BAAF) served as the basis for the structure on which the research was carried out. Each step of the framework was attributed to unique marketing activities, digital competence, and sustainability outcomes. These conceptual links are explored within the paper in compliance with the grounded conceptual approach through the use of pattern matching and theme contrast [23, 24].
3. Validation of Analysis: The conceptual correlations identified within the literature studies were analysed for internal consistency with relevance to the industry scenario. Key indicators of the critical concerns of readiness to apply the technology, human involvement in artificial intelligence, and the ethics of data were analysed conceptually through scenario analysis of the secondary sources within the industry [9, 10].

Analytical framework overview

The process of analysis correlates adoption levels of AI with three overarching performance areas:
1. Operating Efficiency (process automation, cost optimisation)
2. Market Responsiveness (Customer Insight)
3. Sustainability Orientation (Ethical Use of Data/ Innovation).

These domains form the basis for determining the expected relationships among the conceptual constructs, and this is without the need for empirical verification. These relationships are considered as a set of directional assumptions that are supported through the synthesis of the literature, and not through statistical inference.

Conceptual mapping

Table 2 below encapsulates the analytical mapping process between the four core conceptual dimensions for the study along with their relevant literature. All four core conceptual dimensions, namely Technological Capability, Human-AI Collaboration, Data Governance & Ethics, and Feedback & Learning Systems, are mapped with key construct themes identified through the process of structured literature synthesis.
The results show that technological capability, especially the existence of automation and data analysis infrastructure, is an enhancer of efficiency in operations and market responses [9, 11]. On the other hand, human–AI collaboration in innovation and brand authenticity, as mediated by the proposed model, confirms the significance of human control in AI marketing [3, 20, 22].
Data governance and ethics are named as important enablers for sustainable competitiveness, focusing

Table 2

ANALYTICAL MAPPING OF CORE DIMENSIONS AND SUPPORTING LITERATURE

Analytical dimension	Key constructs	Expected direction	Supporting source(s)
Technological capability	Automation, infrastructure, analytics	Enhances efficiency and responsiveness	[9], [11], [17]
Human–AI collaboration	Shared creativity, interpretive control	Strengthens innovation and brand authenticity	[3], [20], [22]
Data governance & ethics	Transparency, bias control, trust	Reinforces sustainable competitiveness	[19, 25]
Feedback and learning systems	Adaptive processes, campaign optimisation	Improves long-term digital maturity	[10], [23], [24]

on transparency and trust within algorithmic systems [18, 19, 25]. Lastly, learning loops for feedback are suggested for promoting digital maturity by integrating adaptive loops into business processing activities [11, 23, 24].

These collectively come together to establish the foundation for the Balanced AI Adoption Framework (BAAF), since each component collectively contributes towards having a balanced understanding of the technology adoption process that ensures efficiency, authenticity, and sustainability for the marketing of the textile industry.

Methodological contribution

This conceptual methodology allows for replicability for possible later empirical testing.

It contributes to the following:

- development of an effective link between AI adoption and transformation of textile marketing;
- providing an analytical framework useful for either comparative analysis or case studies;
- following the methodological approaches of the journal Industria Textila in giving importance to the conceptual rigour as well as the managerial implications.

RESULTS AND DISCUSSION

Conceptual results

Findings emanating from this conceptual study are based upon the approaches for synthesising and mapping discussed in the methodology section.

Via the three-step analytical approach involving a structured literature analysis and framework development and validation, it was found that four fundamental factors are at play when it comes to AI-induced transformation and textile marketing, and they are Technological Readiness, Human and AI Collaboration, Data Governance and Ethics, and Feedback and Learning Systems.

From the analysis, the adoption of AI in the textile industry was found not to be a displacement process but a maturity process. It was found that for successful companies, AI tools are adopted incrementally in a process involving displacement of rules by Rule-based Automation, moving on to Predictive Modelling, and finally ending up at Strategic Co-Creation, following the Balanced AI Adoption Framework (BAAF) maturity stages.

Moreover, the conceptual validation confirmed the interdependence among the three performance domains defined in the 4th section:

- Operational Efficiency is achieved through automation and optimised workflows.
- Market Responsiveness improves via predictive analytics and customer insight generation.
- Sustainability Orientation strengthens through data ethics, transparency, and responsible innovation.

These relationships were verified for internal logical consistency and supported by secondary industrial evidence [9, 10].

Discussion of the Balanced AI Adoption Framework (BAAF)

According to BAAF, there are five different stages of maturity that exist around AI in textile marketing, which are, in fact, connected. Each helps in striking a balance between digital skills growth and supervision by humans:

1. Digital Baseline (Stage 1): Firms market by hand and don't apply any analytics. In this stage, one can clearly see that much reliance was placed on intuition, and little data was being applied.
2. Assisted Automation (Stage 2): Basic AI tools, such as chatbots and keyword assistants, assist with tasks in marketing that are highly repetitive. Human oversight ensures that all are contextually correct and also mitigates risk.
3. Collaborative Intelligence (Stage 3): Predictive analytics and recommendation systems help people make better decisions, which means better ROI and more personalised experiences. The defining mechanism is shared control between marketers and AI.
4. Semi-Autonomous Optimisation (Stage 4): Machine learning algorithms improve segmentation, ad placement, and timing. Human involvement is shifting toward quality control and ethics auditing.
5. Strategic Co-Creation (Stage 5): AI is embedded within cross-channel strategies that enable content creation, ensure brand consistency, and monitor sustainability. Human strategic leadership ensures everybody follows moral and cultural norms.

All these points towards the conclusion that firms do not follow the above-mentioned stages linearly.

Rather, the process of transition between these stages varies based on the situation, which can be influenced by data quality, management culture, or policies prevalent at a particular time. Such findings support the claim made by Dynamic Capabilities Theory that digital maturity can be generated by adaptive learning and that it does not involve long-term investments in technology [23, 24].

Comparative insights

Comparative syntheses of the literature from the period 2018–2025 show that textile companies with balanced human-centred approaches to artificial intelligence (AI) outperform companies that focused on purely automation strategies [3, 21–24]. Textile companies reported: (i) enhanced customer trust [3, 21], (ii) superior marketing performance and clean data flows [3, 22], and (iii) enhanced organisational resilience and an environment favourable for new business generation [23, 24], after incorporating the capabilities of the machines and human creativity for ethical guidance. Together, the various findings inform the theoretical imagination of an evolution process for the human computing interface of artificial intelligence through human expertise and processor power co-development.

Managerial and strategic implications

The findings indicate that there exists a set of management guidelines for textile firms wishing to undergo an AI-led transformation:

- Create roadmaps of integration that align with the business strengths and the status of the data.
- Develop programs for enhancing literacy regarding artificial intelligence as well as the ability to make decisions based on observations.
- Establish guidelines on ethical AI, which emphasise fairness and transparency.
- Before proceeding to more advanced levels of maturity, utilise performance feedback tools to apprise yourself of your level of progress.

The BAAF recommends that policymakers and trade bodies adopt a common framework for 'AI readiness' and support SMEs with financial support, skills development, and data infrastructure.

Summary of conceptual findings

Table 3 summarises the conceptual understandings attained through the process of analysis as highlighted in the 4th section. This accounts for the relationships among the four dimensions associated with the Balanced AI Adoption Framework (BAAF) – technological readiness, human-AI collaboration, data governance/ethics, and feedback/learning processes.

These results confirm the importance of technological readiness as a precondition of digital transformation since companies that have high infrastructure development progress faster in the maturity levels of AI. This lends further support to the Technology-Organization-Environment (TOE) theory that includes technological enablers as important drivers of innovation capability.

Likewise, the collaboration between human and artificial intelligence was found to improve creative performance and retain brand authenticity, consistent with the Dynamic Capabilities Theory (DCT) that emphasises the role of adaptive learning for gaining a sustainable competitive advantage.

Data governance and ethics are crucial to building consumer trust and synchronising marketing processes with values related to sustainability, thereby affirming the fundamental constructs of sustainable marketing theory. Furthermore, feedback and learning processes within these frameworks verify that a learning loop is a catalyst with a positive leveraging effect on organisational learning. These frameworks affirm the reflexivity implied by the BAAF model.

Taken together, the patterns identified in table 3 show that the Balanced AI Adoption Framework is effective at combining the various aspects of technology, humans, and ethics into a single conceptual framework for the promotion of sustainable adoption of artificial intelligence within the textile market.

Synthesis and future outlook

These conceptual results make it clear that the deployment of AI is a function of alignment that occurs between data, people, and objectives. The Balanced Framework for the Adoption of AI provides a scalable and ethical framework that can help bring about transformation in the textile industry.

Table 3

ANALYTICAL SUMMARY OF CONCEPTUAL FINDINGS WITHIN THE BALANCED AI ADOPTION FRAMEWORK (BAAF)

Analytical dimension	Observed pattern	Theoretical interpretation
Technological readiness	Firms with strong infrastructure advance faster in AI maturity.	Supports TOE model emphasis on technological enablers.
Human–AI collaboration	Balanced decision-making enhances brand creativity and authenticity.	Reinforces DCT principle of adaptive learning.
Data governance & ethics	Transparent data practices increase consumer trust.	Aligns with sustainable marketing theory.
Feedback and Learning Systems	Iterative evaluation improves digital maturity over time.	Validates the dynamic feedback mechanism within BAAF.

To apply this framework from theory to practice, textile companies must apply these stages through operational actions. To begin, a medium-sized clothing brand in Stage 2 (Assisted Automation) could apply AI-powered chatbots to answer generic customer questions while retaining human supervision for expert fashion advice. The same brand could apply predictive analysis in Stage 3 (Collaborative Intelligence) to accurately predict anticipated demand during each season, thereby aligning marketing strategies with its aims of green upgrading.

To guide further studies, it is advised that a structured roadmap for an empirical test ought to verify the BAAF model. The stages to follow:

- Phase 1: Pilot Case Studies. In-depth interviews of marketing managers of textile firms from the EU and Asian regions to establish refined stage-specific variables.
- Phase 2: Quantitative Validation. Using SEM or Partial Least Squares PLS-SEM on an international survey with a focus on the adoption of AI and its impact on ROI and sustainability variables in the first 300 textile SMEs.
- Phase 3: Longitudinal Tracking. This involves tracking a group of textile brands on a longitudinal basis for 24 months while they undergo development from Stage 1 to Stage 4 to determine improvements in organisational resilience and customer trust.

As further research unfolds with an ever-expanding testing horizon regarding SEM analysis and PLS-SEM or cross-case industry analysis in the future, it has potential uses for testing maturity and sustainability regarding AI in the Creative Industries.

CONCLUSION

In this paper, the potential of data technology in the realm of textile marketing is examined in terms of developing customer engagement and sustainability through the use of data technology in the marketing sector of the textile industry. Through research and development, the framework of a 'Balanced AI Adoption Framework', or the 'BAAF', is proposed as a possible approach in understanding the different stages that need to be considered in developing a data technology-based sustainable marketing framework in the textile industry.

It is a staged route for managers, particularly in SMEs: start small with low-risk automation, such as chatbots or keyword aids, to build capacity; step up to predictive analytics; carefully select generative uses. In that order, the operational and ethical exposure falls, employees gain skills, and customer trust deepens. Transparent communication, responsible innovation, and diligent monitoring of sustainability metrics enhance environmental performance and strengthen brand reputation.

BAAF also provides a foundation for future research. Future research may use comparative case approaches or structural equation models. Also, the framework would aid in testing for readiness and governance. Future research that would enable the furtherance of this field of study would focus on answering the questions listed below: How does the BAAF of integrated impacts affect consumers' trust in a high-quality textile brand? How applicable is the framework for SMEs with sub-standard digital infrastructure? And what are the long-run impacts of human-computer collaboration on creative marketing deliverables?

On balance, a more harmonious or balanced rather than completely automated process seems likely to ensure a bright future for textile marketing as a whole. Nevertheless, it seems that the suggested BAAF model presents some drawbacks, where a possible perception of being too slow when it comes to high-tech worldwide companies might be a concern, as well as the obvious risk of operational bottlenecks when facing accelerated technological advancements without an adequate reskilling of the personnel involved. Future studies must address these issues through the use of longitudinal data analysis. When smart tech meets creativity, businesses receive improved, more tailored, and more enduring outcomes.

REFERENCES

[1] Bertola, P., Teunissen, J., *Fashion 4.0. Innovating fashion industry through digital transformation*, In: Research Journal of Textile and Apparel, 2018, 22, 4, 352–369

[2] Dimitrijević, D., Dimitrijević, N., Adamović, Ž., *Digital marketing from the perspective of the producer/seller in the SMEs of the textile and clothing industry*, In: Tekstilna Industrija, 2023, 71, 3, 52–62

[3] Akter, S., Sultana, S., Mariani, M., Wamba, S.F., Spanaki, K., Dwivedi, Y.K., *Advancing algorithmic bias management capabilities in AI-driven marketing analytics research*, In: Industrial Marketing Management, 2023, 114, 243–261

[4] Sangwan, P., Kumar, P., *Influence of digital marketing capabilities on the performance of textile industry SMEs*, In: Proceedings of the 2nd International Conference on Emerging Technologies and Sustainable Business Practices (ICETSBP 2024), Atlantis Press, 2024, 33–49, https://doi.org/10.2991/978-94-6463-544-7_4

[5] Grand View Research, Textile Market Size, Share & Trends Analysis Report, Available at: https://www.grandviewresearch.com/industry-analysis/textile-market [Accessed on August 20, 2025]

[6] Grand View Research, *Textile fibre market report (Industry analysis page)*, Available at: https://www.grandviewresearch.com/industry-analysis/textile-fibre-market-report [Accessed on August 31, 2025]

[7] Market.us., *AI in Textile Market Size, Share, Trends (Forecast 2024–2033)*, Available at: https://market.us/report/ai-in-textile-market/ [Accessed on August 10, 2025]

[8] Ultralytics, *The future of textile production with AI-driven manufacturing*, 2024, Available at: https://www.ultralytics.com/blog/the-future-of-textile-production-with-ai-driven-manufacturing [Accessed on August 10, 2025]

[9] European Commission. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW), *Transition Pathway for the Textiles Ecosystem: Report on stakeholder pledges and commitments*, 1 March 2024, Available at: https://single-market-economy.ec.europa.eu/system/files/2024-03/Report%20on%20stakeholder%20pledges%20and%20commitments.pdf [Accessed on August 10, 2025]

[10] Harreis, H., Koullias, T., Roberts, R., Te, K., *Generative AI: Unlocking the future of fashion*, McKinsey & Company, 2023

[11] Špiler, M., Milošević, D., Miškić, M., Gostimirović, L., Beslać, M., Jevtić, B., *Investments in digital technology advances in textiles*, In: Industria Textila, 2023, 74, 1, 90–97, http://doi.org/10.35530/IT.074.01.202287

[12] Publications Office of the European Union, *Transforming the textile industry with digital technologies: Sectoral watch – technological trends in the textile industry*, 2021, Available at: https://op.europa.eu/publication/manifestation_identifier/PUB_EA0821189ENN [Accessed on August 31, 2025]

[13] Quiles-Soler, C., Martínez-Sala, A.M., Monserrat-Gauchi, J., *Fashion industry's environmental policy: Social media and corporate website as vehicles for communicating corporate social responsibility*, In: Corporate Social Responsibility and Environmental Management, 2023, 30, 1, 180–191

[14] Ramos, L., Rivas-Echeverría, F., Pérez, A.G., Casas, E., *Artificial intelligence and sustainability in the fashion industry: a review from 2010 to 2022*, In: SN Applied Sciences, 2023, 5, 12, 387

[15] Hyun, H., Park, J., Hong, E., *Enhancing brand equity through multidimensional brand authenticity in fashion retailing*, In: Journal of Retailing and Consumer Services, 2024, 78, 103712

[16] Gupta, S., Melewar, T.C., Foroudi, P., *AI strategy for global brand identity*, In: Industrial Marketing Management, 2025, 131, A1–A7

[17] Caescu, S.C., Botezatu, F., Chivu, R.G., Popa, I.C., Florescu, M.S., *The impact of online marketing on the use of textile packaging: an approach to consumer behaviour*, In: Industria Textila, 2021, 72, 2, 210–216, http://doi.org/10.35530/IT.072.02.202019

[18] Ozbek, A., Tor-Kadıoğlu, C., *The effects of consumer clothes design engagement on brand love and loyalty*, In: Industria Textila, 2022, 73, 3, 259–267, http://doi.org/10.35530/IT.073.03.202140

[19] Zhang, X., Li, M., *How do textile enterprises use digital technology to realize green innovation? A multicase comparative study*, In: Industria Textila, 2025, 76, 4, 511–523, https://doi.org/10.35530/IT.076.04.2024100

[20] Reuters, *Zalando uses AI to speed up marketing campaigns and cut costs*, 2025, Available at: https://www.reuters.com/business/media-telecom/zalando-uses-ai-speed-up-marketing-campaigns-cut-costs-2025-05-07/ [Accessed on August 31, 2025]

[21] Guilbault, L., *Zegna rolls out AI-powered luxury clienteling*, In: Vogue Business, 2023, Available at: https://www.vogue.com/article/zegna-rolls-out-ai-powered-luxury-clienteling [Accessed on August 15, 2025]

[22] Floridi, L., Cowls, J., *A unified framework of five principles for AI in society. Machine learning and the city: Applications in architecture and urban design*, 2022, 535–545

[23] Porter, M.E., Heppelmann, J.E., *How smart, connected products are transforming competition*, In: Harvard Business Review, 2014, 92, 11, 64–88

[24] Teece, D.J., *Dynamic capabilities and strategic management: Organizing for innovation and growth*, Oxford University Press, 2009

[25] World Economic Forum, *The Presidio Recommendations on Responsible Generative AI (Report),* 2023

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