



# From Generative to Agentic Intelligence: How AI Derivatives Reshape Strategic Decision–Making in Textile Enterprises

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**Abstract:** This study aims to examine how emerging derivatives of artificial intelligence—particularly generative AI, agentic AI, predictive analytics, computer vision systems, and AI-enabled decision-support architectures—are transforming strategic orientations in textile enterprises. Rather than treating AI merely as an operational efficiency tool, the study positions it as a strategic capability that influences competitive positioning, innovation management, supply-chain responsiveness, sustainability agendas, customer engagement, and organizational decision-making. The study is designed as a conceptual and literature-based analytical paper. It draws upon recent academic studies indexed in Web of Science and DergiPark, focusing on the intersection of artificial intelligence, textile and fashion industries, digital transformation, strategic management, and sustainability. Based on this synthesis, the article proposes an integrated framework explaining how AI derivatives shift textile firms from reactive and efficiency-centered strategies toward anticipatory, adaptive, and semi-autonomous strategic models. The study argues that generative AI enhances textile firms' strategic flexibility by accelerating design ideation, customization, digital prototyping, and brand communication. Agentic AI, in contrast, extends the strategic scope of artificial intelligence by enabling goal-oriented task execution, autonomous coordination, supplier monitoring, scenario assessment, and multi-step decision support. Predictive AI and computer vision contribute to defect prevention, demand forecasting, inventory optimization, and real-time production control.

**Keyword:** Artificial Intelligence Derivatives; Generative AI; Agentic AI; Textile; Strategic Management; Digital Transformation; Smart Manufacturing

**JEL Classification:** J08, Z22, Z33

## 1. Introduction

The textile industry is undergoing a profound transformation shaped by digitalization, sustainability pressures, volatile global supply chains, and rapidly changing consumer expectations. Traditionally characterized by labor-intensive production, short product life cycles, and strong cost competition, the sector is now increasingly driven by data, automation, and intelligent decision systems. Within this transformation, artificial intelligence (AI) has emerged not merely as a technological support mechanism, but as a strategic capability that can redefine how textile enterprises design products, organize production, manage supply chains, interact with customers, and build competitive advantage. Recent studies indicate that AI applications in textiles have expanded from automation and quality control to fashion forecasting, sustainable material development, personalized design, digital prototyping, and circular economy-oriented production models (Bulut, 2026; Kaya, 2024; Nisa et al., 2025).

However, the current wave of AI development differs from earlier phases of digital transformation in one critical respect: firms are no longer dealing with a single, generic concept of artificial intelligence. Instead, they face a diversified ecosystem of AI derivatives, including predictive AI, generative AI, computer vision, conversational AI, decision-support systems, and, more recently, agentic AI. Each of these derivatives affects business strategy through different mechanisms. Predictive AI supports demand forecasting, inventory management, and production planning; computer vision enhances defect detection and real-time quality assurance; generative AI enables novel textile patterns, fashion concepts, product descriptions, and rapid design experimentation; and agentic AI introduces the possibility of semi-autonomous systems that can coordinate multi-step workflows, evaluate scenarios, and act toward predefined business goals with limited human intervention (Wu & Li, 2024; Kumar et al., 2026). This diversification makes it necessary to examine AI not only as an operational technology, but also as a strategic architecture that reshapes managerial logic and organizational capability.

In the textile context, the strategic implications of AI are particularly significant. Fashion and textile markets are increasingly defined by rapid trend cycles, demand uncertainty, sustainability regulations, and the need for differentiated customer experiences. AI-powered systems can help firms anticipate market movements, shorten design-to-market cycles, reduce material waste, and shift from standardized mass production toward data-informed customization. For instance, generative AI has been shown to contribute to knitted textile design by expanding ideation capacity and accelerating early-stage creative development (Wu & Li, 2024). Similarly, recent bibliometric and review studies emphasize that AI-driven applications support sustainable fashion and textile production through waste reduction, traceability, and resource-efficient design practices (Bulut, 2026; Mulayim, 2026; Nisa et al., 2025). These developments suggest that AI is

beginning to influence not only how textile firms produce, but also what they choose to produce, for whom, and under which strategic priorities.

The growing role of AI also raises important managerial and organizational questions. A textile enterprise may adopt AI tools for efficiency gains without fundamentally changing its strategy; yet, firms that integrate AI into innovation management, sustainability planning, market positioning, and supply-chain governance may move toward a more adaptive and intelligence-based business model. Prior research on digital transformation and digital leadership suggests that data analytics, AI literacy, and managerial capability are increasingly important for organizational decision quality and long-term competitiveness (Aksoy, 2023; Duman, 2024). In addition, empirical work conducted with textile-sector employees reveals that AI and robotics are not perceived merely as technical innovations, but also as forces that affect labor relations, skill expectations, and the future organization of work (Yıldız, 2023). Therefore, the strategic influence of AI derivatives cannot be understood without considering both technological opportunities and organizational readiness.

Despite the rapid expansion of the literature, existing studies remain somewhat fragmented. A large portion of the textile-AI literature focuses on specific applications such as design generation, smart textiles, defect detection, or sustainability. Another strand of research concentrates on broader issues of digital transformation, Industry 4.0, and workforce implications. Yet, relatively few studies examine how multiple AI derivatives collectively reshape business strategy in textile enterprises. This gap is becoming more relevant as AI systems evolve from narrow analytical tools toward generative and agentic forms capable of influencing strategic foresight, customer value propositions, product portfolios, and decision-making processes. Accordingly, this article seeks to address the following central question: How do different derivatives of artificial intelligence affect the strategic orientations of textile enterprises?

To answer this question, the article develops a conceptual framework linking AI derivatives with strategic transformation in the textile industry. It argues that AI-driven change unfolds across several interconnected dimensions: product and design strategy, production and quality strategy, supply-chain and market responsiveness, sustainability and circularity strategy, and managerial decision-making capacity. By synthesizing relevant literature from textile studies, digital transformation research, and emerging discussions on generative and agentic AI, the study aims to contribute to the strategic management literature and offer a sector-specific analytical model for future empirical research. In this respect, the article positions AI not as a supplementary digital tool, but as a strategic intelligence infrastructure that may redefine competitiveness in the textile sector during the next phase of industrial transformation.

## 2. Conceptual Framework of AI Derivatives

Artificial intelligence has evolved from a broad technological category into a diversified ecosystem of specialized systems that differ in their analytical logic, degree of autonomy, and strategic relevance. In the early stages of industrial digitalization, AI was commonly associated with automation, data processing, and rule-based decision support. Today, however, the rapid development of machine learning, deep learning, large language models, multimodal systems, and autonomous agents has produced a more complex structure of AI derivatives. These derivatives should not be treated as interchangeable technologies; rather, each represents a distinct form of intelligence that contributes differently to organizational strategy, operational capability, and competitive positioning. In textile enterprises, where design sensitivity, cost pressures, demand volatility, and sustainability requirements coexist, this distinction becomes especially important.

For the purposes of this study, AI derivatives refer to the major functional forms of artificial intelligence that shape enterprise activities across the value chain. These forms include predictive AI, generative AI, computer vision-based AI, conversational and language-based AI, decision-support AI, and agentic AI. While these categories often overlap in practice, they can be conceptually separated according to the type of value they create: prediction, creation, perception, interaction, recommendation, and autonomous action. This classification provides a useful framework for analyzing how artificial intelligence affects textile firms not only at the level of operations, but also at the level of strategic management.

### 2.1. Predictive AI: From Historical Data to Strategic Foresight

Predictive AI refers to artificial intelligence systems that identify patterns in historical and real-time data in order to forecast future outcomes. In business contexts, predictive AI is frequently used for demand forecasting, inventory optimization, risk estimation, price prediction, and disruption monitoring. Within the textile industry, this derivative of AI is particularly relevant because firms face highly unstable fashion trends, seasonal fluctuations, fluctuating raw material costs, and uncertainty in international supply networks. Machine-learning-based forecasting models can help textile enterprises anticipate sales volumes, identify potential supply-chain interruptions, and align production planning with expected market conditions (Jebbor, Benmamoun, & Hachimi, 2024).

Predictive AI therefore creates strategic value by shifting textile enterprises from reactive planning toward anticipatory management. Rather than responding to stockouts, overproduction, or procurement disruptions after they occur, firms may use predictive systems to develop more resilient sourcing strategies, adaptive inventory policies, and market-sensitive product planning.

Previous studies also emphasize the importance of data mining and machine learning in textile demand estimation and production planning, indicating that predictive analytics can support more evidence-based managerial decisions in the sector (Çörekciöglu, 2021). In strategic terms, predictive AI strengthens a firm's capacity for foresight, which is essential in industries where timing, flexibility, and trend recognition strongly influence profitability.

## **2.2. Generative AI: From Analysis to Content, Design, and Strategic Creativity**

Generative AI refers to systems capable of producing new content—such as text, images, design alternatives, patterns, product concepts, code, or scenarios—based on learned structures from large datasets. Unlike predictive AI, which primarily estimates what is likely to happen, generative AI contributes to the question of what could be created. In textile and fashion contexts, this distinction is highly consequential. Generative AI can support fabric pattern development, knitted textile design, digital prototyping, product descriptions, campaign concepts, visual merchandising, and personalized fashion recommendations.

Recent research has shown that generative AI can meaningfully contribute to knitted textile design by expanding the range of visual alternatives available during the ideation phase and by accelerating creative experimentation in fashion design processes (Wu & Li, 2024). Studies published in *DergiPark* similarly note that AI-assisted fashion design tools help designers save time, better interpret customer expectations, and access broader creative possibilities during design development (Kaya, 2024; Özlü & Demir, 2024). These findings suggest that generative AI should not be reduced to a “creative assistant” role alone; it is better understood as a technology that can influence product strategy, brand differentiation, and innovation speed.

From a strategic management perspective, generative AI strengthens the textile firm's ability to move from standardized offerings toward rapid experimentation and adaptive customization. It enables companies to test multiple design directions before committing to physical production, explore niche customer segments, and shorten the journey from concept to market. Furthermore, recent management research argues that generative AI can support strategic advantage when firms integrate it into organizational learning, resource allocation, and business model development rather than using it only for isolated content-generation tasks (Ruokonen, 2025). For textile enterprises, this means that generative AI may become a strategic bridge between creativity, market responsiveness, and value creation.

## **2.3. Computer Vision and Perceptive AI: Making Textile Processes Observable**

A third major AI derivative is computer vision-based AI, which enables systems to interpret images, visual patterns, surface structures, and physical defects. Textile manufacturing relies heavily on visual quality assessment, particularly in yarn inspection, fabric defect detection, sewing quality,

printing consistency, and finished-product control. Manual inspection, although still widely used, is vulnerable to fatigue, subjectivity, and inconsistency. AI-supported visual systems can detect anomalies with greater speed and repeatability, supporting more standardized quality control processes.

Recent studies emphasize that AI-driven defect detection systems combine image processing, machine learning, and deep learning to identify fabric faults and support automated quality management in textile manufacturing (Ozek, 2025). Earlier research in the Turkish literature also discusses the use of artificial neural networks in textile quality control and fabric defect recognition, showing that machine-learning approaches have long-standing relevance for production efficiency in the sector (Çörekcioğlu, 2021). Newer DergiPark studies further underline that AI-based fault prediction and prevention are becoming increasingly important for cost control and operational stability in textile production (Özkan, 2026).

Strategically, computer vision expands managerial visibility over operational processes. It contributes to zero-defect aspirations, lowers waste and rework, improves customer satisfaction, and supports compliance with quality standards in international markets. Since textile companies compete not only on price but also on reliability and consistency, perceptive AI systems can become part of a broader quality-based differentiation strategy. In this sense, computer vision is not merely a production technology; it is an enabling capability for strategic positioning around trust, precision, and operational excellence.

#### **2.4. Conversational and Language-Based AI: Interaction, Knowledge Access, and Organizational Communication**

Conversational AI and language-based AI include chatbots, large language model interfaces, internal knowledge assistants, automated customer-support systems, and text-generation tools. These systems interact with users through natural language and support a wide range of business activities, including customer communication, supplier correspondence, employee training, market intelligence summaries, and internal documentation.

Although conversational AI is not specific to textiles, its sectoral implications are substantial. Textile firms often operate with multilayered communication structures involving designers, production teams, purchasing units, global suppliers, wholesalers, retailers, and end consumers. Language-based AI can reduce communication delays, automate repetitive inquiry management, summarize customer feedback, and assist in preparing multilingual product information. DergiPark-based studies on AI in fashion and communication-oriented processes show that artificial intelligence increasingly affects not only design and demand forecasting, but also customer interaction and sectoral communication models (Kaya, 2024).

At the strategic level, conversational AI contributes to organizational responsiveness and knowledge democratization. It may allow textile firms to transform dispersed institutional knowledge into accessible decision support, improve the quality of customer engagement, and reduce the time needed to convert market signals into managerial action. However, this derivative also introduces risks related to misinformation, brand tone inconsistency, and over-automation of relationship-sensitive interactions. Therefore, its strategic adoption requires governance mechanisms and human oversight.

### **2.5. Decision-Support AI: Enhancing Managerial Judgment**

Decision-support AI refers to systems designed to synthesize data, compare alternatives, generate recommendations, and assist managers in evaluating complex problems. These systems are especially relevant in contexts where decisions require balancing multiple criteria, such as supplier selection, production scheduling, sustainability investment, market entry, or product portfolio design. In textile enterprises, decision-support AI can incorporate data from sales, procurement, production, logistics, and sustainability metrics to strengthen strategic planning.

A data-driven intelligent decision support system developed for textile fabrics demonstrates how predictive analytics can be embedded into structured managerial decision processes, especially where product characteristics and production outcomes must be assessed together (Ribeiro et al., 2023). This line of research aligns with a broader transformation in strategic management: decision-making is no longer based solely on managerial experience or intuition, but increasingly on human-AI collaboration. AI may not replace judgment, but it can enlarge the informational horizon within which strategic judgment is exercised.

Accordingly, decision-support AI affects textile strategy by improving the quality, speed, and consistency of complex managerial choices. It can help firms compare sourcing alternatives, assess sustainability trade-offs, estimate market scenarios, and evaluate the likely outcomes of investment decisions. In strategic terms, this derivative increases the firm's analytical capability, which becomes increasingly valuable in a sector exposed to both global competition and rapid technological change.

### **2.6. Agentic AI: Toward Semi-Autonomous Strategic Systems**

The most recent and conceptually transformative derivative is agentic AI. Agentic AI refers to AI systems that can pursue goals, plan sequences of actions, interact with tools or digital environments, and execute multi-step tasks with a higher degree of autonomy than conventional assistants. Rather than responding only to direct prompts, agentic systems may monitor conditions, initiate actions, coordinate subtasks, and adapt their behavior to changing objectives.

Recent information systems literature identifies agentic AI as a new frontier because it combines reasoning, memory, tool use, and autonomous workflow execution, thereby opening possibilities for more active participation in organizational processes (Kumar, Wei, & Zhang, 2026).

For textile enterprises, agentic AI may represent a major strategic shift. An agentic system could, for example, monitor changes in raw material prices, compare supplier alternatives, flag potential delays, prepare production–scheduling options, and generate a management briefing. In design–intensive firms, agentic systems might coordinate between consumer trend analysis, generative design tools, and product assortment planning. In supply–chain management, they could track disruptions, recommend sourcing adjustments, and automate parts of procurement communication under defined managerial rules.

Yet the strategic promise of agentic AI should be approached cautiously. The literature emphasizes that agentic AI creates opportunities, but also introduces governance, security, accountability, and reliability challenges (Kumar et al., 2026). This is especially relevant for textile companies because errors in procurement, demand interpretation, or compliance–related decisions can generate substantial financial and reputational consequences. Therefore, the adoption of agentic AI should be framed not as full managerial substitution, but as the emergence of semi–autonomous strategic support architectures operating within clearly designed human control systems.

### 2.7. A Functional Classification of AI Derivatives in Textile Enterprises

Based on the discussion above, AI derivatives can be summarized according to their dominant strategic function is given in Table 1.

*Table 1. AI Derivatives and Strategic Contributions*

AI Derivative	Core Capability	Illustrative Textile Applications	Strategic Contribution
Predictive AI	Forecasting	Demand estimation, supply disruption prediction, inventory planning	Strategic foresight and resilience
Generative AI	Content and concept creation	Pattern design, digital prototyping, campaign concepts	Innovation speed and differentiation
Computer Vision AI	Visual interpretation	Fabric defect detection, quality control	Quality strategy and waste reduction

<b>AI Derivative</b>	<b>Core Capability</b>	<b>Illustrative Textile Applications</b>	<b>Strategic Contribution</b>
Conversational AI	Natural-language interaction	Customer service, supplier communication, internal knowledge access	Responsiveness and communication efficiency
Decision-Support AI	Recommendation and scenario analysis	Supplier selection, production planning, sustainability choices	Evidence-based managerial judgment
Agentic AI	Goal-oriented autonomous task execution	Workflow coordination, scenario monitoring, procurement support	Semi-autonomous strategic adaptation

This conceptual classification is central to the present study because it clarifies that the strategic influence of artificial intelligence in textile enterprises is not homogeneous. Each derivative affects a different component of strategy, yet their combined use may eventually create a more integrated AI-enabled strategic architecture. Predictive AI informs the future; generative AI expands creative alternatives; computer vision improves operational accuracy; conversational AI increases responsiveness; decision-support AI strengthens judgment; and agentic AI introduces coordinated autonomy. The strategic transformation of textile firms will therefore depend not only on whether they adopt AI, but also on which derivatives they combine, for what purposes, and under what organizational capabilities.

### 3. AI and Strategic Transformation in Textile Enterprises

The strategic transformation of textile enterprises has traditionally been discussed in relation to cost leadership, production efficiency, export competitiveness, and responsiveness to changing consumer demand. However, the emergence of artificial intelligence has begun to alter the very foundations of this strategic logic. AI is no longer confined to the automation of isolated operational tasks; it increasingly influences how firms interpret markets, configure value chains, organize innovation processes, and formulate long-term competitive priorities. In this regard, the rise of AI derivatives—particularly predictive, generative, and agentic systems—signals a shift from technology-assisted textile production to intelligence-enabled textile strategy (Bulut, 2026; Bermeo-Giraldo et al., 2025).

One of the clearest manifestations of this transformation is the expansion of AI from the production floor to the strategic core of the firm. Earlier digitalization initiatives in textiles mostly focused on machinery modernization, automation, and efficiency gains. Recent studies, however, show that digital transformation in the sector is increasingly linked with business performance,

product quality, market expansion, customer satisfaction, and supply-chain optimization (Bermeo-Giraldo et al., 2025). Similarly, digital transformation research emphasizes that supply-chain visibility, flexibility, and operational efficiency improve when advanced technologies such as AI, big data analytics, and digital networks are integrated into managerial processes (Boyacıoğulları, 2025). These findings indicate that AI affects strategy by enabling firms to compete not only through lower cost, but also through speed, adaptability, intelligence, and resilience.

In textile and fashion enterprises, this strategic shift is especially visible in the relationship between market sensing and value creation. The fashion segment is highly sensitive to rapidly changing consumer preferences, social-media-driven trends, and short product life cycles. AI applications are now used in areas such as trend analysis, demand forecasting, design assistance, virtual try-on technologies, customer communication, and product personalization (Kaya & Aytaç, 2024). From a strategic perspective, these applications allow firms to move from a largely intuition-based market approach toward a more data-informed and customer-responsive model. Generative AI strengthens this transformation by enabling rapid concept development and design variation, while predictive AI supports the anticipation of demand shifts and inventory needs. Together, they help textile firms align product strategy more closely with dynamic market signals (Kaya & Aytaç, 2024; Bulut, 2026).

A second strategic area concerns the reconfiguration of the textile value chain. The value chain of textile enterprises extends from raw material sourcing to design, manufacturing, logistics, retail, and post-consumption processes. AI can influence each of these stages, but its strategic significance arises from their integration. For example, demand forecasts may shape procurement choices; design preferences may inform production scheduling; quality-control data may affect supplier evaluation; and sustainability indicators may influence brand positioning. The literature on digital transformation in supply chains emphasizes that technology-driven integration strengthens organizational responsiveness and improves coordination across functions (Boyacıoğulları, 2025). In the textile sector, this suggests that AI-based strategy is not simply about adopting individual tools, but about constructing a more synchronized and adaptive enterprise architecture.

The sustainability agenda further deepens the strategic role of AI. Textile firms face growing pressure to reduce waste, improve traceability, manage resource efficiency, and respond to the broader expectations of circular economy policies. Recent research highlights that AI-related studies in textile and fashion increasingly intersect with sustainability, circularity, smart materials, and environmentally conscious production practices (Bulut, 2026; Mulayim, 2026). In addition, empirical research on textile manufacturing firms shows that AI can strengthen the relationship between green knowledge management and sustainable performance, especially when supported

by transformational leadership and organizational knowledge capabilities (Zhang et al., 2025). This indicates that AI is becoming part of a wider sustainability-oriented strategic capability, not merely a production technology. In other words, firms that use AI to reduce material waste, improve resource planning, and support eco-innovation may achieve both environmental and competitive gains (Zhang et al., 2025).

Yet, the strategic transformation generated by AI depends heavily on organizational readiness. Technology adoption alone does not guarantee strategic advantage. A recent study on digital maturity in textile enterprises finds that strategy, managerial support, market analysis, and strategic awareness are more decisive than technology usage competency by itself (Kahveci, 2026). This finding is highly important for the present article because it confirms that AI should be embedded in a broader managerial vision. Textile enterprises that acquire AI tools without adapting their organizational structures, decision-making routines, workforce capabilities, and strategic priorities may obtain only fragmented operational benefits. Conversely, firms that align AI investments with innovation strategy, sustainability goals, and long-term positioning are more likely to convert technological change into durable competitive advantage (Kahveci, 2026; Bermeo-Giraldo et al., 2025).

Accordingly, AI-driven strategic transformation in textile enterprises can be interpreted as a movement across three interconnected levels. First, at the operational level, AI improves efficiency, quality, forecasting, and coordination. Second, at the organizational level, it reshapes capabilities, knowledge flows, and decision-making processes. Third, at the strategic level, it influences how firms define competitiveness, sustainability, innovation, and market positioning. This layered transformation provides the foundation for the next section of the study, which examines the specific strategic impact dimensions of AI derivatives in textile enterprises in a more systematic way.

#### **4. Strategic Impact Dimensions and Proposed Model**

The strategic influence of AI derivatives in textile enterprises can be evaluated through a set of interconnected impact dimensions. As discussed in the previous sections, artificial intelligence does not affect firms through a single technological channel; rather, it transforms strategy by reshaping market intelligence, innovation capacity, operational architecture, sustainability orientation, and managerial decision systems. In this respect, the strategic value of AI in textiles emerges from the interaction between different AI derivatives and the specific competitive requirements of the sector. The following dimensions provide a structured discussion of this transformation.

#### 4.1. Strategic Foresight and Market Intelligence

One of the most important strategic contributions of AI is its capacity to strengthen foresight-oriented management. Textile and fashion markets are exposed to volatile consumer preferences, rapid seasonal shifts, social-media-driven trends, and international price fluctuations. Predictive AI systems can process large volumes of sales data, search behavior, customer feedback, and supply-chain indicators to generate more informed forecasts regarding demand, product life cycles, and market movements. In this sense, AI allows textile firms to shift from a reactive market posture toward a more anticipatory strategic orientation.

The literature increasingly emphasizes that AI-supported textile and fashion studies focus on trend forecasting, market analysis, and data-driven design orientation (Bulut, 2026; Mulayim, 2026). Likewise, digital maturity research in the textile sector suggests that firms that connect digital technologies with strategic awareness and market analysis are better positioned to transform technological adoption into organizational competitiveness (Kahveci, 2026). Therefore, AI-driven market intelligence should be viewed not merely as a forecasting tool, but as a mechanism that informs product portfolio decisions, target-market selection, and timing strategies.

#### 4.2. Innovation, Design, and Product Differentiation

A second strategic impact dimension concerns innovation and product differentiation. In textile enterprises, competitive advantage increasingly depends on the ability to develop distinctive designs, reduce concept-to-market time, and respond to fragmented consumer preferences. Generative AI becomes particularly relevant at this point because it expands the creative search space of firms. It can support pattern generation, color combinations, visual alternatives, collection concepts, digital prototyping, and even individualized product ideas (Öz & Alimova, 2026).

Recent studies underline that AI in textile and fashion design contributes to personalized production, trend-sensitive design development, and the integration of creativity with computational systems (Bulut, 2026). The growing literature on AI-driven sustainability in textile and fashion design also shows that digital fashion, smart textiles, and circular innovation have become dominant thematic clusters in recent research (Mulayim, 2026; Öz & Kalkan, 2023). These findings suggest that generative AI is not merely an auxiliary design technology; it may directly affect innovation strategy by enabling experimentation at lower cost, increasing variation, and reducing the risks associated with physical sample development.

From a strategic perspective, this transformation pushes textile firms from product replication toward AI-assisted differentiation. Companies that combine human creativity with generative AI capabilities may achieve faster new-product development, more accurate alignment with niche

market segments, and stronger brand uniqueness. Yet, the persistence of human aesthetic judgment remains essential, particularly in premium textiles, fashion identity, and culturally embedded design processes.

### **4.3. Operational Excellence, Supply-Chain Agility, and Resilience**

The third strategic dimension is the contribution of AI derivatives to operational excellence and supply-chain agility. Textile enterprises must balance cost, quality, speed, and flexibility within complex production and sourcing systems. Computer vision, predictive analytics, and decision-support AI can improve fabric defect detection, predictive maintenance, cutting optimization, demand planning, supplier evaluation, and inventory management. When these technologies are integrated, the firm's operational system becomes more responsive and less vulnerable to uncertainty.

Research on AI and sustainable textiles highlights the importance of automated quality control, garment-condition assessment, and data-driven textile sorting for circular processes (Randjbaran, 2025; Nisa et al., 2025). Similarly, studies on textile digital maturity indicate that competitiveness increasingly depends on the alignment of technological capabilities with managerial strategy rather than on isolated automation efforts (Kahveci, 2026). In strategic terms, AI enables textile firms to develop agile value chains capable of adjusting production and procurement decisions in line with evolving demand and resource constraints.

This dimension is especially critical for export-oriented textile manufacturers facing external shocks such as raw material price changes, delivery uncertainty, energy costs, and regulatory pressures. Firms that use predictive and decision-support AI more effectively may strengthen resilience while reducing excess stock, rework, and delayed responses to market changes. Thus, AI contributes to a shift from a traditionally cost-centered production strategy toward a resilience-centered operational strategy.

### **4.4. Sustainability, Circularity, and Resource Strategy**

The fourth impact dimension is the role of AI in advancing sustainability-oriented strategy. The textile industry is under growing pressure due to material waste, water consumption, chemical use, carbon emissions, and the broader regulatory momentum surrounding circular economy practices. AI derivatives can support sustainability through waste minimization, zero-waste design, optimized dyeing processes, material traceability, garment-condition assessment, and textile-to-textile recycling systems (Öz, 2020).

Recent systematic and bibliometric studies show that AI applications in textiles are increasingly discussed within the framework of circular economy transitions, sustainable fashion, smart

textiles, and eco-efficient design (Nisa et al., 2025; Mulayim, 2026). Furthermore, research conducted on textile manufacturing firms suggests that AI can reinforce the positive relationship between green knowledge management and sustainable performance, particularly when embedded in a broader organizational commitment to eco-innovation (Zhang et al., 2025). These findings indicate that AI should be seen as a component of resource strategy, not merely as an instrument of operational efficiency.

For textile companies, this means that sustainability can become more measurable, more controllable, and more strategically integrated. AI may help firms identify waste-intensive stages, optimize resource allocation, and generate more transparent sustainability claims. Nevertheless, the environmental value of AI depends on its actual integration into decision systems; if it is used only to increase volume and speed without circular principles, it may reinforce rather than reduce unsustainable production patterns.

#### **4.5. Managerial Decision-Making, Organizational Capability, and Human-AI Collaboration**

The fifth dimension concerns the transformation of managerial decision-making and organizational capabilities. Textile strategy has historically relied on the experience of owners, designers, purchasing managers, and production specialists. AI now introduces a new layer of analytical support that can assist in scenario evaluation, supplier comparisons, product planning, and sustainability trade-offs. As a result, strategic decision-making becomes more data-intensive and less dependent on fragmented intuition (Öz et al., 2019).

The emergence of agentic AI extends this transformation further. According to the OECD's 2026 conceptual report, agentic AI systems are characterized by their ability to pursue goals, plan actions, use tools, and operate with varying degrees of autonomy (OECD, 2026). For textile enterprises, this may open new possibilities in procurement monitoring, market scanning, production coordination, and routine strategic reporting. However, the same literature stresses that agentic systems require strong oversight, accountability, and careful governance because autonomy without control may generate operational and reputational risks (OECD, 2026).

Thus, the strategic challenge is not whether AI will replace managers, but how managers will develop human-AI collaborative governance. Textile firms need digital leadership, data literacy, cross-functional coordination, and ethical awareness in order to turn AI adoption into strategic competence. In this sense, the future textile enterprise will likely be one in which human expertise, domain knowledge, and AI-supported analytical capacity are combined within a more adaptive decision architecture (Öz, et al., 2019).

#### 4.6. Proposed Model: AI Derivatives–Strategic Transformation Framework for Textile Enterprises

Based on the literature and the preceding discussion, this study proposes the AI Derivatives–Strategic Transformation Framework for Textile Enterprises. The model argues that different derivatives of artificial intelligence influence distinct but interconnected layers of enterprise strategy. (Table 2)

*Table 2. AI Derivatives and its Outcomes in Textile.*

AI Derivative	Primary Strategic Function	Textile Enterprise Outcome
<b>Predictive AI</b>	Anticipation and forecasting	Demand visibility, market foresight, inventory planning
<b>Generative AI</b>	Creative expansion and innovation	Faster design cycles, customized products, brand differentiation
<b>Computer Vision AI</b>	Perception and quality control	Defect reduction, lower waste, process reliability
<b>Conversational AI</b>	Interaction and knowledge access	Enhanced customer communication, supplier coordination, internal learning
<b>Decision-Support AI</b>	Analytical recommendation	Better scenario planning, supplier evaluation, sustainability decisions
<b>Agentic AI</b>	Goal-oriented semi-autonomous execution	Workflow orchestration, monitoring, proactive strategic support

The proposed model rests on three assumptions. First, AI derivatives are complementary rather than substitutive; textile firms are likely to benefit most when they combine several derivatives according to their strategic priorities. Second, technological adoption produces strategic value only when matched with organizational capability, including digital maturity, leadership commitment, workforce development, and data governance. Third, the highest strategic impact emerges when AI moves beyond efficiency improvement and becomes embedded in competitive positioning, innovation logic, and sustainability strategy.

Accordingly, the model suggests a progression from AI-enabled operations to AI-informed strategy, and finally to AI-integrated enterprise transformation:

Operational Stage: AI is used for isolated efficiency gains such as defect detection or forecasting.

Strategic Stage: AI begins to influence design, market positioning, and supply-chain decisions.

Transformational Stage: Multiple AI derivatives are integrated into the firm's innovation, sustainability, and managerial decision architecture.

This framework contributes to the literature by consolidating fragmented discussions on textile AI applications into a single strategic perspective. It also provides a conceptual basis for future empirical studies that may test relationships among AI adoption, digital maturity, strategic agility, innovation performance, and sustainable competitiveness in textile enterprises.

## 5. Conclusion and Policy/Managerial Implications

The rapid diversification of artificial intelligence into predictive, generative, conversational, computer-vision-based, decision-support, and agentic forms is reshaping the strategic landscape of textile enterprises. This transformation extends far beyond the automation of repetitive tasks or the digitalization of isolated business functions. Rather, AI derivatives increasingly influence how textile firms design products, interpret consumer demand, optimize production, manage supply chains, pursue sustainability objectives, and redefine their competitive positions. In this regard, the strategic value of AI does not arise merely from technological adoption, but from the ability of enterprises to integrate these technologies into their decision-making architectures, organizational capabilities, and long-term business models.

The analysis developed in this study suggests that textile enterprises are entering a new phase in which competitive advantage will depend on the capacity to orchestrate multiple AI derivatives in a complementary manner. Predictive AI supports forecasting and operational efficiency; generative AI enables creative design, marketing content, and rapid prototyping; computer vision improves quality control and waste reduction; conversational AI enhances customer engagement; and agentic AI introduces a more autonomous form of workflow coordination and strategic execution. When these technologies are deployed in a fragmented or experimental manner, their impact remains limited. However, when they are embedded within a coherent strategic framework, they can contribute to a broader transformation of value creation, organizational agility, and market responsiveness. Recent industry analyses similarly emphasize that firms generating measurable value from AI are those that redesign workflows, build data and talent infrastructures, and link AI investments directly to growth, innovation, and operating-model transformation rather than treating them as isolated digital tools (McKinsey & Company, 2025; World Economic Forum, 2025).

For textile companies, one of the most important implications is that AI strategy should not be reduced to technology procurement. Managers should first identify the strategic problem they aim to address: shortening design cycles, reducing inventory risk, improving sustainability performance, increasing customization, strengthening supplier coordination, or accelerating

international market entry. The relevant AI derivative should then be selected in accordance with this strategic need. For instance, generative AI may be particularly valuable for trend-sensitive fashion design and personalized product development, whereas predictive analytics may be more critical for yarn demand planning, energy consumption forecasting, or inventory optimization. Likewise, agentic AI may become increasingly relevant in multi-stage textile operations where procurement, production scheduling, logistics, and customer communication require coordinated decision flows. The strategic question, therefore, is not simply “Which AI tool should be adopted?”, but rather “Which strategic capability should be strengthened through which AI derivative?”

A second managerial implication concerns the necessity of organizational readiness and human capability development. Textile firms, especially small and medium-sized enterprises, may face significant barriers related to data quality, digital skill gaps, investment capacity, and resistance to organizational change. The literature on AI and digital transformation in textiles indicates that sustainability-oriented applications—such as waste reduction, circular production, optimized material use, and process efficiency—depend not only on algorithmic capacity but also on institutional learning, interdisciplinary collaboration, and operational discipline (Randjbaran, 2025; Yildiz & colleagues, 2026). Therefore, managers should treat AI transformation as a capability-building process. This requires upskilling employees, creating cross-functional teams that bring together textile engineers, designers, data specialists, and strategic managers, and developing internal governance mechanisms for the responsible use of AI-generated outputs.

A third implication relates to sustainability and circular economy strategies. Textile production is widely associated with high resource use, waste generation, and pressure for more transparent and traceable supply chains. AI derivatives offer important opportunities in this field: fabric defect detection, demand-sensitive production planning, smart recycling systems, material innovation, and more precise sustainability reporting. Nevertheless, these opportunities should be framed carefully. AI should not be presented as an automatic solution to sustainability problems; instead, it should be understood as an enabling infrastructure that can improve the accuracy, speed, and scalability of sustainability-oriented decisions. In this sense, future-oriented textile enterprises will likely be those that connect AI deployment with circular design, low-waste manufacturing, transparent sourcing, and environmental performance indicators, rather than focusing exclusively on cost reduction.

From a policy perspective, the findings point to the need for a sector-specific AI transformation agenda for textiles. Public institutions should support the diffusion of AI capabilities among textile SMEs through incentive programs, digital innovation hubs, shared testing infrastructures, and applied training models. Since the textile sector in many countries includes a large number of medium- and small-scale firms, the unequal diffusion of AI may widen the productivity gap

between technologically advanced firms and traditional manufacturers. Policymakers should therefore prioritize accessible AI literacy programs, sectoral data platforms, collaborative university–industry projects, and financial instruments that reduce the adoption costs of strategically relevant AI systems. Moreover, public policy should encourage the development of standards for data governance, algorithmic transparency, intellectual property protection in AI–assisted design, and ethical responsibility in workforce–related applications.

Another crucial policy issue is the relationship between AI transformation and employment. Current evidence indicates that AI adoption may not simply eliminate jobs but can reorganize occupational structures, increase demand for hybrid skills, and reshape the division of labor between humans and intelligent systems. At the same time, organizations expect more noticeable workforce effects in the coming years, which makes proactive skills policy essential (McKinsey & Company, 2025). In the textile sector, this means that vocational education and university curricula should increasingly integrate data literacy, AI–supported design, smart manufacturing, digital sustainability, and human–AI collaboration. Rather than preparing workers for a disappearing industrial model, education systems should prepare them for an AI–augmented textile ecosystem.

Overall, this study argues that the strategic impact of AI derivatives in textile enterprises should be understood through a multidimensional lens that connects technology, organizational transformation, sustainability, and competitiveness. The proposed framework highlights that AI becomes strategically meaningful only when it is aligned with business objectives, supported by institutional capacity, and embedded into an adaptive managerial logic. Future research may empirically test this framework across different segments of the textile value chain, compare the strategic effects of specific AI derivatives, or examine how firm size, export orientation, and digital maturity moderate the relationship between AI adoption and strategic performance. In this way, the discussion can move beyond the general claim that “AI changes industries” toward a more precise understanding of how different forms of AI reshape strategy in one of the world’s most dynamic and transformation–sensitive sectors.

## References

- Aksoy, C. (2023). İşletmelerin dijital dönüşümü ve dijital liderlik yaklaşımı. *DergiPark*. Open access.
- Bermeo–Giraldo, M. C., et al. (2025). Research agenda on the evolution of digital transformation in the textile sector: A bibliometric analysis and research trends. *Discover Sustainability*. Open access.
- Boyacıoğulları, H. S. (2025). Dijital dönüşüm ve tedarik zinciri yönetimi ilişkisi: Bir araştırma. *İnternet Uygulamaları ve Yönetimi Dergisi*, 16(2). Open access via *DergiPark*.

- Bulut, S. (2026). Artificial intelligence in textile and fashion design: A bibliometric analysis. *Journal of Innovative Engineering and Natural Science*, 6(1), 88–104. Open access via DergiPark.
- Çörekcioglu, M. (2021). Yapay sinir ağı yöntemlerinin tekstil sektöründe kullanım alanları. DergiPark. Open access.
- Duman, M. Ç. (2024). Üretimde dijitalleşmenin kalite üzerine etkileri. DergiPark. Open access.
- Jebbor, I., Benmamoun, Z., & Hachimi, H. (2024). Forecasting supply chain disruptions in the textile industry using machine learning: A case study. *Ain Shams Engineering Journal*, 15(12), 103116. Open access.
- Kahveci, E. (2026). Assessing digital maturity in the textile sector: An integrated MEREC and OCRA approach. *Administrative Sciences*, 16(3), 135. Open access.
- Kaya, Ö. (2024). Fashion sector and artificial intelligence applications. *Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*. Open access via DergiPark.
- Kaya, Ö., & Aytaç, S. (2024). Fashion sector and artificial intelligence applications. *Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 14(4), 1100–1122. Open access via DergiPark.
- Kumar, N., et al. (2026). Agentic artificial intelligence as a new frontier in enterprise transformation. *Information & Management*. International indexed journal.
- Kumar, N., Wei, X., & Zhang, H. (2026). Agentic artificial intelligence as a new frontier in information systems: Promise, peril, and research opportunities. *Information & Management*, 63(3), 104317. Open access.
- Mulayim, B. B. (2026). Tekstil ve moda tasarımında sürdürülebilirlik ve yapay zekâ etkileşimi: 2019–2025 arası küresel araştırma eğilimleri. *Gazi University Journal of Science Part C: Design and Technology*. Open access via DergiPark.
- Nisa, H., et al. (2025). A systematic review of reimagining fashion and textiles through artificial intelligence for circular economy transitions. *Applied Sciences*, 15(10), 5691. Open access.
- OECD. (2026). The agentic AI landscape and its conceptual foundations. *OECD Artificial Intelligence Papers*, No. 56. Open access.
- Ozek, A. (2025). Artificial intelligence driving innovation in textile defect detection. *Textiles*, 5(2), 12. Open access.
- Öz, S., Dindarık N., Duman, F. (2019). Schumpeteryan Girişimcilik ve 21. Yüzyıl Girişimcilik Yaklaşımları: Y Kuşağı Girişimcileri Üzerine Nitel Bir Araştırma, *opus* (13), pp. 1059–1091.
- Öz, S. (2020). Genel Teknoloji ve Dijital Dönüşüm Teorisine Giriş. Book Chapter in “Teknolojik ve Dijital Dönüşüm”, Nobel, pp. 169–192.
- Öz, S., Kalkan, M. (2023). GIG Ekonomisi ve Emek Piyasaları Bibliometrik Analizi. Chapter in the Book: “Cumhuriyetin 100. Yılında Türk Emek Piyasasının Güncel Sorunları”, Filiz Kitabevi, pp. 189–212.
- Öz, S., Alimova, D. (2026). *Innovation in Textile Industry*, BeTa Science Association, İstanbul.

- Özkan, E. B. (2026). Tekstil üretim süreçlerinde hata tahmini ve önlenmesi: Yapay zekâ ve makine öğrenmesi yaklaşımı. Pamukkale University Journal of Engineering Sciences. Open access via DergiPark.
- Özlü, P. G., & Demir, N. E. (2024). Moda tasarımı sürecinde üretken yapay zekâ destekli sistemler. STAR Sanat ve Tasarım Araştırmaları Dergisi, 5(8), 110–122. Open access via DergiPark.
- Randjbaran, E. (2025). Artificial intelligence for sustainable textiles: A review of circular economy applications. Textile Science and Research Journal. Open access.
- Ribeiro, R., et al. (2023). A data-driven intelligent decision support system that assists in evaluating textile fabrics. Neural Computing and Applications, 35, 23141–23164. Open access.
- Ruokonen, M. (2025). Managing generative AI for strategic advantage. Research-Technology Management, 68(4), 2–10. Open access.
- Wu, X., & Li, L. (2024). An application of generative AI for knitted textile design in fashion. The Design Journal, 27(2), 270–290. Open access.
- Yıldız, İ. (2023). Yapay zekâ: Bir tehdit mi? Bir yardımcı mı? Tekstil sektörü çalışanlarının değerlendirmeleri. DergiPark. Open access.
- Zhang, J., et al. (2025). Empowering eco-innovation: How artificial intelligence and green leadership enhance knowledge capital for sustainable performance. Journal of Environmental Management. Indexed international journal.