Digitilization the path for sustainable growth of Indian textile industry

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ABSTRACT

This article outlines the reasons why the Indian textile industry has to become digital, the difficulties it has experienced, and the ways in which the sector has adapted to digitalisation to overcome the negative effects of the COVID-19 pandemic and achieve sustained development in both domestic and international markets. India's textile sector is among the oldest in the nation and, after agriculture, provides the second-highest number of jobs. Both expert and unskilled workers are employed by it. The handloom, wool, handicrafts, silk, and other varied items are produced by the Indian textile and clothing sector. The sector is the world's top producer of jute and cotton, the second-largest producer of silk, and the source of 95% of hand-woven textiles sold worldwide is India. The COVID-19 epidemic had a devastating impact on the textile sector, directly or indirectly affecting every worker in the supply chain. Fortunately, the industry was able to turn the COVID-19 problem into an opportunity by embracing digitalisation and investigating the online textile market, which helped to revitalise the sector. By using digital technology and altering the business model, digitalisation refers to the process of transitioning to a digital economy and exploring new avenues for generating value and money. The present company model was not inherently abandoned by the digital transition; rather, the new digital value chain model enhanced the conventional setup. The industry's online skills in demand creation, operations management, supply chain management, digital marketing, e-commerce platforms, logistics, and stock management have all accelerated thanks to digitalisation. By incorporating essential supply chain technologies like the internet of things, artificial intelligence, machine learning and data analytics, automation and robots, direct to customer, etc., the sector gained a competitive edge. The Indian textile and clothing sector was valued at 223 billion US dollars in 2021, according to Statista, and it is expected to generate US$51.11 billion in income from the production of textiles in 2022—a consistent rise over the previous year. The textile sector has seen both possibilities and problems as a result of digitisation. However, the sector must overcome these obstacles since digitalisation is essential to the sector's long-term, sustainable development.

Key words: Digitalization, Artificial intelligence, Automation, Robotics, Machine learning

Introduction

The textile industry in India has a significant historical legacy, being one of the oldest sectors in the country. Agriculture is the only sector that generates a greater number of employment opportunities compared to the industry. The initiative generated employment opportunities for both skilled and unskilled workers. In India, the textile industry is a significant source of employment, directly engaging around 45 million people. Additionally, it provides employment opportunities for an additional 60 million individuals in associated sectors, including women and the rural population. The Indian textile and apparel industry is responsible for the production of a diverse range of things, including handloom products, wool garments, handicrafts, silk fabrics, and several other goods. This enterprise include activities such as spinning, weaving, processing, and apparel making. The textile and clothing sector contributes around 14% to the nation's industrial production and approximately 3% to its gross domestic product. The textile industry accounts for around 8% of the aggregate excise tax revenue collected. The textile industry in India has enormous importance both inside the country and on the global stage. The manufacturing of fibre, yarn, and fabric is widely recognised as the second-largest sector globally, holding significant importance. India ranks sixth in terms of synthetic fibre production. The textile industry contributes around 15% of India's export earnings.

Impact of COVID-19 on Textile industry

The emergence of the COVID-19 pandemic has had a significant and adverse effect on both the worldwide and Indian textile industry. The pervasive ramifications of the Covid-19 pandemic have precipitated significant transformations in several numerical indicators, resulting in a substantial contraction of the business.

The domestic market had a significant decline characterised by a substantial increase in cancellations and a notable decrease in order placements. The drop in consumer wants led to a lack of monetary circulation in the market. The workforce saw significant impact, resulting in the displacement of millions of skilled and unskilled labourers who were compelled to relocate back to their respective places of origin. Small-scale industries had significant hardships due to substantial obligations and a lack of revenue, resulting in the closure of several enterprises in a permanent manner. The impact has been significant, resulting in a contraction of around 28-30% in the growth forecast for the textile and clothing sector. The worldwide supply chain has seen significant challenges due to the cancellation of orders, non-payment of bills, logistical disruptions, and other related issues. The supply chain serves as a fundamental component of the Textile Industry, playing a crucial role in generating profits via its robust and integrated structure. Prominent corporations were terminating or deferring their orders, so impacting the small-scale enterprises engaged in the supply chain. The current circumstances have had a significant influence on the labour force, since it represents their only source of income. Significant global shifts have been noted in the realm of marine transport, including a decrease in the frequency of sailings and a decline in cargo needs. The domestic market saw a contraction of around 28% to 30%, resulting in a reduction in value to USD 61 billion, as a consequence of the pandemic epidemic.

Digitalization

The textile sector effectively transformed the challenges posed by the COVID-19 crisis into an opportunity by embracing digitalisation and venturing into the internet market for textiles. This strategic shift not only revitalised the business but also brought it a sense of renewal. Digitalisation refers to the use of digital technology in order to transform a company model and provide novel avenues for income and value creation. It encompasses the transition towards a digital-centric corporate framework. The digital transformation did not explicitly discard the existing business model; rather, it enhanced the previous framework with the introduction of the digital value chain model. The advent of digitalisation has facilitated the sector in enhancing its online skills across several domains such as demand creation, operations management, supply chain management, digital marketing, e-commerce platforms, logistics, and stock management. The garment business in India has seen a significant transformation due to the process of digitalisation. This transformation has presented a chance for India to capitalise on the Covid-19 issue. As a result, India has swiftly established itself as a prominent supplier of medical textiles, thus attaining the second place globally in terms of medical textile manufacturing.

The advent of digitalisation has had a profound impact on the buying behaviours of both business-to-business (B2B) and business-to-consumer (B2C) transactions. Cloud-based communication technologies have significantly transformed the sustainability and resource efficiency in manufacturing, leading to enhanced transparency and sustainability within supply chains and production processes. This phenomenon will have an impact on the buying behaviours of both business-to-business (B2B) and business-to-consumer (B2C) transactions.

Need for digitalization

In contemporary society, consumers with a strong affinity for technology anticipate the provision of superior goods, personalised services that provide additional benefits, as well as prompt delivery and consultation via subscription-based models. Within the textile industry, there are promising prospects for automation via the use of digital technologies such as the Internet of Things (IoT), artificial intelligence, and enterprise resource planning (ERP). These innovations provide the potential to enhance several aspects of the fabrication process, including design, coloration, fibre construction, fabric production, finishing, and distribution. In addition, the implementation of digital transformation within the textile sector will address other intricate elements, including the management of dye stock, coordination of staff activities, and monitoring of equipment. Additionally, this will empower players to surpass consumer expectations, embrace a transparent and comprehensive value chain across several channels, and discern profitable customer connections and company sectors. These factors are essential prerequisites in a progressively demand-oriented economy.

Currently, the global community finds itself in the middle of a new era of industrialisation, sometimes referred to as the new industrial revolution. This revolution is distinguished by the emergence and integration of sophisticated robotics, artificial intelligence, the Internet of Things, cloud computing, and several other technological advancements. Industry 4.0 is the forthcoming paradigm of manufacturing technology, embodying a significant and escalating tendency towards automation and the sharing of data. The integration of advanced technology, digital systems, and automated processes will enable the production of high-quality goods with increased efficiency and cost-effectiveness. Through the process of adapting to digitisation and digital transformation, individuals are able to change their traditional manufacturing processes into what is often referred to as a "Smart Factory."

Digitalization in Textile industry

1. Application of Internet of Things

The notion of the Internet of Things (IoT) entails the establishment of a network including tangible entities. The term "things" refers to physical entities or items. The Internet of Things (IoT) refers to the exchange and manipulation of data, as well as the limited control over physical items, facilitated by sensors, software, and other technologies. The use of this technology has the potential to significantly decrease human labour, mitigate the occurrence of mistakes, and minimise deviations from desired outcomes. The Internet of Things (IoT) has significant potential for use within the manufacturing sector, including the textile industry, spanning from the first stages of fibre production to the final production of fabric. The incorporation of Internet of Things (IoT) technology into spinning and weaving machines has been shown to be beneficial in optimising various processes and significantly reducing the occurrence of problems. The use of monitoring systems for intermediate processes and the automated collection of data may contribute to the improvement of quality, reduction in time, manpower, paperwork, machine stoppage time, and cost, while simultaneously boosting production efficiency. The monitoring of data from machines has the capability to provide real-time visibility of the operation.

The use of virtual digital sampling tools has facilitated the creation of samples that closely resemble the final products. The integration of these tools with contemporary Computer Aided Design (CAD) systems has resulted in a reduction in fabric waste and enhanced the system's flexibility. The use of 3D printing and 4D printing technologies has significantly influenced the industrial industry in terms of final product production. The advancements in automated needlework machines have significantly improved their capabilities, resulting in enhanced accuracy, repeatability, and reduced time and human labour required for making needlework and patterns.

The use of the Internet of Things (IoT) offers several benefits within the sales domain of the textile industry. One of the primary benefits is that it enables the efficient management of large volumes of data. In contemporary marketing practises, advertisements have evolved to focus on certain demographic segments, use individuals' search histories as a basis for targeting.

The field of E-Textile is now seeing significant growth, with a projected annual growth rate of 30.4% according to recent survey data. The aforementioned area has significant potential for future development, with existing applications spanning several domains such as medicine, defence, fashion, sustainability, energy, and manufacturing.

2. Artificial intelligence

Artificial intelligence (AI) encompasses the emulation of human intellect in intelligent devices that are designed to exhibit human-like thinking and behaviour via programming. Artificial intellect (AI) is a subfield within the discipline of computer science that focuses on the development of computers capable of executing activities that traditionally need human intellect. The automation of textile industry is being implemented in response to the growing customer demand. The use of artificial intelligence (AI) in many industries has been shown to effectively mitigate the occurrence of errors and maintain a low level of production costs. Textile manufacturing incorporates this process across all phases of preproduction, production, and postproduction.

Artificial intelligence (AI) is being used to a greater extent in numerous aspects of design creation, production planning and management, fabric spreading, cutting, bundling, sewing operations, pressing, ironing, packing, and quality control, among others. Artificial intelligence (AI) has found significant use in the textile sector, manifesting in many crucial applications.

The use of artificial neural networks is prevalent within the textile industry across several domains.

a. Fabric defect identification: The presence of defects in fabric has a negative impact on the overall value of textile items. Any imperfection present in the cloth is transferred to the end product, perhaps leading to its rejection. Therefore, it is important to assess the fabric's quality before to the production process. The process of fabric inspection involves the manual examination of textiles by proficient personnel with illuminated tables and specialised equipment. The aforementioned method has a sluggish pace and often permits defects to go undetected in the final result. In this particular scenario, the use of artificial intelligence (AI) has the capability to execute this undertaking at an accelerated pace, exhibiting much enhanced precision, all while avoiding the effects of tiredness. The use of artificial intelligence may facilitate the anticipation of fabric qualities prior to the production process via the application of neuro-fuzzy or alternative systems. This is achieved by leveraging the yarn and fabric's constructional data.

b. Pattern inspection: Fabric patterns may include several elements, such as weaving, knitting, braiding, finishing, and printing, among others. The use of vision-based inspection in lieu of visual inspection has the potential to mitigate human tiredness and mistakes in the identification of anomalies and faults, hence benefiting manufacturers. Artificial intelligence methods, such as Artificial Neural Networks (ANN), are used in the textile sector to identify defects during fabric inspection. Various multi-layer back propagation algorithms are used for the training and testing of this artificial neural network (ANN) system. The algorithm acquires knowledge about the weaving pattern, yarn qualities, colours, and acceptable defects via analysis of the provided photos.

c. Colour matching: The incorporation of colour has significant importance in the realm of textile goods. The perceived quality of a textile product is often associated with its visual appearance. The acceptability or satisfaction of a product's colour might be assessed, or it can be evaluated in more detail, such as being deemed "too light," "too dark," "too red," or "too green." In order to address this issue, it is possible to design an artificial intelligence (AI) system that incorporates a binary classification mechanism, namely a 'Pass/Fail' feature. This implementation aims to enhance both the precision and effectiveness of the AI system.

d. SCM: The field of fashion encompasses the management of supply chains, which involves the movement of various components such as fibres, yarns, fabrics, clothes, trimmings, and accessories between different manufacturing sites or retail locations. Supply chain management (SCM) is a comprehensive framework that encompasses a range of business processes, activities, information, and resources with the objective of generating value for buyers. The implementation of Standard Supply Chain Management has the capacity to effectively control costs and enhance corporate competitiveness.

3. Enterprise Resource Planning: Enterprise Resource Planning (ERP) is a comprehensive corporate tool that facilitates the methodical management of activities, hence enhancing production and time efficiency. Enterprise resource planning (ERP) refers to a software solution that effectively caters to the requirements of a company by adopting a process-oriented approach. Its primary objective is to closely align all activities within the organisation in order to achieve the organisational objectives.

ERP software's are available in different sectors in textile. Such as

- ERP software for home textiles,
- ERP software for Spinning mills,
- ERP software for weaving mills,
- ERP software for textile processing mills

Enterprise Resource Planning (ERP) plays a crucial role in facilitating both the design (Computer-Aided Design or CAD) and production (Computer-Aided production or CAM) aspects of product development. Moreover, ERP systems also oversee the comprehensive operations of the textile sector. Enterprise Resource Planning (ERP) encompasses a wide range of organisational functions, including procurement, production, distribution, accounting, human resources, corporate performance and governance, customer services, and sales. Additionally, this encompasses the domains of business intelligence, enterprise asset management, electronic commerce, and various other strategies pertaining to business operations.

4. Robotics

Robotics has emerged as a highly dependable technological domain that exhibits remarkable responsiveness in adapting to dynamic changes. In contrast to other modes of automation, robots possess a high degree of adaptability. By using appropriate resources, it is possible to modify a product line within a timeframe ranging from a few hours to many days or even weeks. The duration of implementation for this particular automation is relatively shorter compared to other forms of automation. The textile sector is now using a range of very effective robotic applications.

a. Robot printing and drawing: Robotic systems are highly suitable for the tasks of printing and drawing, since they possess the capability to automatically code intricate pathways, provided that appropriate tools are used.

b. Logistics transportation: Picking, packaging, warehousing, and sorting are few tasks that may be effectively executed with the use of robotic systems.

c. Bale handling: The handling of bales is an ideal application for large-scale industrial robots, since they possess the capability to handle weights of about 2 tonnes. These machines may be readily programmed to independently do tasks like as picking, stacking, and sorting bales.

d. 3D fiber structure printing: 3D printing has emerged as a recent advancement in the field of robotic textile production. The automated system manipulates the textile material to conform to the desired three-dimensional configuration, while the curing agent solidifies the material, securing it in its final position.

e. Laser welding: In recent times, there has been a notable departure from the conventional practise of sewing as the only method for fabricating material connections. The use of laser welding techniques enables the fusion of two fabric pieces by the application of a laser.

f. Fabric testing: Robotic systems provide a viable approach for conducting comprehensive testing procedures that require subjecting materials to diverse stress conditions.

g. Complex sewing: The act of sewing presents a significant level of difficulty within the realm of textile manufacture, especially in the context of garment production. The Sewbo system, which has been used by the textile industry, involves the temporary transformation of cloth into a solid form using a stiffener. This enables the autonomous sewing of seams.

Findings

This paper examines many digital developments within the sector. The positive implications of the transition of industries towards digitalisation have been emphasised. The advent of the Internet of Things (IoT), Artificial Intelligence (AI), Enterprise Resource Planning (ERP), and Robotics has significantly enhanced the operational agility of industries, enabling them to be always prepared to confront shifts in both local and worldwide markets.

Conclusion

The adoption of digitalisation has transitioned from being a discretionary choice to a mandatory need for the industrial sector. The future of sustainable development in the industrial sector lies on the use of automation and digitalisation. Digitalisation encompasses a wide range of organisational functions, including procurement, manufacturing, distribution, accounting, human resources, corporate performance and governance, customer services, and sales.

Additionally, this encompasses the domains of business intelligence, corporate asset management, electronic commerce, and several other methods pertaining to company operations. The strategic combination of forward-thinking and pragmatic strategies towards digitalisation may lead to significant benefits for both the sector and the economy, considering the prominent role of digital technology in today's global landscape.

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