Chapter 4
Scalable Textile Business Intelligence With Operational Data Collection and Analytical Processing

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ABSTRACT

Many textile companies have come to the realization that data is crucial for improving sales and revenue margins. Clothing brands and retailers must develop manufacturing and sales styles that appeal to customers. In recent decades, with advancements in various categories of data analytics and artificial intelligence techniques (e.g., machine learning), the value of data-driven applications has been well acknowledged by textile clothing retailers. They use predictive software outputs for regular operational decision-making. This chapter reviews retail businesses and their products' manufacturing data analytics. It presents a scalable business intelligence framework using a graph data model and its management system. The chapter also highlights that big data technologies and related supporting resources (e.g., the Internet of Things) enable real-time data capture, storage, processing, and sharing. This helps businesses make operational decisions faster and more effectively. This chapter presents an algorithm for extracting knowledge from stored business data to exemplify the analytical value of the graph database model for business intelligence.

INTRODUCTION

The textile and clothing industry is a significant part of the global economy (Pal & Yasar, 2020). In 2000, consumers spent around one trillion US dollars on clothing, with one-third spent in Western Europe, one-third in North America, and one-quarter in Asia. Clothing and textiles account for seventy per cent of total world exports, and developing countries, particularly in Asia, dominate the sector. These global

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business records and the recent coronavirus pandemic significantly challenge the textile industry. The pandemic has caused disruptions in the industry, including adopting remote work and economic slowdown.

However, the business world started to work better in 2023, and it was arguably the first full post-pandemic year – and with that, the business world observed certain things return to "normal". Travelling increased, many people spent more time at the office, face-to-face commerce no longer took place through protective masks, and people came to retail shops to buy clothes. Here are many channels that either emerged or persisted. Inflation continued to swell, with only recent, partial relief in some parts of the world. Economic uncertainty and a global cost-of-living crisis have been at the forefront of individuals' and business organizations' minds. In particular, the industry needs to understand the changing buying behaviours and preferences.

To make informed decisions in these uncertain times, textile and clothing companies rely on artificial intelligence (AI) techniques for interpreting business operational data. However, more than merely having data and advanced technology is required. Businesses must be able to turn data into insights and insights into action to realize their value. Moreover, AI can aid textile and clothing companies in augmenting data-driven decision-making, improving their capabilities, and maximizing their impact on the business.

Different radio frequency identification (RFID) devices and tags, sensors, actuators, and mobile devices have been integrated into textile manufacturing processes to collect business operations data, as shown in Figure 1. These devices capture massive amounts of data and store it in suitable formats. However, due to the lack of interoperability, data generated by different devices cannot be shared smoothly due to heterogeneity, which has become a severe challenge for the business community. Another issue is finding appropriate storage mechanisms and mining and extracting the hidden information from the data. Graph databases have played an attractive role in storing and processing this massive amount of data in recent decades. Graph data models are crucial in today's data-driven decision-making. They rely on mathematical graph theory-based representations and computations that enable flexible and powerful evaluations of domain objects and their relationships. Thus, graph analytics and graph mining have become popular among academics and practitioners from various business domains.

The main goal of this chapter is to provide an example of how graph data-based business intelligence applications can be used in the clothing industry. However, the real-world operations of the textile and clothing industry are complicated and challenging. The textile and garment manufacturing process involves numerous operational activities, from raw materials to producing finished products. The textile and clothing production process includes various industries and their integrated efforts. For example, the agriculture, chemical, and textile industries work together to produce natural and synthetic fibers, the primary components of fashion and commercial textile products for industrial use. Researchers have described an industrial world that faces challenges in maintaining sustainability, controlling environmental pollution, and ensuring equality in global environmental policies and organizational approaches. Academics and practitioners are introducing new business models that focus on preventing resource waste and improving work practice efficiency.

The textile industry can develop more ecological and sustainable products by carefully selecting materials and constituent ingredients. This includes using materials and components that are recycled, recyclable, and biodegradable, as well as those produced using eco-friendly processes. It also involves minimizing the use of chemicals and energy during production, using water-based solvents and glues, avoiding hazardous and restricted substances, and using renewable materials and innovative manufacturing technologies.