# Amazon's Supply Chain: Benefits and Challenges of Business Intelligence

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## Abstract

This review highlights the significant impact of *Business Intelligence* (BI) on enhancing improving Amazon's supply chain and logistics. Using advanced data tools, Amazon can work more efficiently, lower costs, and keep customers happy. BI helps Amazon use predictive analytics, and route planning to make operations faster and better meet customer needs. However, Amazon faces several challenges in implementing BI systems, such as the complexity of global operations and the associated high costs. In general, the report emphasizes that BI is key for Amazon to match its business goals with sustainability efforts and to succeed in the long term.

## 1 Introduction

BI is vital for organizations seeking to leverage data to make informed decisions. By integrating data collection and analysis, BI provides actionable insights that enhance operational efficiency and increase competitiveness. Amazon's use of BI to optimize its supply chain is a prime example of transformation in modern logistics. It highlights how data-driven tools create clear advantages and drive efficiency.

This report is divided into three main sections. Section 2 introduces BI and its key components. Section 3 provides an overview of BI applications in Amazon's supply chain. Section 4 discusses the challenges of implementing BI at Amazon. The conclusion summarizes the key findings.

## 2 Business Intelligence

BI is fundamental to modern organizations, enabling data-driven decisions that enhance performance and competitiveness. BI systems are tools that integrate data collection, data storage, and knowledge management with analytical capabilities to present relevant patterns about complex information to planners and decision-makers (Negash and Gray, 2008). Its primary goal is to convert raw data into actionable insights, allowing organizations to make informed strategic choices, optimize operations, and proactively respond to market dynamics. As shown in Figure 1 (left), the strategic, layered steps of BI, along with their timeline and level of detail, encompass a range of processes, from broad to specific. For the sake of clarity and focus, specific details and examples from each layer and component of BI processes will be omitted in this report.
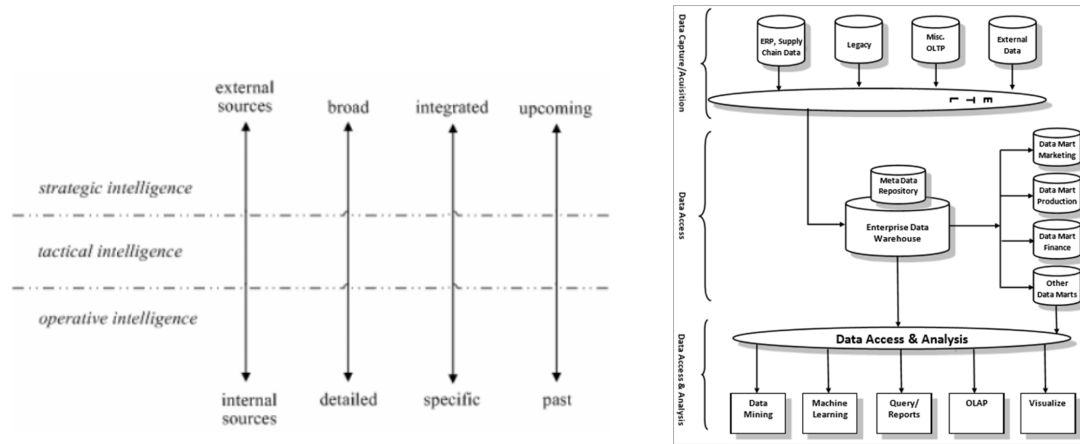
Figure 1: Strategic levels of BI (Pirttimaki, 2007) [left]; Framework of BI (Bharadiya, 2023) [right].

The following key BI components work together to transform data into actionable insights as shown in Figure 1 (right):

- *Data warehousing* involves collecting and storing large volumes of structured data in a central repository, facilitating efficient access for analysis (Golfarelli et al., 2004).

- *ETL (Extract, Transform, Load)* ensures data is extracted from various sources, cleaned, and transformed before being loaded into the warehouse, preparing it for analysis (Dayal et al., 2009).

- *Data mining* is a collection of statistical methods used to discover patterns and trends in large datasets (Jiawei and Micheline, 2006).

- *Reporting and dashboards* visually present key metrics, assisting in monitoring performance and tracking progress (Negash and Gray, 2008).

- *Predictive analytics* forecasts future outcomes using historical data and algorithms, aiding businesses in forward planning (Waller and Fawcett, 2013).

- *Self-service BI* empowers non-expert users to craft their own documentations, allowing greater flexibility (Schlesinger and Rahman, 2016).

- *Real-time analytics* analyzes data instantly as it is created, allowing quick decisions in fast-changing situations (Verma et al., 2017).

Today, BI is very important for e-commerce companies aiming to improve their logistics and meet customer expectations for fast and accurate service (Dash et al., 2019). In the following sections, Amazon's implementation of BI will be analyzed. Key concepts, including data warehousing and predictive analytics, will be highlighted in Amazon's practices to illustrate improvements in supply chain management.

## 3 BI applications in Amazon's supply chain

Amazon is a global leader in online retail, offering a wide range of products, including books, electronics, clothing, and household items. In addition to retail, Amazon provides services like cloud storage, music and
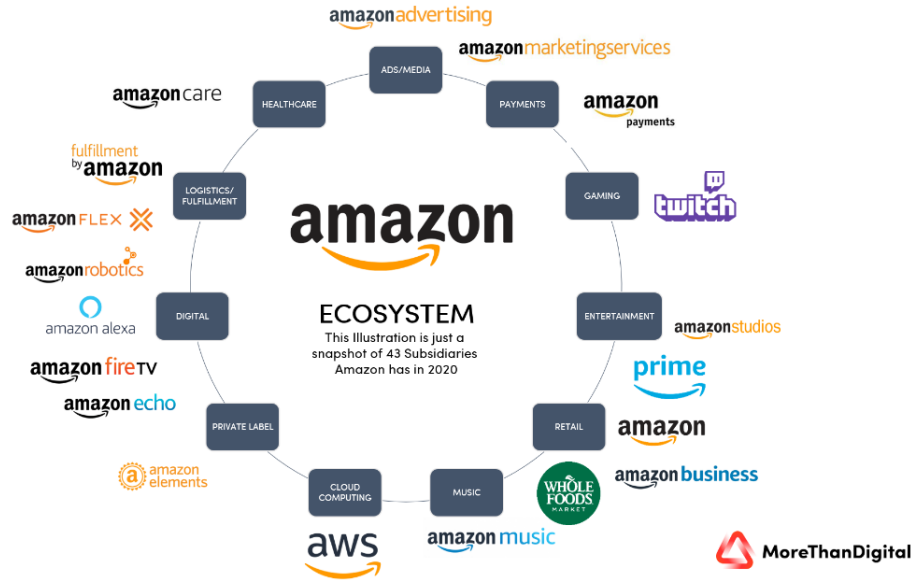
Figure 2: Amazon ecosystem (Talin, 2024).

video streaming, and an online marketplace for third-party sellers (see Figure 2). The company is a perfect example of how BI can transform supply chains using cutting-edge technologies and real-time data.

Here are the three cornerstone pillars of how Amazon uses BI in supply chains (SupplyChainToday, 20XX):

- **Predicting customer demand**: BI enables Amazon to forecast customer demand for each product, allowing them to proactively stock items in advance to meet future needs (AWS, 2022).

- **Automation in distribution centers**: Amazon uses BI to manage robots and machines that help pack and sort products quickly, making work faster and more accurate (Sifted, 2024).

- **Delivery route optimization**: BI helps Amazon plan the best routes for deliveries, so packages arrive faster and drivers use less fuel (Freight, 2024).

## 3.1 Predicting customer demand

Amazon uses tools like *Amazon Forecast* and *Amazon SageMaker*. These tools have advanced AI elastic algorithms that can manage a lot of data from various sources (Liberty et al., 2020), which offer better flexibility for handling large data sets. This includes data about customer shopping habits, seasonal trends, social media insights, and even IoT (Internet of Things) data. This system helps Amazon increase the accuracy of demand forecasts by up to 40% (Sezer et al., 2020) as shown Figure 3. Predicting customer demand tools utilize nearly all major BI components, starting from data warehousing, progressing through data mining and predictive analytics, and concluding with reporting and dashboards.

## 3.2 Automation in distribution centers

Amazon employs a sophisticated system for storing its materials with the assistance of *Kiva robots* (Bogue, 2016). These robots are designed to efficiently manage inventory by handling storage pods, enhancing the organization and retrieval of products in their stock centers. They move storage pods filled with products,
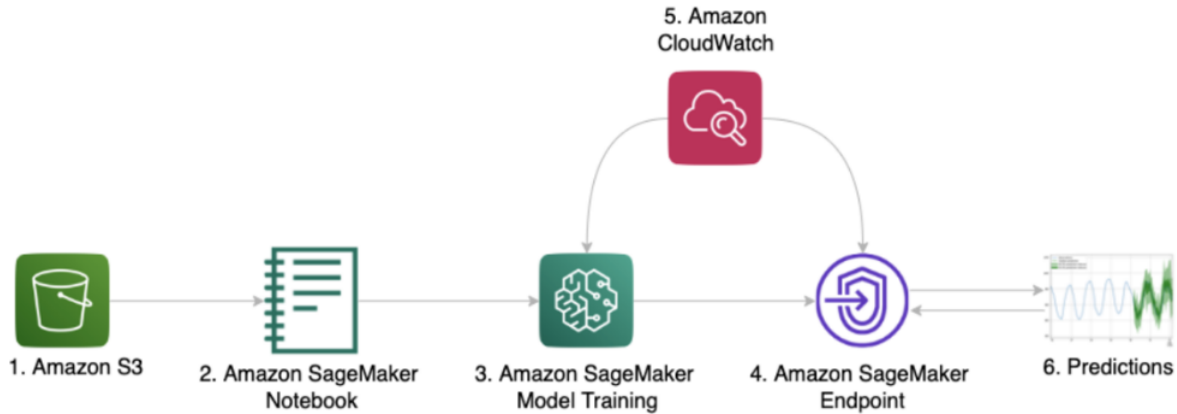
Figure 3: Using of Amazon SageMaker (AWS, 2022).

allowing workers to focus on packing. This system uses data warehousing to keep track of inventory and ETL processes to update information accurately. Real-time analytics helps the robots navigate and avoid obstacles. Reports and dashboards show important data about operations, while predictive analytics can forecast future inventory needs.

### 3.3 Delivery route optimization, operational efficiency and cost reduction

With BI, Amazon can plan efficient delivery routes by analyzing data like traffic patterns, customer locations, and optimal driving routes. This approach helps the company lower transportation costs and save fuel. For Amazon Prime members, this means quicker deliveries since Amazon can prioritize and speed up shipping. BI also helps the company forecast delivery demand, ensuring that resources are well-planned to meet high customer expectations, especially during peak shopping times (Merchán et al., 2024).

In addition to automating inventory management, BI enhances speed and efficiency by optimizing delivery times and improving storage processes, contributing to operational flexibility. By leveraging real-time data, BI reduces logistics costs related to transportation and warehousing. This is closely linked to real-time analytics, which allows Amazon to analyze data as it is generated. Moreover, BI significantly impacts customer satisfaction by ensuring fast, reliable deliveries, especially for Amazon Prime members, and by offering clear, transparent order tracking through dashboards (Kuandykov, 2021).

## 4 Challenges of implementing BI at Amazon

Amazon has big challenges in keeping customer data safe, especially with respect to *General Data Protection Regulation* GDPR (Consulting, 2023). BI can help solve these problems by putting strong security measures in place, like data mapping, which finds privacy risks and makes sure data moves correctly. BI tools also help manage consent, so Amazon can get proper permission for data use and include privacy rules in their work. Real-time analytics let Amazon watch who accesses sensitive data and respond quickly to any issues. Regular audits through BI help Amazon stay up-to-date with changing rules, which builds customer trust in how they handle data (Haddara et al., 2023).

Integrating BI data from Amazon's diverse global markets presents another challenge. Each region has unique data regulations and cultural nuances, complicating data standardization and quality control. A

unified data strategy is necessary for effective analysis, but the scale and diversity of operations make this difficult. Challenges such as high costs and the need for data aggregation from various sources are also significant. Combining BI with disruptive technologies, like social media, cloud computing, and mobile technology, forms the SMAC stack (Social, Mobile, Analytics, and Cloud). This integration holds great potential for improving enterprise computing, offering benefits such as enhanced supply chain planning, better collaboration, and increased stakeholder engagement (Nair, 2015).

Additionally, Amazon faces multiple challenges in using AI for sustainable supply chain management. While AI promises to improve productivity and efficiency, it is often claimed to do so at the expense of true environmental sustainability. The focus on corporate social responsibility may exaggerate the benefits of AI while minimizing costs, such as increased production and consumption that can harm fragile ecosystems and marginalized communities. Moreover, AI can lead to greater resource extraction, reinforcing harmful practices rather than promoting genuine sustainability. Therefore, as Amazon seeks to enhance its operations through BI and AI, it must navigate these hidden dangers and acknowledge that technology alone may not solve the deeper issues of sustainability in global supply chains (Dauvergne, 2022).

## 5    Conclusion

The advantages of BI for Amazon are significant and multifaceted. With the implementation of advanced BI tools, improvements in efficiency, cost reductions, and increased customer satisfaction have been achieved. These benefits strengthen Amazon's competitive position and create a more responsive business model that meets changing consumer demands.

However, challenges are also faced in integrating BI effectively, particularly concerning data security and sustainability. As concerns grow about the environmental impact of operations, the potential of BI to enhance sustainability through optimized delivery routes and reduced emissions must be explored further. By focusing on both efficiency and sustainability, Amazon's operational goals can be aligned with broader environmental objectives. This dual approach will be essential for the company's success in a rapidly changing market landscape.

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