

# EDI-Driven Dynamic Pricing for Retail Systems Using Real-Time Supply Chain Data

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## Abstract

Retail pricing decisions depend on several operational variables, including supplier costs, customer demand, and inventory availability. Many retailers still implement scheduled price updates through manual processing or periodic calculations based on databases. This may cause a delay between supply chain events and price changes. Electronic Data Interchange (EDI) systems are already used for the transmission of large volumes of data between suppliers and retailers in a structured format. The data exchanged includes information on supplier costs, confirmations, and inventory levels. However, the data exchanged through EDI systems is rarely integrated directly with pricing algorithms. This study proposes a system architecture that connects EDI transaction data with automated pricing models. The framework integrates an EDI message interface, transaction processing layer, centralized retail database, and pricing engine. The proposed architecture demonstrates how supply chain events transmitted through EDI messages can trigger automated pricing calculations, providing continuous operational input for retail pricing decisions.

**Keywords:** Electronic Data Interchange; Dynamic Pricing; Retail Systems; Supply Chain Integration; Pricing Engine; Real-Time Data.

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## **1. Introduction**

The role of pricing decisions is central to retail operations since they have a direct impact on the generation of revenues, demand for products, and performance of inventory. At all times, retail operations have to strike a balance between pricing strategies and the constraints of the supply chain. If pricing decisions are not made dynamically to keep up with changes in the supply chain, then the organization is bound to suffer loss of profit or poor performance of the inventory.

The issue of dynamic pricing has been extensively researched in the fields of operations research and marketing science. Initial studies have shown that dynamic pricing can have a positive impact on the performance of revenues for certain industries, including the airline industry or online retail markets [1, 2]. Other studies have also been done to investigate the effects of dynamic pricing on consumer behavior or market competition [3, 4].

Nevertheless, despite the increasing volume of such studies, a significant number of retail organizations still utilize a pricing process that depends on a schedule rather than real-time information. This may mean that prices are updated on a daily or weekly basis using past sales data. Although such a practice allows retail managers to maintain control over the entire pricing process, it may not respond to current supplier costs or stock levels.

The importance of information sharing among supply chain partners has been a significant theme in supply chain-related studies. The bullwhip effect is a widely recognized phenomenon that demonstrates how the delayed transmission of information can cause demand fluctuations among supply chain partners [5]. New information-sharing mechanisms are thus a necessity to maintain a coordinated supply chain.

Electronic Data Interchange (EDI) is a standardized system of information exchange among enterprises. This allows companies to automatically send and receive documents such as purchase orders, invoices, shipping notices, and inventory reports [6, 7]. Because these documents contain detailed operational data, EDI systems represent a valuable source of information about supply chain activity.

From professional experience in managing various projects related to enterprise infrastructure and system integration, EDI communication streams are able to maintain information flow between suppliers, logistics platforms, and internal retail systems. This includes managing environments related to enterprise systems, monitoring operational systems, and integrating infrastructures related to business systems.

The issue is that these pricing systems are not integrated into supply chain communication channels. While EDI messages are able to update accounting systems and logistics platforms, these systems are not able to process information through data pipelines that are based on fixed intervals of time. This means that operational data that could be used for decision-making is not being utilized effectively.

This study attempts to address this issue by developing a system architecture that is based on integrating EDI transaction streams into automated pricing systems. The purpose is to demonstrate that supply chain communication systems can be utilized for dynamic pricing decisions.

## **2. Materials and Methods**

### **2.1 System Architecture**

The architecture proposed in this study integrates supply chain communication systems with automated pricing models through a layered framework. The system consists of four main components: an EDI interface, a transaction processing layer, a centralized retail database, and a pricing engine.

The overall architecture is illustrated below:

Suppliers / Internal Systems → EDI Interface → Transaction Processing Layer → Central Retail Database → Pricing Engine → Updated Product Prices

The EDI interface acts as the entry point for supply chain messages transmitted by suppliers and internal retail systems. These messages follow standardized EDI document formats commonly used in business communication. Examples of this type of message are purchase orders that trigger supplier transactions, supplier invoices that confirm cost information, shipment notifications that contain descriptions of logistics activities, and inventory reports that offer stock information.

When these messages are received, the EDI interface interprets the structure of the documents and converts them into a structured format in the database. These records are transferred to the transaction processing layer for validation. Validation procedures confirm product identifiers, message timestamps, and transaction consistency in order to prevent inaccurate data from entering operational systems.

Validated records are then stored in the centralized retail database. This database maintains historical records of supplier costs, product transactions, and inventory levels across warehouse locations. The database therefore provides the operational context required for pricing decisions.

The pricing engine monitors the database for operational events that may require price adjustments. These events may include supplier cost updates, changes in sales demand, or inventory levels that exceed predefined thresholds. When such events occur, the pricing engine calculates a revised product price using the pricing model described below.

### **2.2 Pricing Model**

The pricing model presented in this study is a rule-based algorithm designed to illustrate how operational data can influence retail pricing decisions. The model incorporates three primary variables: supplier cost variation, demand variation, and inventory levels.

Supplier cost variation represents changes in the wholesale price paid by the retailer. These changes are often transmitted through invoice messages exchanged via EDI systems. When supplier costs increase, the pricing engine may adjust retail prices in order to maintain margin levels. When supplier costs decrease, prices may be

reduced in order to stimulate demand. Demand variation is measured by comparing recent sales activity with historical averages. Retail transaction records stored in the operational database allow the system to detect changes in product demand over time. If demand increases significantly, the pricing model may increase prices slightly to maintain balance between demand and available inventory.

Inventory levels also influence price adjustments. When inventory exceeds predefined thresholds, the pricing system may reduce prices moderately in order to accelerate product movement. When inventory levels fall below target levels, prices may increase slightly to avoid stock shortages.

The pricing formula can be expressed as:

$$P_{\text{new}} = P_{\text{base}} + (C_{\text{change}} \times w1) + (D_{\text{change}} \times w2) - (I_{\text{ratio}} \times w3) \quad (1)$$

In this formula, the updated price depends on supplier cost variation, demand variation, and inventory conditions. The weighting parameters determine how strongly each factor influences the final price. The pricing logic incorporates three input streams — supplier cost change, demand variation, and inventory level — which together determine the revised product price output.

### ***2.3 Simulation Framework***

Although this study focuses on system architecture, a conceptual simulation framework is described in order to illustrate how such systems may be evaluated empirically. The simulation environment represents a retail operation that manages multiple products across several warehouse locations.

The simulation includes supplier cost updates, product sales transactions, and inventory replenishment events. These operational events generate data streams that are processed by the pricing engine. By observing how the pricing engine responds to these events, researchers can evaluate the behavior of automated pricing algorithms under different operational conditions.

## **3. Results**

The architecture presented in this study demonstrates the technical feasibility of integrating EDI transaction streams with automated pricing systems. Supplier invoices transmitted through EDI messages contain updated cost information that can be processed immediately by the pricing engine. Inventory reports generated by warehouse systems provide real-time information about stock levels. Sales transactions recorded in retail databases allow the system to monitor demand variation continuously. The pricing engine can determine whether price changes are needed without waiting for scheduled price updates. For example, when supplier costs are changed or when inventory levels are beyond certain limits, the pricing engine can trigger price recalculation.

The relationship between inputs and pricing decisions is summarized in Table 1.

**Table 1:** Relationship between operational inputs and pricing decisions

Input Variable	Source System	Role in Pricing
Supplier Cost	EDI Invoice	Maintains margin
Demand Variation	Sales System	Adjusts price based on demand
Inventory Level	Inventory System	Controls stock movement

These observations illustrate how supply chain communication systems can provide the operational data required for dynamic pricing models. Rather than building new data pipelines, retailers may integrate pricing engines directly with existing EDI infrastructure.

#### 4. Discussion

Previous research on dynamic pricing emphasizes the importance of timely information for pricing decisions. Studies by Elmaghraby and Keskinocak [1] demonstrated that pricing systems capable of responding to operational signals can improve revenue management performance. Similarly, Chen and Iyer [3] showed how automated pricing strategies influence market competition and consumer behavior.

The architecture proposed in this study aligns with these findings by demonstrating how supply chain communication systems can provide real-time operational data to pricing algorithms. Because EDI systems already transmit supplier cost updates and inventory information, they represent a practical foundation for automated pricing systems.

Another advantage of the proposed approach is that it builds on infrastructure already used in many retail organizations. EDI communication systems are widely deployed in supply chains, and integrating pricing engines with these systems may require fewer technological changes than developing entirely new data pipelines.

However, the implementation of automated pricing systems should also be done in a careful manner. The algorithms for pricing should be structured in a way that prices do not fluctuate erratically. Retail organizations can use a combination of automated recommendations and management review to ensure pricing stability.

Future research may evaluate the proposed architecture using operational retail datasets and explore more advanced pricing models that incorporate predictive analytics or machine learning techniques.

#### 5. Conclusions

This study proposed a system architecture that integrates EDI transaction data with automated pricing models for retail environments. The framework demonstrates how supply chain communication systems can provide operational data for pricing decisions.

By connecting pricing engines with EDI transaction streams, retailers may improve the responsiveness of price adjustments and reduce delays associated with scheduled pricing workflows. The architecture presented in this study provides a foundation for future research that evaluates automated pricing systems using real operational datasets.

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