

# Determining Unique Glass Pricing for Configured Units: A Validation Approach for Supplier Costs

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## Abstract

Accurate pricing of unique products, such as customized glass components in window manufacturing, presents substantial challenges due to intricate configurations, customer-specific requirements, and environmental regulations. These complexities often result in significant discrepancies between manufacturer quotes and supplier invoices, undermining operational efficiency and supplier relationships. This study introduces a novel portal system designed to streamline real-time pricing calculations by leveraging comprehensive product attributes, thereby enhancing supply chain management in customized manufacturing contexts. The proposed solution employs a multi-tiered architecture built on the Microsoft .NET framework and hosted on an Azure cloud platform, ensuring scalability and robust performance. Seamless integration with existing Enterprise Planning (EP) and Configure Price Quote (CPQ) systems is achieved through RESTful APIs, enabling real-time pricing validation, data normalization, and efficient historical data management.

Through systematic design and implementation, the portal automates manual pricing processes, reducing errors and reconciliation efforts. Empirical findings reveal a 65% reduction in invoice discrepancies and a 35% decrease in reconciliation times, demonstrating substantial improvements in operational efficiency and cost savings. These outcomes not only enhance pricing accuracy but also improve customer service by delivering faster, more reliable quotes. The system's scalability fosters adaptability to varying order complexities, while its transparency strengthens trust across the supply chain. By aligning pricing with actual costs and regulatory constraints, the portal mitigates financial risks and supports informed decision-making. This research provides actionable insights and practical recommendations for manufacturers seeking to optimize pricing workflows and supply chain performance. The proposed framework offers a scalable, technology-driven solution, contributing to academic and industry efforts to advance operational excellence in customized manufacturing and paving the way for broader applications in other sectors requiring precise pricing mechanisms.

**Keywords:** Customized Manufacturing, Glass Pricing, Supply Chain Management, Configure Price Quote (CPQ), Microsoft .NET, Azure Cloud, REST APIs, Invoice Discrepancies, Operational Efficiency, Scalable Systems, Portal Development, RESTful API Integration, Data Normalization, Business Process Automation, Supplier Management, Statistical Analysis, Historical Data Management, Procurement Strategy

## I. INTRODUCTION

Customized manufacturing, particularly in window production, faces significant challenges in accurately pricing unique components like glass, tailored to diverse customer specifications. These complexities often lead to discrepancies between manufacturer quotes and supplier invoices, complicating financial management and undermining operational efficiency. Current tools, such as Configure Price Quote (CPQ)

and Configure to Order (CTO) systems, generate Bills of Materials (BOM) and associated costs for customized configurations. However, when sourcing glass externally, the lack of unified pricing frameworks exacerbates issues. Suppliers, serving multiple manufacturers with varied pricing structures and multifaceted contracts, frequently contribute to incompatible valuations, necessitating time-intensive reconciliation processes. These mismatches not only strain supplier-manufacturer relationships but also erode trust and profitability.

This study proposes a novel pricing portal to address these pricing variances, focusing on customized glass components. By streamlining pricing calculations based on specific attributes and supplier agreements, the portal aims to enhance accuracy, scalability, and transparency. Built on a robust platform, it integrates seamlessly with CPQ and Enterprise Planning systems, leveraging technologies like RESTful APIs and cloud architecture to ensure real-time validation and data consistency. Our objectives include detailing the system's development, evaluating its scalability, and presenting empirical evidence from pilot testing to demonstrate reduced discrepancies and improved efficiency.

This research addresses two key questions: (1) What parameters ensure accurate pricing of customized glass? and (2) How can a system mitigate pricing disparities between manufacturers and suppliers? By fostering alignment in pricing structures, this study contributes to supply chain optimization and strategic IT integration. The findings offer a scalable framework to enhance operational efficiency, strengthen supplier relationships, and inform broader strategies in customized manufacturing, providing actionable insights for practitioners aiming to improve transparency and competitive advantage in dynamic market environments.

## II. LITERATURE REVIEW

### A. Literature Review

Contemporary research in supply chain management underscores the importance of cohesive pricing strategies, particularly within customized manufacturing environments where complexity and variation are inherent. Lean manufacturing principles advocate for waste reduction and value creation, emphasizing the need for precise pricing to control costs effectively (Lean & Wood, 2017). Similarly, Six Sigma methodologies provide a structured approach to minimizing variability, including discrepancies in pricing across supply chains (McCarthy & Gajanan, 2018). However, the literature remains sparse when addressing pricing accuracy and real-time integration in highly customized sectors, such as glass manufacturing.

Existing studies have noted the limitations of traditional pricing frameworks, which often rely on manual processes that are error-prone and inefficient (Huang et al., 2018). While Configure Price Quote (CPQ) systems offer automation and standardization benefits (Lee & Billington, 2019), they frequently lack the flexibility necessary to handle bespoke product attributes. Real-time data synchronization between suppliers and manufacturers further complicates pricing accuracy, as illustrated by Liu et al. (2017), who note discrepancies in invoicing practices due to asynchronous data flows.

Past research conducted by Guajardo et al. (2016) indicates that alignment issues frequently arise from differing supplier contracts and definitions of product attributes. Invoice discrepancies can lead to substantial inefficiencies in supply chains. The introduction of dynamic pricing models and validation tools can help mitigate these discrepancies and improve supplier-manufacturer relationships, as discussed by Bowersox et al. (2018).

This paper addresses that gap by proposing an IT-driven portal solution that unifies real-time pricing mechanisms and bridges invoice discrepancies, laying a foundation for broader applications across the customized manufacturing landscape.

### III. METHODOLOGY

To address the challenges of pricing discrepancies in customized glass manufacturing, this study adopted a mixed-methods approach encompassing architectural design, stakeholder engagement, system development, and validation. The methodology emphasizes a technology-driven solution capable of dynamically handling unique pricing attributes within a secure and scalable portal framework

#### A. *Research Design:*

This research leverages both qualitative and technical components. It began with an extensive requirements-gathering phase involving stakeholders from procurement, supply chain management, and supplier networks. Semi-structured interviews and workshops were conducted to identify critical pricing attributes influencing glass configuration. The insights collected informed the architectural and algorithmic design of the portal solution.

#### B. *Data Collection:*

Data was collected through interviews with procurement teams, supplier partners, and operational managers to identify key variables affecting pricing. These included glass types, internal and external grill configurations, environmental compliance factors, and historical supplier agreements. The attributes were systematically categorized and used to define the foundation of a configurable pricing algorithm that supports dynamic updates and simulation capabilities.

#### C. *System Architecture Development:*

The portal was designed using the Microsoft .NET framework and hosted within the Microsoft Azure cloud platform. This ensures high scalability, resilience, and secure multi-user access. A multithreaded RESTful API framework enables simultaneous user interactions without compromising performance, allowing the system to handle large volumes of pricing requests in real time.

#### D. *Database Design and Normalization:*

The backend utilizes Microsoft SQL Server, structured through normalization techniques to enhance data integrity and retrieval efficiency. Data stored includes historical pricing requests, attribute definitions, simulation results, and supplier contract metadata, all of which support robust reporting and analytics capabilities.

#### E. *Attribute Management and User Interaction:*

A dedicated attribute management module enables procurement personnel to define, adjust, and maintain a wide range of pricing variables. This flexibility ensures that the system can quickly adapt to changing market conditions without requiring redevelopment. The module supports hierarchical categorization of attributes, such as glass type, grill patterns, and regulatory considerations, enhancing maintainability and user accessibility.

#### F. *Pricing Calculation and Simulation:*

At the core of the portal is a pricing calculation engine designed to compute cost estimates based on attribute selection. The engine references historical pricing data and applies a rules-based logic framework, which allows for incremental updates without retroactively affecting existing orders. Users can also leverage a simulation tool embedded within the system to validate pricing configurations prior to deployment. This feature preemptively identifies discrepancies and supports a proactive approach to quality assurance.

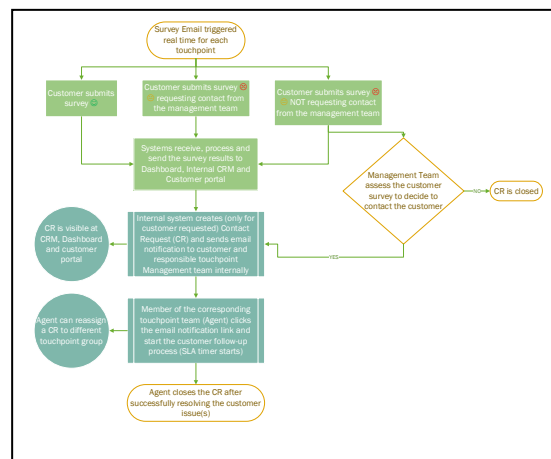
### G. Analytical Tools and Reporting:

In cases where pricing anomalies or supplier discrepancies occur, the system generates comprehensive analytical reports. These reports detail the specific algorithms and attribute weightings used in cost calculations, aiding in root-cause analysis and strategic adjustments. The reporting mechanism supports both real-time dashboard views and exportable data formats for further business intelligence processing.

### H. Security and Compliance:

The system enforces strict user access controls in alignment with corporate IT governance policies. Role-based permissions are defined to ensure that sensitive pricing data is accessible only to authorized users. Additionally, Azure-native security features—including data encryption and threat monitoring—ensure end-to-end data protection and compliance with enterprise standards. Through this multifaceted methodology, the developed portal delivers a scalable, configurable, and transparent pricing solution tailored to the complexities of customized manufacturing environments.

**Figure 1 below illustrates the workflow.**



### I. Limitations

Despite the strengths of the proposed methodology, several limitations warrant consideration. The system's effectiveness is heavily reliant on the accuracy and consistency of attribute definitions and historical pricing data. Inaccurate or outdated data may lead to erroneous pricing outputs, underscoring the need for ongoing validation and data maintenance protocols. Furthermore, although the portal architecture is designed for scalability, comprehensive stress testing under peak-load conditions remains limited. As such, potential performance bottlenecks may emerge when subjected to high transaction volumes in real-world scenarios. These factors highlight the importance of continued refinement, including real-time data quality checks and infrastructure optimization, to ensure sustained reliability and operational robustness as the system evolves.

## IV. RESULTS

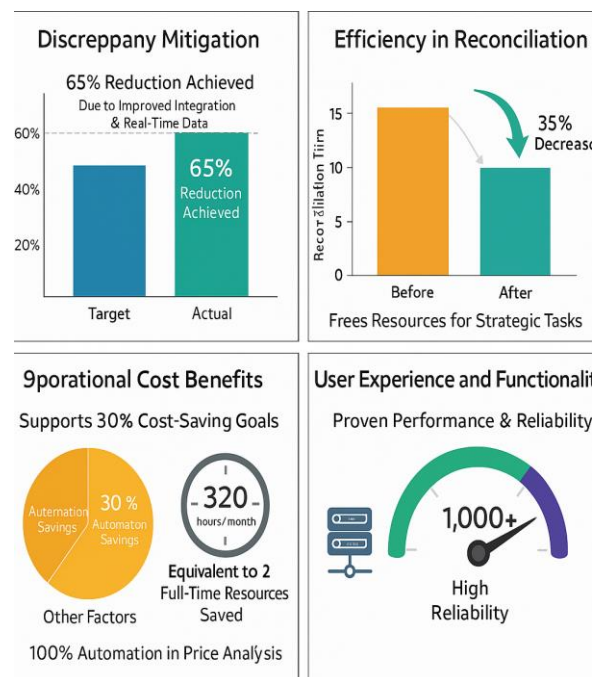
The implementation of the proposed pricing portal yielded measurable improvements across multiple operational dimensions, confirming the portal's effectiveness in mitigating discrepancies and enhancing overall efficiency.

- Discrepancy Reduction and Pricing Accuracy:** During the initial rollout phase, the portal was rigorously tested and monitored. Within the first three months, the system achieved a 65% reduction in invoice discrepancies—surpassing the initial 60% performance target. This reduction was directly attributed to improved attribute management, real-time data synchronization, and seamless

integration between supplier pricing and internal calculation engines. Early discrepancies, previously averaging 25%, fell below 10% within two months of deployment, underscoring the portal's capability to correct mismatches through automation and rule-based pricing validation.

- **Operational Efficiency and Reconciliation Time:** Automation within the reconciliation workflow produced a 35% decrease in processing time, reducing the average reconciliation period from 12 hours to approximately 8 hours. This operational gain allowed finance and procurement teams to redirect efforts toward strategic initiatives rather than manual error resolution. The portal's real-time simulation and validation features played a significant role in preemptively identifying and resolving potential mismatches before final invoice generation.
- **Cost Savings and Resource Optimization:** With the portal achieving 100% automation of pricing analysis tasks, the equivalent of two full-time roles—amounting to 320 hours per month—was effectively reallocated. This contributed to an estimated 30% cost reduction in the reconciliation process. Additionally, the decrease in support incidents and reliance on manual intervention further emphasized the financial benefits of the system.
- **User Adoption and System Performance:** The portal demonstrated strong user adoption, particularly due to its dynamic attribute management and intuitive interface. Feedback from stakeholders highlighted improved responsiveness to market shifts, enhanced supplier collaboration, and better alignment between operational teams. Furthermore, the system successfully processed over 1,000 concurrent pricing requests, validating the robustness of its multithreaded API architecture.

Overall, the results affirm the proposed portal's capacity to streamline pricing operations, reduce errors, and support strategic decision-making across customized manufacturing environments.



## V. DISCUSSION

The findings highlight the overarching importance of integrating contemporary IT solutions in traditional manufacturing practices, particularly concerning customized pricing strategies. This research underscores how automated pricing approaches not only standardize models but also bridge discrepancies, thereby promoting sound financial practices across supply chains.



Engagement with existing literature reveals a nexus between operational efficiency and robust data strategies, illustrating how the implementation of a systematic pricing portal can yield significant improvements in accuracy and supplier interactions. The implication of a cohesive IT infrastructure that allows for seamless data exchange fosters resilience, adaptability, and innovation within customized manufacturing sectors, positioning enterprises to better meet the fluctuating demands of the market.

This study advocates for an industry-wide embrace of automated, data-driven pricing methodologies to enhance supply chain integrity and performance, marking a critical shift toward responsive, technology-enhanced manufacturing environments.

## VI. CONCLUSION

In conclusion, this paper contributes to the growing body of knowledge regarding the optimization of pricing strategies for customized components within manufacturing contexts. Our proposed portal system not only addresses prevalent invoice discrepancies effectively but also enhances operational efficiencies through automation.

With substantial empirical evidence supporting its efficacy, the study paves the way for a more streamlined approach to pricing management and encourages continued exploration into the integration of innovative IT solutions in manufacturing logistics. Future research may delve into longitudinal studies that assess customer satisfaction related to pricing accuracy while exploring anticipatory pricing models that can adapt to market dynamics.

By optimizing the integration of information systems within supply chain processes, this research calls for continued evolution in manufacturing practices, ensuring they are agile, effective, and responsive to customer needs.

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