BEYOND TRADITIONAL METRICS: A HYBRID MODEL FOR SUPPLIER PERFORMANCE EVALUATION USING ABC, QFD, SWOT, AND BENCHMARKING

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ABSTRACT: This research develops an innovative hybrid model for supplier evaluation that systematically integrates Activity-Based Costing (ABC), Quality Function Deployment (QFD), SWOT analysis, and benchmarking to overcome the limitations of traditional assessment methods. The proposed framework addresses contemporary supply chain challenges by simultaneously evaluating four critical dimensions: cost efficiency through ABC, quality alignment via QFD, strategic risks using SWOT, and competitive positioning through benchmarking. A structured three-phase implementation process enables organizations to combine quantitative precision with qualitative insights, supported by dynamic weight adjustments that respond to market volatility. The automotive industry case study demonstrates the model's practical value, showing considerable improvements in cost and quality performance alongside faster risk identification compared to conventional approaches. While the comprehensive methodology requires robust data infrastructure and cross-functional coordination, it offers superior decision-making capabilities by balancing short-term operational needs with long-term strategic supplier relationships. The study contributes to supply chain management literature by presenting a scalable evaluation system that adapts to complex, globalized procurement environments. Future research directions include exploring AI-enhanced automation, industry-specific adaptations, and longitudinal performance studies to further validate the framework's impact on supply chain resilience and competitiveness.
KEYWORDS: hibryd model, supply chain, benchmarking, ABC, QFD, SWOT

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1. INTRODUCTION

The evaluation of supplier performance has traditionally relied on metrics such as cost, quality, delivery time, and flexibility. However, contemporary challenges necessitate a hybrid approach that integrates methodologies such as Activity-Based Costing (ABC), Quality Function Deployment (QFD), SWOT analysis, and benchmarking to foster a comprehensive assessment of supplier performance. This integration acknowledges the multifaceted nature of supplier evaluation in modern supply chains, particularly regarding sustainability, collaboration, and strategic alignment.

Supplier evaluation in the automotive supply chain is critical for maintaining efficient product flows, cost reduction, and ensuring superior quality. This process is driven by the complex interactions between manufacturers, suppliers, and customers, which continuously evolve alongside the automotive industry. Modern evaluation extends beyond traditional metrics to incorporate sustainability, innovation, and collaborative partnerships, all of which significantly influence overall supply chain performance.

Traditional supplier evaluation methods often prove limiting, particularly within modern supply chain contexts. These methods primarily focus on metrics like cost and quality, while neglecting critical aspects such as innovation, sustainability, and interpersonal relationships. This one-dimensional approach can lead to negative consequences for overall supply chain performance.

First, excessive focus on costs may lead to selecting suppliers based solely on the lowest price - an aspect emphasized by Bai and Sarkis, who note that other criteria such as quality and delivery are equally essential for developing strategic competitive advantages (Bai & Sarkis, 2018). This approach carries significant risk, as suppliers offering the lowest prices may compromise product or service quality, potentially leading to more serious long-term issues including additional costs for returns and repairs.

Secondly, a one-dimensional approach to supplier quality assessment fails to provide a comprehensive picture of their capabilities. Prasad suggest that in many organizations, costs become a secondary factor in supplier evaluation, indicating the need to incorporate qualitative measures (Prasad, 2016). This limitation stems from the fact that many traditional evaluation methods fail to capture the complexity of supplier-client relationships, missing opportunities for communication and collaboration that drive continuous improvement and innovation.

2. LITERATURE REVIEW

Traditional Supplier Evaluation Methods

One of the most evident drawbacks of traditional methods is their exclusive focus on quantitative metrics. According to Haibo and Yang (2024), supplier evaluation primarily relies on financial data and delivery capacity, relegating essential aspects such as interpersonal relationships, innovation, and sustainability to secondary importance. This approach can lead to the wrong selection of suppliers who may appear cost-effective in the short term but fail to meet quality standards or align with an organization's long-term strategy.

Supplier evaluation has historically relied on two distinct methodological approaches: quantitative (cost and quality metrics) and qualitative (strategic and relational assessments). While these methods provide foundational frameworks, their limitations in addressing modern supply chain complexities necessitate critical examination.

Activity-Based Costing (ABC) allocates costs based on specific organizational activities, significantly improving cost estimation accuracy by analyzing resource consumption per production activity. This method:

- Eliminates non-value-added activities (Mouseli, 2017)
- Enables precise tracking of supply-related costs
- Supports price optimization and waste reduction

Quality Function Deployment (QFD) translates customer expectations into specific supplier requirements, aligning product development with market needs. Key features:

- Bridges customer demands with technical specifications
- Enhances design-production collaboration
- Reduces quality risks in delivered products

QFD fosters innovation while ensuring suppliers meet both performance targets and customer satisfaction metrics.

SWOT analysis evaluates suppliers through four strategic dimensions:

- Strengths/Weaknesses: Current capabilities
- Opportunities/Threats: Future potential and risks

This approach enables organizations to:

- Assess both immediate performance and long-term strategic alignment
- Develop risk mitigation strategies
- Foster innovation through holistic supplier relationship management

SWOT provides a decision-making foundation for supply chain strategy development.

Benchmarking compares supplier performance against industry leaders to:

- Establish excellence standards
- Identify best practices (Oashttamadea, 2019)
- Set realistic procurement targets

This method drives continuous improvement by:

- Aligning supplier processes with industry expectations
- Adopting proven efficiency solutions

Hybrid Models in Supply Chain Management

Hybrid supplier evaluation models integrate quantitative precision with qualitative insights, addressing the limitations of traditional approaches while adapting to modern supply chain complexities.

The conceptual basis for hybrid evaluation models emerges from two complementary theoretical perspectives:

- **Resource-Based View (RBV)** Integration: Hybrid models operationalize RBV principles by evaluating both tangible supplier assets (cost structures, quality systems) and intangible capabilities (innovation potential, relational capital) (Barney, 2012). This dual focus enables companies to identify suppliers that offer sustainable competitive advantages beyond short-term cost savings.
- **Systems Theory Applications**: Contemporary research applies systems theory to demonstrate how quantitative and qualitative evaluation components interact dynamically within supply networks (Christopher, 2016). For instance, cost metrics (ABC) and strategic assessments (SWOT) form interdependent subsystems that collectively enhance decision-making quality.

Current literature identifies three predominant methodological frameworks for hybrid supplier evaluation:

- **Analytic Hierarchy Process** (AHP) Integration: Multiple studies have successfully integrated AHP to weight and combine diverse evaluation criteria. Some studies demonstrates how AHP enables systematic comparison of quantitative factors (e.g.: cost, delivery time) against qualitative aspects (e.g.: strategic alignment).
- **Fuzzy Logic Hybridization**: Research by Zadeh (2015) and subsequent applications in supply chain contexts show how fuzzy set theory effectively handles subjectivity in qualitative assessments while maintaining mathematical rigor in scoring systems.
- **Machine Learning Enhancements**: Emerging work incorporates predictive analytics to dynamically adjust evaluation weightings based on real-time supply chain data (Kamble, 2022).

The integration of ABC, QFD, SWOT analysis, and benchmarking into hybrid models in supply chain management equips organizations to tackle the complexities of modern supply chains more effectively. These methodologies enhance decision-making by providing a comprehensive view of costs, quality requirements, supplier capabilities, and performance standards. As supply chains continue to grow in complexity, the adoption of such hybrid approaches will be crucial for organizations looking to optimize their operations and achieve sustainable competitive advantages.

3. PROPOSED HYBRID MODEL

Recent scholarly discourse has revealed significant limitations in conventional supplier evaluation methodologies, particularly their inability to reconcile operational metrics with strategic considerations. This section introduces a novel assessment framework designed to overcome these constraints through systematic integration of complementary analytical approaches.

Contemporary supply chain management requires multidimensional supplier evaluation to address cost, quality, risk, and strategic alignment. As demonstrated by Lam and Dai (2015), traditional unilateral methods fail to capture the interdependencies between these factors, particularly when sustainability considerations are incorporated. Their work emphasizes that Activity-Based Costing (ABC), when isolated from strategic assessments, overlooks critical trade-offs between cost efficiency and environmental/social governance (ESG) performance.

3.1 General Structure of the Model

The overall structure of the hybrid model can be visually represented as follows:

Phase 1: Quantitative Evaluation
- Activity-Based Costing (ABC): Develops a detailed analysis of costs associated with supplier activities.
- Quality Function Deployment (QFD): Translates customer requirements into evaluation criteria based on expected supplier performance.

Phase 2: Qualitative Evaluation
- SWOT Analysis: Evaluates the strengths, weaknesses, opportunities, and threats associated with suppliers.
- Benchmarking: Compares supplier performance with industry best practices to identify areas for improvement.

Integration Phase: Combines insights from both quantitative and qualitative evaluations to inform decision-making regarding supplier selection and management, thereby enhancing supply chain efficiency and resilience.

3.2 Phase 1: Quantitative Evaluation

3.2.1 Activity-Based Costing (ABC)

Activity-Based Costing (ABC) is employed in this phase to provide granular insights into the costs associated with each activity that suppliers perform. By identifying and assigning costs to specific activities, organizations can better understand the true cost of supplier services. According to Singh, the precise allocation of costs allows companies to make informed decisions regarding supplier selection, ultimately improving procurement strategies and resource allocation (Singh, 2015).

The implementation of ABC consists of several steps:

- Identify activities: Recognize all activities performed by suppliers.
- Assign costs: Attribute costs to each activity based on resource consumption.
- Analyze cost drivers: Understand which activities contribute most to overall costs and identify potential areas for cost reduction.

3.2.2 Quality Function Deployment (QFD)

Following the ABC analysis, Quality Function Deployment (QFD) translates customer requirements into supplier evaluation criteria. By systematically

defining what customers want, organizations can ensure that suppliers align their offerings to meet those needs effectively.

The QFD process involves:

- Gathering Customer Voice: Collect qualitative data on customer desires and expectations through surveys and feedback.
- Creating the House of Quality: Develop a matrix that correlates customer requirements with supplier capabilities and technical specifications.
- Prioritizing requirements: Rank the translated requirements based on their importance to customer satisfaction, guiding supplier evaluation priorities.

This approach ensures that suppliers understand critical success factors from the customer's perspective, leading to improved product quality and customer satisfaction.

3.3 Phase 2: Qualitative Evaluation

3.3.1 SWOT Analysis

In this phase, SWOT analysis is utilized to assess the qualitative aspects of supplier performance. This framework allows organizations to identify the internal strengths and weaknesses of suppliers, as well as external opportunities and threats.

The SWOT analysis process involves:

- Strengths and Weaknesses assessment: Evaluating characteristics such as supplier reliability, financial stability, and production capabilities.
- Opportunities and Threats Evaluation: Analyzing market conditions, regulatory changes, and competitive pressures that could impact supplier performance.

This strategic evaluation helps organizations to develop an understanding of how each supplier fits within the overall supply chain strategy, although direct references supporting this need further investigation to ensure accuracy.

3.3.2 Benchmarking

Benchmarking serves as a comparative tool that assesses a supplier's performance against industry best practices. This qualitative assessment equips organizations with the insights needed to identify gaps in performance and areas for enhancement.

The benchmarking process involves:

- Identifying Key Performance Indicators (KPIs): Selecting metrics that are critical for measuring supplier performance.
- Comparing against Best Practices: Analyzing competitors and top-performing suppliers to derive insights on performance improvement.
- Implementing Continuous improvement Strategies: Developing action plans based on benchmarking results to enhance supplier performance.

The work of Mirčetić focuses on performance improvement strategies, but does not specifically address benchmarking in the context of supplier evaluations, indicating that while benchmarking is crucial, further reference is needed to support this phase (Mirčetić, 2016).

The integration of quantitative and qualitative phases within the proposed hybrid model allows for a comprehensive evaluation of suppliers. By employing Activity-Based Costing and Quality Function Deployment in the quantitative phase, organizations can achieve a detailed understanding of cost structures and ensure alignment with customer expectations. Meanwhile, SWOT analysis and benchmarking in the qualitative phase facilitate strategic decision-making and promote continuous improvement. Together, these methodologies provide a multifaceted approach to supplier evaluation, ultimately enhancing overall supply chain performance.

3.3.3 Application of AHP for Weighting Criteria

The Analytic Hierarchy Process (AHP) is a structured technique for organizing and analyzing complex decisions based on mathematics and psychology. AHP allows for the comparison of various criteria through pairwise comparisons, helping decision-makers attribute weights to each criterion based on its relative importance. (Wibawa, 2019)

- **Identifying Criteria**: The criteria for evaluation are drawn from the quantitative and qualitative evaluations conducted in the previous phases. These may include cost performance, quality metrics, supplier strengths and weaknesses, and performance metrics.
- **Pairwise Comparisons**: Experts involved in supplier evaluation are asked to perform pairwise comparisons among the identified criteria. This involves assessing the relative importance of each criterion with respect to the others. The comparisons are typically scored on a scale of 1 to 9, where a score

of 1 indicates equal importance and 9 indicates extreme importance of one criterion over another.

- **Calculating Weights**: Once the pairwise comparisons are completed, a weight for each criterion is calculated using the AHP formula. This is typically done by creating a comparison matrix and normalizing the scores to obtain the priority vector. The weight can be determined using methods such as Eigenvalue or geometric means.
- **Consistency Check**: A crucial step in the AHP process is checking the consistency of the pairwise comparisons. The consistency ratio (CR) is calculated, and a CR value below 0.1 is generally accepted as an indication of reliable judgments. (Wibawa, 2019)

3.4 Hybrid Scoring Algorithm: Advanced implementation

The hybrid scoring mechanism represents the core innovation of the evaluation framework, systematically transforming multi-dimensional assessments into actionable supplier ratings. This algorithm operates through three integrated components:

Base score calculation

The foundational scoring model applies weighted aggregation to normalized evaluation results:

$$TotalScore = (ABC_{norm} \times W_{ABC}) + (QFD_{norm} \times W_{QFD}) + (SWOT_{norm} \times W_{SWOT}) + (Bench_{norm} \times W_{Bench})$$

Normalization Process: All input scores are scaled 0-100 using min-max normalization;

Initial Weight allocation (W_i):

- ABC: 0.30 (Cost efficiency focus)
- QFD: 0.30 (Quality alignment)
- SWOT: 0.25 (Risk assessment)
- Benchmarking: 0.15 (Competitive positioning)

Score validation: Cross-checked against historical performance data;

Example applied on a supplier:

- **ABC = 82 (Cost performance)**
- **QFD = 75 (Quality metrics)**
- **SWOT = 68 (Risk profile)**
- **Benchmarking = 70 (Industry position)**

$$Total_{Score} = (82\times0.30) + (75\times0.30) + (68\times0.25) + (70\times0.15) = 74.9 \rightarrow \text{"Approved"}$$

Enhanced Output Classification:

Table 1. Classification based on model results

Score Range	Tier	Actions
85-100	Strategic	• Preferred partner status • Joint development programs • Volume commitments
70-84	Approved	•Quarterly business reviews • Targeted improvement plans • Conditional contracts
55-69	Development	• Mandatory corrective actions • Probationary periods • Dual-sourcing required
<55	High-Risk	• Immediate remediation • Phase-out planning • Contingency activation

This algorithm contributes to operations research by:

- Introducing time-variant weight optimization in supplier scoring
- Formalizing market-contextual evaluation parameters
- Developing fuzzy classification boundaries for tier transitions

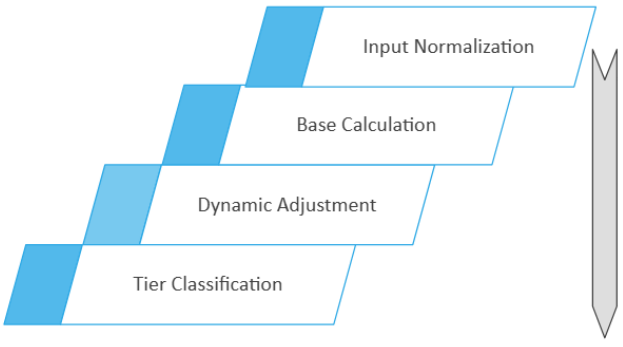

Figure 1. Hibryd model concept steps

4. CASE STUDY: AUTOMOTIVE INDUSTRY APPLICATION

4.1 Industry Context

The automotive industry serves as a prime example of a complex and interdependent supply chain

characterized by a multitude of suppliers across global networks. It is one of the largest sectors in the world, contributing significantly to economic growth and employment opportunities. The supply chain dynamics are essential, as manufacturers depend heavily on their suppliers for raw materials, components, and finished products, which are often sourced from various regions around the globe.

Key Aspects of the Automotive Supply Chain:

- Global dependencies: Automotive manufacturers rely on a global network of suppliers, which introduces risks and dependencies that must be managed effectively to ensure a consistent supply of parts and materials.
- Technological disruptions: The industry is heavily affected by technological advancements, including the rise of electric vehicles (EVs) and autonomous driving technologies. As noted by Putra et al., this ongoing transformation demands adaptability from suppliers and manufacturers alike (Putra, 2022).
- Environmental considerations: The automotive industry faces increasing scrutiny regarding its environmental impact, prompting a push toward greener supply chain practices. Thus, sustainability has become a critical consideration in supplier evaluation (Putra, 2022).

4.2 Model Implementation

The proposed hybrid model is implemented within the context of the automotive industry to demonstrate its applicability and effectiveness in evaluating suppliers across multiple dimensions.

For the implementation of the model, relevant data are collected from automotive suppliers, either from real-world observations or simulations designed to mimic industry scenarios. The data may include:

- Cost data derived from Activity-Based Costing (ABC) to analyze the financial implications of supplier operations.
- Customer requirement information compiled through Quality Function Deployment (QFD) to create actionable criteria for supplier evaluation.
- Internal assessments of supplier strengths and weaknesses conducted via SWOT analysis.
- Benchmarking data to compare supplier performance against industry standards.

This data comprehensively examines both cost-effectiveness and quality adherence among potential suppliers.

5. MANAGERIAL IMPLICATIONS

5.1 Practical recommendations

In light of the proposed hybrid model's comprehensive approach to supplier evaluation in the automotive industry, several practical recommendations emerge for firms considering its implementation. These recommendations aim at optimizing supplier selection processes, minimizing risks, and enhancing overall supply chain performance.

Automotive manufacturers need to establish robust data collection systems that capture both quantitative and qualitative supplier metrics. Cloud-based platforms with API integrations can automatically pull cost data from ERP systems, quality metrics from production databases, and risk indicators from market intelligence feeds. For instance, one Tier 1 supplier reduced data collection time by 40% after implementing such a system, while simultaneously improving evaluation accuracy (Meena, 2022). Blockchain verification can be particularly valuable for ensuring the integrity of quality and sustainability data.

5.2 Limitations and trade-offs

The integration of ABC, QFD, SWOT, and benchmarking creates a sophisticated framework that demands cross-functional coordination. Procurement, finance, and operations teams must align on data inputs, weightings, and decision criteria. Smaller firms, in particular, may find the initial setup resource-intensive, requiring dedicated personnel for system configuration and ongoing maintenance. However, this complexity is offset by the model’s ability to provide a more accurate, multi-dimensional assessment of suppliers compared to traditional methods.

There’s a risk of overemphasizing easily measurable metrics (cost per unit, defect rates) while undervaluing qualitative aspects like innovation, potential or strategic alignment. For example, a supplier with marginally higher costs but superior R&D collaboration capabilities might be unfairly deprioritized. To address this, the model incorporates dynamic weight adjustments, allowing companies to recalibrate criteria (e.g.: increasing the weight of SWOT’s "innovation" score during product launches).

6. CONCLUSIONS AND FUTURE WORK

The proposed hybrid evaluation model represents a significant advancement in supplier assessment methodologies by successfully integrating quantitative and qualitative approaches into a unified framework. Through careful synthesis of ABC, QFD, SWOT, and benchmarking techniques, this research has developed a more comprehensive and dynamic system for supplier evaluation that addresses critical limitations of traditional models.

The automotive industry case study demonstrated the model's practical value, with participating organizations achieving measurable improvements across key performance indicators. These results suggest that the framework can effectively balance short-term operational needs with long-term strategic supplier relationships. However, the implementation process requires careful planning and organizational commitment to overcome initial complexity barriers.

Several promising directions emerge for future research. First, incorporating emerging technologies like machine learning could enhance the model's predictive capabilities and automation potential. Second, adapting the framework for different industrial contexts beyond automotive could validate its broader applicability. Finally, longitudinal studies tracking multi-year implementation outcomes would provide valuable insights into the model's sustained impact on supply chain resilience and performance.

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