AI Driven Vendor Performance Rating

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Abstract

The increasing sophistication of global supply chains and the reliance on external suppliers has rendered the assessment of vendor performance an important managerial role. The traditional vendor assessment systems are usually manual, subjective and time consuming and this makes it difficult to implement them in dynamic business settings. The current research paper is a proposal of an AI-based vendor performance rating system that allows objective and consistent and data-driven assessment of a vendor based on key performance indicators like the overall performance of the vendor, timeliness in performance, adherence to quality standards, and reliability of its services. The research methodology was a quantitative one, where the historical data of organizational vendors and the scoring methods based on machine learning were used to produce composite performance scores. A systematic grouping of the vendors was done to Excellent, Good, Average and Poor and the data analyzed in relation to the descriptive statistical procedures. The results indicate that the majority of the vendors demonstrate good delivery and quality-conformance performance and the small percentage reveals the existence of the performance gap that requires correction activity. The opportunities of AI-based assessment systems to reduce subjectivity, enhance transparency and make informed decisions are identified in the paper, which would ultimately lead to the optimization of vendor management and the supply chain.

Keywords: Artificial Intelligence, Vendor performance rating, Supply chain management, Machine learning, Delivery performance, Quality compliance.

1. INTRODUCTION

Vendor management is quite a significant aspect in ensuring that the organization is running smoothly, controlling its expenses and the supply chain is strong enough to withstand shocks in the current competitive and digitally oriented business environment. The traditional vendor evaluation methods are normally manual inspections and personal judgment, which might bring out inconsistency, bias and waste of time. With the increased complexity of the supply chain and the quantity of information that is associated with the vendors, organizations are shifting to more advanced technologies to enhance a greater accuracy and visibility to the vendor evaluation process. Specifically, Artificial Intelligence (AI) has a high potential of managing large amounts of data and identifying the trends in performance, as well as yielding objective results, which is why it becomes a useful supplement to the modern vendor performance management.

A vendor performance rating system A.I.-based can be used to assist companies in rating vendors systematically, based on key performance dimensions, such as timeliness of delivery, adherence to quality, cost-efficiency, and reliability of services. Those systems also provide real-time, data-driven performance ratings by using machine learning algorithms and data analytics to draw the procurement decision-making process, minimize risks, and facilitate further performance improvement. Along with reducing the number of human biases during the assessment of the vendor, the integration of AI in the process of evaluating the vendors also enhances the interactions between the company and the suppliers, which results in greater efficiency within the supply chain as well as competitiveness of the organization.

2. LITERATURE REVIEW

Alt[1] and Nguyen (2025) examined the growing significance of artificial intelligence in the vendor ecosystems and digital sourcing settings. They indicated in their research that the use of AI-based systems to help in the automation of vendor assessment is increasing, which would help to improve transparency and accuracy of decision-making within the platform-based supply chains. The authors emphasized that AI-based vendor evaluation systems reduced the

dependence on human evaluation and allowed utilizing data and facilitating collaboration between organizations and vendors within the framework of digital ecosystems.

Hazarika (2020) examined the larger issues of artificial intelligence within the workforce management and organisation use. The paper has addressed the topic of how AI technologies have changed the way of decision making by increasing the efficiency, consistency and predictability. Though the study was mainly on health workforce, it still gave a good insight on how AI-based analytical systems could be extended to performance appraisal scenarios such as vendor appraisal by reducing human bias and improving operational efficiency.

Kamble and Gunasekaran (2020) examined big data-driven performance measurement systems in supply chain management and suggested a framework to implement the same. Their results showed that the performance evaluation based on data enhanced the visibility of the supply chain, responsiveness, and efficiency. The paper has highlighted the need to combine highly sophisticated analytics and smart systems to gauge supplier and vendor performance in a better way, hence aiding in strategic decision-making and ongoing performance enhancement.

Perifanis and Kitsios (2023) conducted a thorough literature review to explore the role of artificial intelligence in creating business value in the digital age of strategy. Their analysis found out that the use of AI had greatly benefitted the strategic decision-making process by increasing the ability to process data, the accuracy of predictions, and efficiency in operations. The authors highlighted that AI-powered analytics facilitated performance measurement of organizational functions within their capabilities and capabilities to process massive amounts of data into meaningful actions, which enhanced better business value and competitive edge.

Rainy and Chowdhury (2022) surveyed the use of artificial intelligence in digital retail supply chain vendor performance assessment. Their research emphasized that AI-oriented decision-making models had enhanced the accuracy and reliability of vendors evaluation through integration of various performance measures like efficiency in delivery, adherence to quality, and responsiveness of the services provided. The authors found that AI-based evaluation systems helped decrease the level of subjectivity in the process of selecting a vendor and monitoring activities and were also instrumental in serving strategic sourcing choices and improving overall supply chain efficiency.

3. RESEARCH METHODOLOGY

The study employs a quantitative and AI-based framework of assessing the performance of vendors in terms of delivered, quality, service and overall performance using past organizational data. The performance of the vendors based on the objective classification in categories of performance is made possible by the descriptive statistical analysis and machine learning techniques used to classify the vendors into performance category so that informed decision-making can be done.

3.1 Research Design

In this study, the research design is quantitative and analytical to assess the performance of the vendors on an AI-based rating scale. The methodology is based on objective assessment, and statistical data analysis of performance indicators of a vendor to guarantee its accuracy, consistency, and data-driven decision-making.

3.2 Data Collection

Secondary and operational data were obtained through organizational records on vendors such as delivery schedules, quality inspection reports, defect logs, rejection records, and data on service responses. The data set was a historical performance data of vendors during a specified evaluation to make the analysis reliable and consistent.

3.3 Vendor Performance Criteria

The performance of the vendors was measured against several key performance indicators (KPIs), which are as follows:

- Overall performance score

- Delivery timeliness
- Quality compliance
- Service reliability

To reduce subjectivity in assessment, each criterion was measured based on standardized performance measurements.

3.4 AI-Driven Evaluation Model

An AI scoring system was created to analyze the data about the vendors and produce composite performance ratings. The model used machine learning to examine the patterns, standardize the performance measures, and give weighted scores to every assessment criterion. The vendors were automatically categorized in four groups of Excellent, Good, Average, and Poor vendors.

3.5 Data Analysis Technique

Vendor performance outcomes were interpreted using descriptive statistics analysis. The result of performance was in percentage format and was presented as tables and graphical presentation to enable clear comparison and interpretation of the performance of the vendor on various dimensions.

4. RESULT AND DISCUSSION

The results indicate that a majority of the vendors are doing well regarding the overall rating, timeliness in delivery, and compliance to quality. Very few percentages are in need of upgrading and remedial measures to make the supply chain efficient.

4.1 Overall Vendor Performance Classification

Table 1 shows the general vendor performance classification that was developed through the AI-based vendor performance rating system. The vendors have been classified into four groups namely, Excellent, Good, Average and Poor depending on their composite performance scores as per various evaluation criteria. Figure 1 presents the graphical depiction of such distribution, which allows making a rapid visual comparison of the level of performance of the vendors.

Table 1: Overall Vendor Performance Rating (%)

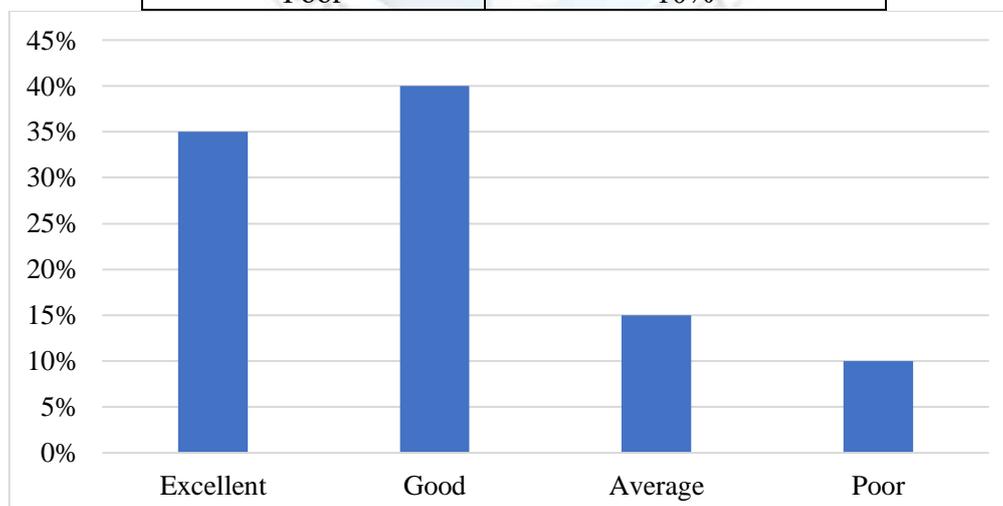| Performance Category	Percentage of Vendors (%)
Excellent	35%
Good	40%
Average	15%
Poor	10%

Figure 1: Graphical Representation of Overall Vendor Performance Rating (%)

The findings are that a significant proportion of vendors are rated as Excellent (35%), and Good (40%), with an overall proportion of 75% of the total vendors. This implies that the AI system is successful in identifying high performing vendors and represents high and general vendor

performance. Meanwhile the 15 percent of vendor are featured as Average, which means that there is a room of improvement, and 10 percent of the vendors are rated as Poor, which means that the vendor may need correction measures, monitoring or even replacement in order to ensure the efficiency of the supply chain.

4.2 Delivery Performance Analysis

Table 2 shows how the AI-based system has rated the performance of vendors in terms of their delivery timeliness and divided them into on-time delivery, slight delay, and frequent delays. These categories can be represented graphically on Figure 2, which allows getting a clear picture of the compliance of vendors with the delivery schedules.

Table 2: Delivery Performance Evaluation (%)

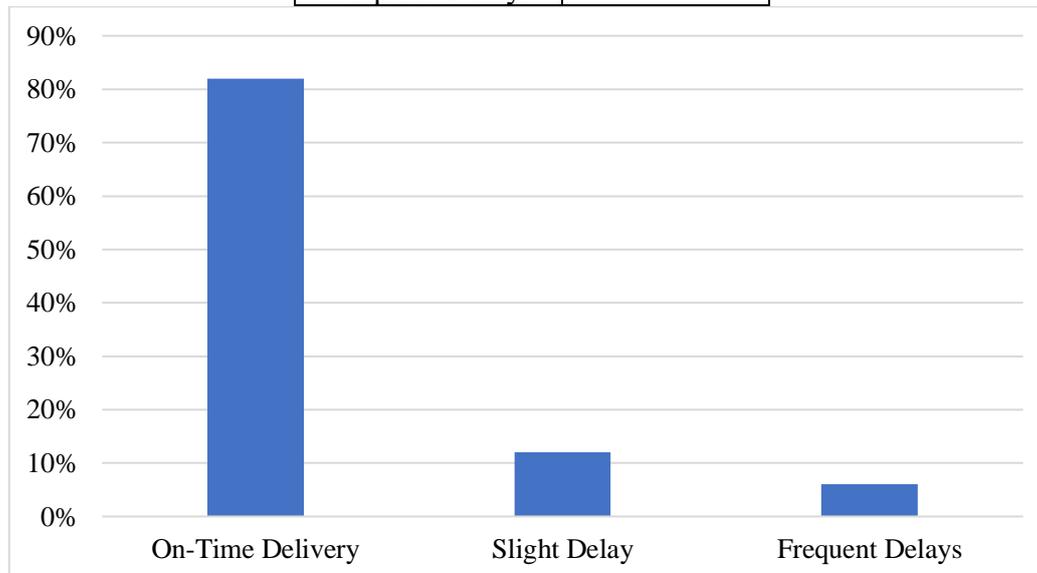| Delivery Status	Vendors (%)
On-Time Delivery	82%
Slight Delay	12%
Frequent Delays	6%

Figure 2: Graphical Representation of Delivery Performance Evaluation (%)

The results indicate that the majority percentage of vendors (82%) was steadily maintained on-time delivery, which implies that they were highly reliable in the performance of their contracts in terms of product delivery time. A lower proportion of vendors (12%) was slightly delayed, indicating the presence of the logistical or operational problems occasionally. Frequent delays were observed only in 6% of vendors, which shows a small number that can adversely affect supply chain continuity. In general, AI-based evaluation can be deemed successful to filter between trusted vendors and those that need to be improved in performance or to take corrective measures in the delivery management.

4.3 Quality Compliance Assessment

Table 3 shows quality compliance of the vendors as per the AI based evaluation methodology. It categorized vendors into three quality categories namely, High Quality, Acceptable Quality, and Low Quality, by the number of defects, requirement, and number of rejections. These levels of quality compliance are graphically represented by Figure 3 and allow one to easily compare the categories of vendors.

Table 3: Quality Compliance Levels (%)

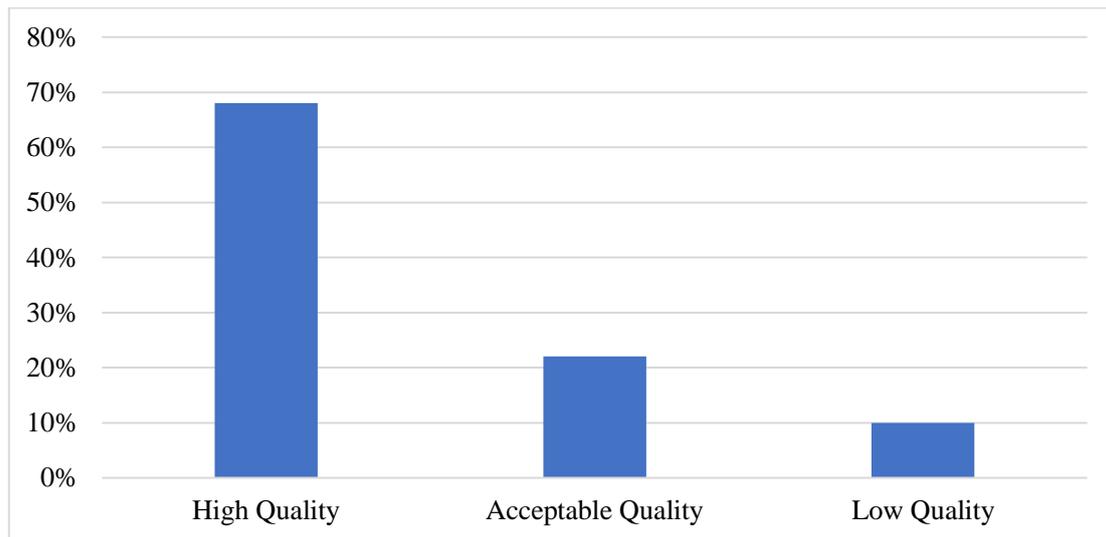| Quality Level	Percentage (%)
High Quality	68%
Acceptable Quality	22%
Low Quality	10%

Figure 3: Graphical Representation of Quality Compliance Levels (%)

The results show that most vendors (68%) are always able to deliver quality products or services, which is good compliance to quality standards. Another 22% are in the acceptable quality category and this indicates that even though the minimum standards are achieved, there is room to improve quality. Nonetheless, only 10% of vendors are characterized by low quality compliance, which can result in higher operational risks, rework, or satisfaction among customers. The AI-based evaluation is effective to demonstrate quality leaders and find the vendors to whom urgent quality improvement measures are necessary.

4.4 Discussion

The results prove that AI-based system of performance rating of vendors is a solid and data-driven tool to assess vendors on such vital dimensions like overall performance, delivery efficiency, and quality compliance. The size of Excellent and Good vendors, as well as the good performance in on time delivery and quality delivery shows that there is effective vendor alignment to the expectations of the organization. Meanwhile, the fact that the vendors with average to poor performance have been identified shows that the system can identify the risks areas, thus allowing the timely corrective measures, performance enhancement strategies, and make the wise strategic choices to enhance the overall effectiveness of the supply chain.

5. CONCLUSION

The study finds that AI-based vendor performance rating system is a powerful and trustworthy tool to assess vendors in an organized and objective way. The findings reveal that the majority of vendors are doing well based on their main dimensions like general performance, timeliness of delivery, and quality compliance, which means that they correspond well to the organizational demands. Meanwhile, the system is effective in ensuring that poor performing vendors are detected in time and corrective measures are put in place to ensure improvement in performance. The AI-based solution will make the supply chain more transparent, aid better procurement decisions, and contribute to the overall supply chain efficiency and competitiveness by reducing the role of human bias and using data-driven insights.

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