

DEMAND FORECASTING AS A STRATEGIC INSTRUMENT FOR MANAGERIAL DECISION-MAKING: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

This study conducts a Systematic Literature Review (SLR) to evaluate the strategic role of demand forecasting in managerial decision-making. Utilizing Publish or Perish software, relevant articles published between 2015 and 2025 were retrieved from Scopus, Web of Science, Dimensions, and Google Scholar. Applying the PRISMA guidelines, eleven rigorous studies were selected for final analysis. The findings indicate that while traditional time-series methods, such as ARIMA and exponential smoothing, remain widely utilized, there is a significant shift toward machine learning and hybrid models to achieve higher accuracy amid complex demand patterns. Furthermore, bibliometric analysis conducted via VOSviewer identified four primary research clusters: model development, forecasting methodologies, managerial approaches, and sectoral applications. This study concludes that demand forecasting transcends its function as a mere technical tool, serving instead as a vital strategic instrument that significantly enhances managerial decision-making efficiency.

Keywords: *decision-making; demand forecasting; machine learning; managerial economics; systematic literature review.*

ABSTRAK

Penelitian ini melakukan Systematic Literature Review (SLR) atau Tinjauan Literatur Sistematis untuk mengevaluasi peran strategis peramalan permintaan dalam pengambilan keputusan manajerial. Dengan menggunakan perangkat lunak Publish or Perish, artikel-artikel relevan yang diterbitkan antara tahun 2015 dan 2025 dikumpulkan dari Scopus, Web of Science, Dimensions, dan Google Scholar. Melalui penerapan pedoman PRISMA, sebelas studi yang memenuhi kriteria ketat dipilih untuk analisis akhir. Temuan penelitian menunjukkan bahwa meskipun metode deret waktu (time-series) tradisional, seperti ARIMA dan exponential smoothing, masih digunakan secara luas, terdapat pergeseran signifikan ke arah pembelajaran mesin (machine learning) dan model hibrida untuk mencapai akurasi yang lebih tinggi di tengah pola permintaan yang kompleks. Selain itu, analisis bibliometrik yang dilakukan melalui VOSviewer mengidentifikasi empat kluster penelitian utama: pengembangan model, metodologi peramalan, pendekatan manajerial, dan aplikasi sektoral. Studi ini menyimpulkan bahwa peramalan permintaan melampaui fungsinya yang hanya sebagai alat teknis belaka, melainkan berfungsi sebagai instrumen strategis vital yang secara signifikan meningkatkan efisiensi pengambilan keputusan manajerial.

Kata kunci: *ekonomi manajerial; pengambilan keputusan; pembelajaran mesin; peramalan permintaan; tinjauan literatur sistematis.*

1. INTRODUCTION

In today's dynamic and highly competitive business environment, the ability to anticipate future demand has become a critical capability for organizations in formulating operational strategies and making sound managerial decisions. Demand forecasting serves as the cornerstone of various management functions, encompassing inventory management, production planning, distribution logistics, and marketing strategy. Accurate demand forecasting enables companies to mitigate the risk of inventory surplus or shortage, reduce operational costs, and enhance customer satisfaction. Conversely, forecasting errors can lead to operational inefficiencies, financial losses, and the forfeiture of market opportunities (Chen et al., 2020; Raza & Ding, 2021).

As technology has advanced, demand forecasting methodologies have evolved considerably from qualitative approaches grounded in intuition and expert judgment, to quantitative methods based on historical data, and more recently to the application of machine learning algorithms and hybrid models that integrate multiple analytical techniques. Prior studies indicate that statistical methods such as ARIMA, Holt-Winters, and regression analysis continue to be extensively utilized (Alon et al., 2019; Hyndman & Athanasopoulos, 2018), yet these are increasingly supplemented by artificial intelligence-based algorithms including LSTM, SVM, and hybrid models, which have demonstrated superior accuracy under conditions of complex, seasonal, or intermittent demand (Makridakis et al., 2018; Singh & Yassine, 2022). Furthermore, demand forecasting has been applied across a wide array of sectors including retail, food industry, energy, logistics, and tourism underscoring both the breadth of its application and the significance of continued research in this domain (Petropoulos & Kourentzes, 2020; Ghosh, 2021).

Despite the substantial body of existing research, a notable gap remains in the literature regarding a comprehensive synthesis of demand forecasting approaches as they relate to managerial decision-making. The majority of studies tend to concentrate on the technical aspects of model accuracy, with relatively few systematically examining how forecasting outputs can be integrated into an organization's strategic decision-making processes (Ali et al., 2020; Spiliotis et al., 2020). Moreover, the rapid proliferation of artificial intelligence-based methods necessitates a comparative assessment of their relevance and effectiveness relative to conventional techniques, so as to provide practical guidance for managers in selecting appropriate methodological approaches (Bermúdez et al., 2020; Makridakis et al., 2020).

Against this backdrop, the present study aims to conduct a Systematic Literature Review (SLR) on demand forecasting within the context of managerial decision-making. By critically examining a range of forecasting methods, their sectoral applications, and their managerial implications, this research seeks to bridge the gap between the technical and practical dimensions of demand forecasting, while also offering renewed insights into its strategic role within organizational management.

2. THEORETICAL FRAMEWORK AND EMPIRICAL STUDIES

Managerial economics is fundamentally concerned with the application of microeconomic and macroeconomic theory to business decision-making processes. A central concept within this framework is demand forecasting, which involves estimating future market requirements based on historical data and relevant external factors. According to the theory of supply and demand, the price and quantity of goods demanded by consumers are determined by the interaction of consumer preferences, income levels, and the prices of substitute and complementary goods (Varian, 2019). In a managerial context, information on demand patterns

is essential for determining production strategies, managing inventories, and guiding investment decisions (Petrooulos & Kourentzes, 2020).

Demand forecasting approaches can broadly be categorized into three types. First, qualitative methods such as the Delphi technique, consumer surveys, and expert judgment are most suitable when historical data are limited or when forecasting for new products (Armstrong, 2001). Second, quantitative time series methods including moving averages, exponential smoothing, ARIMA, and SARIMA rely on historical patterns to identify trends, seasonality, and cyclical behavior (Hyndman & Athanasopoulos, 2018). Third, causal and advanced methods encompass regression analysis, econometric models, and machine learning techniques such as artificial neural networks (ANN), support vector machines (SVM), and hybrid models (Makridakis et al., 2018; Singh & Yassine, 2022).

Several prior studies demonstrate that the selection of a forecasting method is highly contingent on both the industry context and the characteristics of the data. Alon et al. (2019) found that ANN produced more accurate results than traditional time series methods for retail sales forecasting. Research by Ghosh (2021) in the food sector demonstrated that hybrid approaches combining statistical and machine learning methods outperformed individual models in predicting demand for perishable products. Chen et al. (2020) further established that forecasting accuracy carries significant implications for supply chain efficiency, particularly in reducing the bullwhip effect a widespread consequence of demand forecasting errors.

The literature also reflects a broader shift in focus, from merely improving model accuracy toward integrating forecasting outputs into managerial decision-making. Raza and Ding (2021) highlighted that, despite the improved accuracy offered by machine learning, its practical incorporation into business strategy remains limited. Spiliotis et al. (2020) further noted that while international forecasting competitions have stimulated methodological innovation, a persistent gap remains between forecasting techniques and their operational application in managerial practice. Accordingly, a systematic review that addresses not only forecasting methodologies but also how their results can be embedded into production planning, inventory management, marketing strategy, and investment decision-making is both timely and necessary.

On the basis of the foregoing discussion, this study grounds its analysis in demand and supply theory, managerial decision-making theory, and contemporary forecasting frameworks, with the aim of providing a theoretical foundation as well as an empirical synthesis of the role of demand forecasting in supporting strategic managerial decision-making.

3. RESEARCH METHODS

This study employs a Systematic Literature Review (SLR) methodology, aimed at systematically identifying, evaluating, and synthesizing research findings pertaining to demand forecasting within the context of managerial decision-making. The SLR approach was selected for its capacity to generate a comprehensive understanding of research trends, methodological applications, and existing knowledge gaps in the field (Snyder, 2019).

The review process adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which encompass four principal stages: identification, screening, eligibility assessment, and inclusion (Moher et al., 2009).

4. DATA ANALYSIS AND DISCUSSIONS

Data collection was conducted during July and August 2025 through searches across Scopus, Web of Science, Google Scholar (via Publish or Perish), and Dimensions. The initial search yielded a total of 200 articles. These were subsequently subjected to a screening process

based on titles and abstracts, resulting in the exclusion of 183 articles deemed irrelevant to the research topic. The remaining 17 articles proceeded to the eligibility stage for full-text review. Of these, 6 articles were excluded due to inaccessibility of the full text. Consequently, 11 articles were ultimately included in the systematic review.

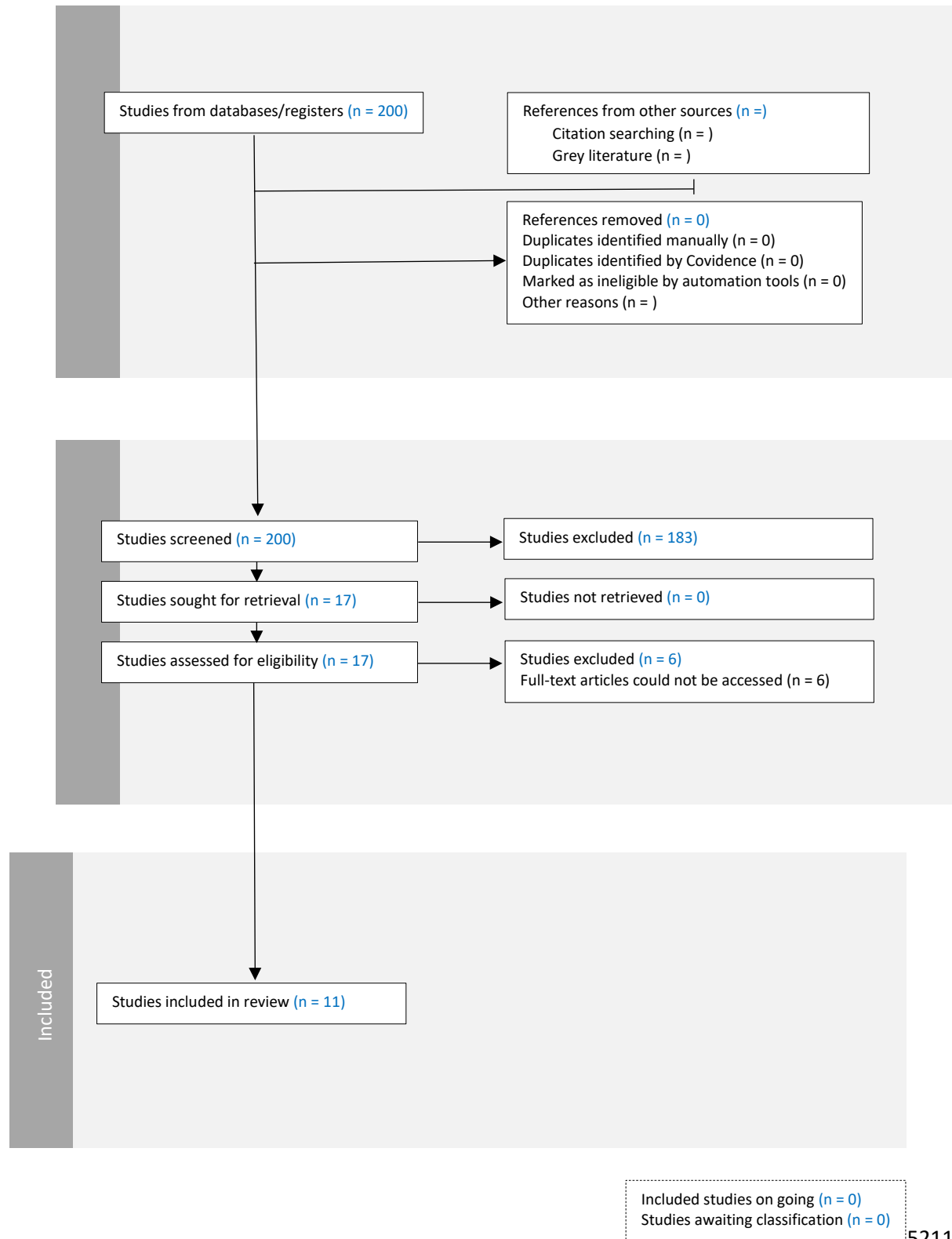


Figure 1. PRISMA Flow Diagram
 Source: Data processed using CONVIDENCE, 2026

Table 1. Summary of Systematic Articles on Demand Forecasting

Author & Year	Method	Sector	Accuracy Indicator	Key Finding
Alon et al. (2019)	ANN vs ARIMA	Retail	MAPE, RMSE	ANN outperforms traditional time series methods in retail sales forecasting
Chen et al. (2020)	Regression & Time Series	Supply Chain	MAPE	Higher forecasting accuracy reduces the bullwhip effect
Ghosh (2021)	Hybrid (ARIMA + ML)	Food Industry	RMSE	Hybrid models are effective for forecasting perishable product demand
Singh & Yassine (2022)	Deep Learning (LSTM)	Trade/Commerce	MAPE	LSTM excels in handling complex and volatile demand patterns
Raza & Ding (2021)	Big Data + ML	E-Commerce	MAE	Big Data integration enhances prediction accuracy
Petropoulos & Kourentzes (2020)	Time Series & ML	Energy	RMSE	Integration of forecasting with business strategy is essential
Makridakis et al. (2018)	Statistical vs ML (M4 Competition)	Multi-Sector	MAPE	ML does not consistently outperform classical statistical methods
Makridakis et al. (2020)	M4 Benchmark	Global	RMSE, MAPE	Combining multiple methods

				yields the most effective results
Bermúdez et al. (2020)	Statistical + ML Hybrid	Logistics	RMSE	Hybrid approaches improve forecasting accuracy
Spiliotis et al. (2020)	Forecasting Competition Evaluation	Multi-Sector	MAPE	Methodological validation benefits from competitive benchmarking
Hyndman & Athanasopoulos (2018)	Time Series	Multi-Sector	MAPE	ARIMA and ETS remain relevant for seasonal data

Source: Processed from selected articles (2015–2025)

To complement the qualitative analysis, this study also conducted a bibliometric analysis using VOSviewer based on the 200 initially retrieved articles, applying a keyword co-occurrence approach to titles and abstracts.

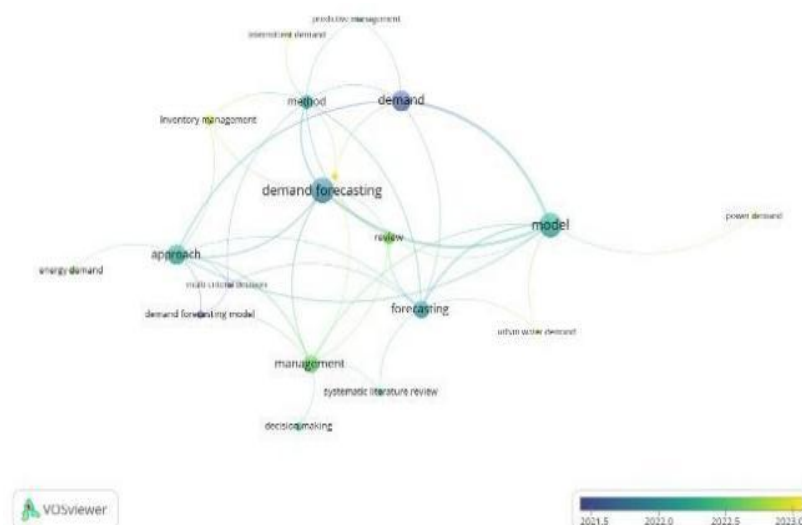


Figure 2. Keyword Co-occurrence Map of Demand Forecasting Research
Source: Data processed using VOSviewer, 2026

The results presented in Figure 2 show that “demand forecasting” functions as the central node, exhibiting a high degree of co-occurrence with other terms such as model, method, forecasting, demand, approach, and management. The keywords model and approach are strongly linked to machine learning and hybrid methods, reflecting the tendency of recent research to prioritize the development of more accurate and adaptive predictive models. Additionally, the keywords management and decision making emerge as connective nodes bridging forecasting with its managerial context, indicating that contemporary research

increasingly emphasizes not only the technical precision of models, but also how forecasting outputs are utilized in strategic decision-making including inventory management, energy demand prediction, and urban water resource planning.

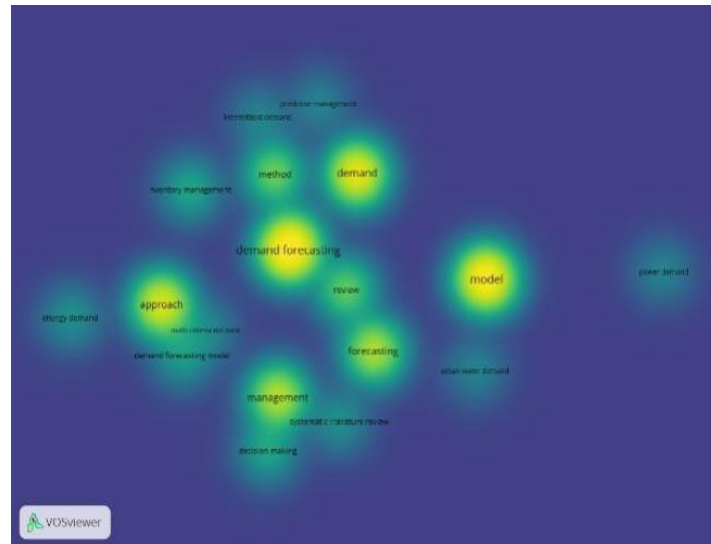


Figure 3. Keyword Density Visualization in Demand Forecasting Research
Source: Data processed using VOSviewer, 2026

Figure 3 illustrates the keyword density visualization, where yellow coloring indicates a high frequency of occurrence. The most prominent keywords are demand forecasting, model, approach, and management, confirming that the literature is concentrated around four overarching themes:

- Model Development-encompassing statistical, econometric, and machine learning approaches (ANN, LSTM, and hybrid models).
- Forecasting Methods-including accuracy evaluation metrics (MAPE, RMSE, MAE) and cross-method comparisons.
- Managerial Approaches-examining the relationship between forecasting and inventory strategy, supply chain management, and risk mitigation.
- Sectoral Applications-spanning energy, food, e-commerce, and urban water management.

Interpretation

The VOSviewer findings corroborate the results presented in Table 1, revealing a clear trajectory in forecasting methods from conventional time series approaches toward the integration of machine learning and big data analytics. Furthermore, the co-occurrence of keywords related to management and decision making underscores the imperative of positioning demand forecasting not solely as an analytical tool, but as a strategic instrument within organizational management.

These findings are consistent with the work of Chen et al. (2020) and Petropoulos and Kourentzes (2020), who emphasized that forecasting accuracy must be integrated with business strategy to produce more targeted and effective decisions. At the same time, Makridakis et al. (2018) cautioned that, despite the growing prominence of machine learning, classical statistical methods remain pertinent under certain conditions. This study therefore affirms the necessity of adopting a context-sensitive approach to the selection of forecasting methods, one that is informed by the specific characteristics of the sector and the managerial requirements at hand.

Discussion

Relationship with Foundational Theory

The findings of this review reinforce the continued relevance of supply and demand theory in explaining the need for demand forecasting, as fluctuations in demand directly influence decisions related to production, inventory, and pricing. Managerial decision-making theory further emphasizes that access to accurate information reduces uncertainty and enhances resource allocation efficiency (Varian, 2019; Armstrong, 2001).

Comparison with Previous Studies

The results of this review are broadly consistent with the conclusions of Makridakis et al. (2018), who found that statistical methods remain competitive; however, more recent studies (Singh & Yassine, 2022; Raza & Ding, 2021) establish that machine learning techniques demonstrate superior performance in the context of complex and non-linear data patterns. These divergent outcomes suggest that the effectiveness of any given method is strongly conditioned by the characteristics of the data and the industry context in which it is applied.

Theoretical and Practical Implications

From a theoretical standpoint, this study reinforces the understanding of how demand forecasting can be integrated within the broader framework of managerial economics. From a practical perspective, the findings offer a substantive reference for managers in:

- a. Selecting forecasting methods that are appropriate to the nature and structure of the available data.
- b. Integrating forecasting outputs into production, inventory, and marketing strategies.
- c. Deploying machine learning selectively and judiciously, with due consideration for data quality and organizational readiness.

Research Limitations

This study is subject to several limitations that warrant acknowledgment. First, the analysis is restricted to 11 selected publications covering the period 2015 to 2025, which means the synthesized findings may not fully represent the entirety of the literature on demand forecasting. Second, although the literature search was conducted across several reputable databases including Scopus, Web of Science, Google Scholar via Publish or Perish, and Dimensions it remains possible that relevant articles were not captured due to access restrictions or differences in indexing across databases. Third, the bibliometric analysis using VOSviewer was based solely on keywords extracted from titles and abstracts, which may result in the incomplete capture of certain research concepts or themes. Fourth, the study places greater emphasis on qualitative and descriptive analysis, without performing a quantitative meta-analysis of effect sizes or a numerical comparison of accuracy across methods.

These limitations present opportunities for future research to expand the scope of included articles, incorporate additional databases, and complement the analysis with quantitative or meta-analytic approaches, thereby generating a more thorough understanding of the effectiveness of demand forecasting methods in the context of managerial decision-making.

5. CONCLUSIONS, RECOMMENDATIONS, AND LIMITATIONS

This study aimed to conduct a Systematic Literature Review on demand forecasting within the context of managerial decision-making. Based on the analysis of eleven articles selected from the period 2015 to 2025, it can be concluded that demand forecasting remains an essential instrument in supporting managerial decisions, particularly those related to production planning, inventory management, marketing strategy, and investment decisions. Classical time series forecasting methods such as ARIMA and exponential smoothing continue to be widely used and remain relevant; however, there is an increasingly pronounced trend toward the adoption of machine learning and hybrid models, which have demonstrated improved accuracy especially under conditions of complex and dynamic demand patterns. The findings also indicate that the integration of forecasting outputs with managerial strategy is receiving growing attention, although a significant gap remains in the literature in terms of connecting the technical aspects of forecasting with comprehensive managerial practice.

In line with these findings, this study recommends that business managers and practitioners direct their attention not only to the selection of accurate forecasting methods, but also to ensuring that forecasting outputs are systematically embedded within strategic decision-making processes. For the academic community, this review highlights opportunities for future research with a broader scope of articles, greater sectoral coverage, and a methodological design that combines qualitative analysis with quantitative or meta-analytic approaches, thereby yielding deeper insights into the comparative effectiveness of demand forecasting methods. The limitations of this study including the restricted number of articles and the reliance on keywords in titles and abstracts represent important considerations that subsequent research can address. Future studies are therefore encouraged to make more comprehensive contributions, both theoretically and practically, to the advancement of managerial economics and data-driven business decision-making.

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