ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (B) March – April, 2025

OPEN ACCESS Original Research Article

# AI-DRIVEN DEMAND FORECASTING IN THE GIG ECONOMY

** Mrs. Pallavi Mahesh Ahire & ** Mrs. Shital Prashant Rode*

** Annasaheb Vartak College, Vasai Road ( West)*

**Abstract:**

*The world is changing rapidly, and this transformation is essential. Let's consider a straightforward example: when cooking a meal, a chef must accurately estimate the precise amount of food needed. This estimation depends on several factors, including the number of people being served, how many types of food are prepared, and various other considerations. The primary intention behind these calculations is to minimize food waste. This paper follows the same principle of minimization of waste and focuses on improving consumer satisfaction through AI-driven demand forecasting in the gig economy. Traditional demand forecasting methods often struggle to accurately predict the consumption of products or services across different companies, making it challenging to meet customer needs effectively. By leveraging AI-driven demand forecasting, businesses can plan more accurately to meet customer demand. Regardless of the industry, the goal is to achieve accuracy and efficiency in service delivery. AI-driven forecasting enhances the demand forecasting process by using algorithms that produce more precise demand predictions. This paper explores the role of AI in demand forecasting within the gig economy, examining its applications, benefits, challenges, and solutions while comparing it to traditional demand forecasting techniques. This paper also provides examples from different sectors to clarify the topic.*

**Keywords:** *AI, Demand Forecasting, Gig Economy, Traditional demand forecasting, AI-driven forecasting, Prediction.*



## Introduction:

The journalist Tina Brown coined the term “gig economy” for the first time in 2009. To some extent, the gig economy is also known as the sharing or on demand economy. Historically, in 1905, the word “gig” was used by jazz musicians to refer to their live musical performances. The journalist Tina Brown described the gig economy as it refers to a labour market characterized by short term, flexible, and often freelance work arrangements in place of permanent or full time employment. The workers who are part of the gig economy are called gig workers or gigs. Where “gigs” can get temporary jobs rather than fixed jobs with a long term contract. To facilitate the “gigs,” normally online platforms are used. These gigs are often called for by the work according to businesses that need services. Here are some platforms like Uber, Ola, Zepto, Zomato, Swiggy, UrbanClap, etc., which offer services on demand. The gig economy gives flexibility to the gig workers to choose when, where, and how much they would like to work. By the time businesses get a benefit towards the overhead costs associated with full time employment in terms of salary, facilities to be provided like life insurance, a cafeteria, office space, electricity, internet, etc.

When the business has a question, "How much of a product or service will be needed in the future?". The best answer to the question is Demand forecasting. Each business has a main focus to fulfil the needs of consumers. Demand forecasting is the process of predicting future consumer demand for a specific product or service. Based on historical data, trends in the market, seasonal change, price, consumer interest, and some other factors contribute to the demand forecast. Whereas accurate demand forecasting is very important and necessary for businesses. It is required to

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (B) Jan – Feb, 2025

OPEN ACCESS Original Research Article

make firm decisions for business planning, inventory management, and workforce planning. It helps companies minimize costs, avoid stock outs or overstocking, and ensure that resources are allocated efficiently.

Artificial Intelligence (AI) is designed to mimic cognitive functions such as learning, problem solving, perception, reasoning, and understanding language. AI is not a single technology but rather a broad field that includes various subfields like Machine Learning (ML), Natural Language Processing (NLP), robotics, Artificial Neural Network (ANN), and computer vision. Over the decades, AI has evolved rapidly, becoming more integrated into everyday life and driving innovations in various industries.

**Literature Review:**

Amosu, O. R., Kumar, P., Ogunsuji, Y. M., Oni, S., & Faworaja, O. (2024) : In the gig economy, traditional demand forecasting methods are necessary for predicting product and service needs based on consumer needs and also optimized resource allocation. These methods are based on historical data, market studies, and expert opinions to calculate future demand. Quantitative and Qualitative traditional demand forecasting methods are used for profitability, efficient supply chain management, improved budgeting, and cash flow. Sometimes predictions can be wrong made by traditional demand forecasting methods.

Muthukalyani, A. R. (2023) : Artificial Intelligence (AI) in the gig economy has changed the face of traditional demand forecasting by providing more accurate and efficient predictions. AI-driven demand forecasting deals with Machine Learning (ML) algorithms, Artificial Neural Network (ANN) algorithms, and data analytics methods to analyse historical as well as real-time data, it also identifies patterns and predicts future demand trends.

Nweje, U., & Taiwo, M. (2025) : The integration of Artificial Intelligence (AI) into the gig economy is transforming how these platforms operate, how workers engage, and how businesses forecast and manage demand. AI in the gig economy offers enhanced efficiency, improved decision making, and better user experiences.

Jones, J. (2025) : Using advanced AI algorithms businesses are preparing successful planning, resource allocation, work assignment, workforce enablement, etc. AI helps forecast demand in real time, allowing businesses to better allocate resources. AI enables real-time analysis, allowing businesses to respond quickly to changes in market conditions or consumer behaviour. Using advanced AI algorithms businesses can analyse the skills, preferences, and ratings of gig workers and match them with the most appropriate tasks or clients. This process becomes more refined as the system gathers more data over time. AI also offers personalized suggestions for workers.

Dwivedi, D. N., & Gupta, A. (2022): AI also helps consumers to post feedback about the product and services they have received. Using AI algorithms performance of “gigs” is calculated easily based on feedback submitted by consumers. The reflection of the performance is in the form of ratings which are posted on the respective online platforms involved in the gig economy. Consumers can make use of such ratings to choose a respective “gig” for a specific service.

**Methodology:**

Predicting the demand for products and services over a period of time is a crucial task in the gig economy for all industries. Using some traditional methods sometimes prediction can be wrong. To improve this scenario AI-driven forecasting techniques are helpful. This paper compares traditional and AI-driven demand forecasting methods.

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (B) Jan – Feb, 2025

OPEN ACCESS Original Research Article

**Traditional Demand Forecasting:**

1. **Qualitative Methods:** Various methods fall under qualitative methods. When businesses collect expert opinions through a structured process to achieve accurate forecasts then it is called "Delphi Methods". It also has a brief focus on historical data. Sales executives are directly involved in sales, they also know the market trends. When feedback collected from the sales team to forecast customer demand is known as a "Sales Force Composite". The best learning source is unhappy customers. To make customers happy "Market Research" is an essential strategy. It helps to understand customer preferences and expectations by collecting data through surveys.
2. Quantitative Methods: Quantity is a part of quality. Various methods fall under quantitative methods. Understanding product trends which especially depends on historical sales data and seasonal changes to identify future demand are known as trend projection and time series analysis.

**Benefits of Demand Forecasting:**

- Efficient Supply Chain Management
- Improved Budgeting and Cash Flow
- Enhanced Profitability

**Challenges of Demand Forecasting:**

- Data Accuracy
- Collaboration
- Adaptability

**AI in Demand Forecasting:**

In certain cases, traditional demand forecasting has been found wrong. To deal with this problem AI takes the lead. By leveraging machine learning (ML) algorithms historical and real-time data analysis can become more easy and quick. In pattern recognition scenarios AI deals with Artificial Neural Network (ANN) algorithms. Using such techniques businesses can forecast exact demand and will be able to follow the principle of minimization of waste. Some sample techniques are discussed as follows:

1. **Real-Time Insights:** To keep up with consumer behaviour and quickly adjust to market trends, businesses must leverage real-time analysis. This strategy not only improves responsiveness but also allows companies to succeed in a constantly changing environment. ARIMA (Auto Regressive Integrated Moving Average) and SARIMA (Seasonal ARIMA) models are examples.
2. **Predictive Analytics:** By analysing data patterns, businesses can make accurate predictions about future demand using Artificial Neural Network (ANN) algorithms. The Multi-Layer Perceptron (MLP) model captures the relationships between input features, like historical sales data and promotions, and future demand. By adjusting its weights during training, it accurately maps these inputs to outputs with high precision.
3. **Data Analysis:** To adapt quickly to market trends, businesses need real-time analysis, enhancing responsiveness in a changing environment. AI algorithms can analyse large data sets from sources like social media and historical sales to deliver valuable insights.
4. **Integration with Other Technologies:** AI can be combined with technologies like natural language processing (NLP) and image recognition to analyse unstructured data and enhance forecast accuracy. BERT (Bidirectional Encoder Representations from Transformers) model can build forecast models based on customer review.

**How does AI for demand forecasting work?**

Integrating AI into demand forecasting revolutionizes traditional methods by leveraging advanced Large Language Models (LLMs) and connecting them with vast organizational data. This innovative approach enhances data analysis, providing deep insights for precise forecasting, enabling businesses to optimize

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (B) Jan – Feb, 2025

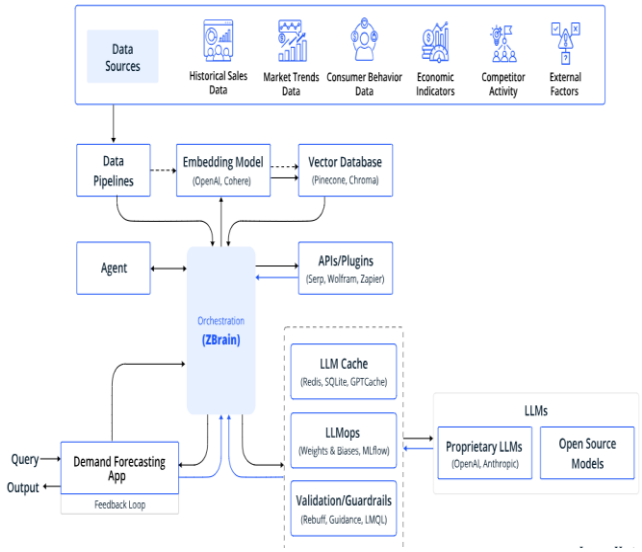
OPEN ACCESS Original Research Article

inventory, streamline supply chains, and align production with market trends.

The system architecture incorporates various components to enhance the efficiency of AI-driven demand forecasting. Here's a concise breakdown of the process:

- Effective demand forecasting relies on various **data sources**, including:

1. **Historical Sales Data**: Past sales records that reveal trends for accurate forecasting.




2. **Market Trends Data:** Insights into current conditions and emerging trends affecting demand.
3. **Consumer Behaviour Data:** Customer interaction information that helps predict purchasing trends.
4. **Competitor Activity:** Insights into competitors' promotions and strategies influencing the market.

**Data Pipelines:** Data from various sources is processed through pipelines that handle ingestion, cleaning, and structuring for analysis.

**Embedding Model:** An embedding model convert's cleaned data into a format suitable for AI systems, often using models from Open AI, Google, or Cohere.

**Vector Database:** The vectors produced by the embedding model are stored in a vector database like Pinecone or Weaviate, allowing for efficient querying and retrieval.

**APIs and plugins:** such as Serp, Zapier, and Wolfram, are essential because they connect various components and provide additional functionalities. They enable access to extra data, integration with necessary tools or platforms, and the ability to perform specific tasks easily.

**Orchestration layer:** The orchestrating layer is essential for managing workflows. ZBrain exemplifies this layer by streamlining prompt chaining, managing API interactions, retrieving contextual data from vector databases, and maintaining memory across multiple calls to language models (LLMs). Its main function is to generate and submit prompts to a language model for processing while ensuring smooth coordination across demand forecasting operations.

**Query execution:** The demand forecasting app's data retrieval and generation process starts when a user submits a query about future market demands, product performance, or inventory needs.

**LLM Processing:** The app forwards the query to the orchestration layer, which retrieves relevant data from the vector database and LLM cache, then sends it to the appropriate LLM for processing.

**Output:** The LLM generates an output based on the query and associated data, including expected product demand and supply chain recommendations.

**Demand Forecasting App:** This app provides AI-generated forecasts in an accessible format, enabling quick, informed decision-making for business planners and supply chain managers.

**Feedback Loop**: User feedback on LLM outputs is essential for continually improving their accuracy and relevance.

**Agent:** AI agents tackle complex problems and enhance learning by interacting with the external environment and utilizing advanced reasoning, strategic tools, and memory techniques.

**LLM Cache:** Tools like Redis, SQLite, and GPTCache

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (B) Jan – Feb, 2025

OPEN ACCESS Original Research Article

cache frequently accessed information to improve the AI system's response time.

**Logging/LLMOps:**

Tools like Weights & Biases, MLflow, Helicone, and Prompt Layer log actions and monitor performance, ensuring LLMs operate efficiently and evolve through ongoing feedback.

**Validation:** A validation layer uses tools such as Guardrails, Guidance, Rebuff, and LMQL to verify the accuracy and reliability of the LLM's output.

**LLM APIs and hosting platforms** are vital for effective demand forecasting and application performance. Developers can choose from advanced LLM APIs like those from Open AI. For hosting, options include major cloud providers like AWS, GCP, and Azure, as well as innovative platforms like Data bricks and Any scale. This approach highlights AI's role in transforming demand forecasting.

**Benefits of AI-driven Demand Forecasting:**

1. Improved Accuracy
2. Real-Time Forecasting
3. Better Handling of Complex Variables
4. Automation and Efficiency
5. Adaptability to New Trends
6. Cost Reduction
7. Scalability

**Challenges in AI-driven Demand Forecasting:**

1. Data Quality and Availability
2. Complexity of Model Training
3. Overfitting and Generalization Issues
4. Interpretability and Transparency
5. Resource Intensive
6. Integration with Existing Systems
7. Dependence on Historical Data
8. Bias and Ethical Concerns
9. Continuous Monitoring and Updates

**Results:**

This paper examines the compelling comparison between traditional demand forecasting methods and advanced AI techniques. AI approaches, especially ARIMA (Auto Regressive Integrated Moving Average) and SARIMA (Seasonal ARIMA), are effective in utilizing historical data to predict current demand. The AR component captures the influence of past observations, while the MA component addresses the impact of past errors. Moreover, incorporating historical sales data, promotional activities, and predicted future demand, the Multi-Layer Perceptron (MLP) model is highly valuable. Additionally, by analysing product reviews using BERT (Bidirectional Encoder Representations from Transformers), we can assess customer sentiment. An increase in positive feedback about a new feature may signal rising demand, which can be seamlessly integrated into forecasting models to enhance accuracy.

**Conclusion:**

In conclusion, AI-driven demand forecasting significantly enhances traditional methods, allowing businesses to make more accurate and dynamic predictions. By using machine learning models like ARIMA, SARIMA, and Multi-Layer Perceptron (MLP), along with natural language processing techniques such as BERT for sentiment analysis, AI can identify complex patterns and seasonal trends. This integration of historical data and real-time analysis enables better decision making, optimized inventory management, and improved strategies.

**Citation:**

1. Amosu, O. R., Kumar, P., Ogunsuji, Y. M., Oni, S., & Faworaja, O. (2024). AI-driven demand forecasting: Enhancing inventory management and customer satisfaction. *World Journal of Advanced Research and Reviews*, *23*(2), 100-110.
2. Muthukalyani, A. R. (2023). Unlocking accurate demand forecasting in retail supply chains with AI-driven predictive analytics. *Information Technology and Management*, *14*(2), 48-57.

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (B) Jan – Feb, 2025

OPEN ACCESS Original Research Article

3. Nweje, U., & Taiwo, M. (2025). Leveraging Artificial Intelligence for predictive supply chain management, focus on how AI-driven tools are revolutionizing demand forecasting and inventory optimization. *International Journal of Science and Research Archive*, *14*(1), 230-250.
4. Jones, J. (2025). AI-Driven Demand Forecasting in Supply Chains: A Qualitative Analysis of Adoption and Impact.
5. Dwivedi, D. N., & Gupta, A. (2022). Artificial intelligence-driven power demand estimation and short-, medium-, and long-term forecasting. In *Artificial intelligence for renewable energy systems* (pp. 231-242). Woodhead Publishing.

**References:**

1. *https://o9solutions.com/articles/everything-about-ai-forecasting/*
2. *https://dl.acm.org/doi/10.1145/3670865.3673642*
3. *https://aithor.co.in/essay-examples/the-role-of-ai-in-advancing-the-gig-economy*
4. *https://www.workflexi.in/future-trends-in-gig-work-adapting-to-ai-and-automation/*
5. *https://www.netguru.com/blog/AI-driven-demand-forecasting#:~:text=By%20analyzing%20vast%20datasets%2C%20AI,product%20availability%20and%20competitive%20pricing.*
6. *https://www.cogentinfo.com/resources/everything-about-ai-forecasting-models*
7. *https://www.researchgate.net/profile/Mariam-Atwani-2/publication/386223492_AI-driven_Demand_Forecasting_Models_A_Systematic_Literature_Review/links/67497827359dcb4d9d3fe5a7/AI-driven-Demand-Forecasting-Models-A-Systematic-Literature-Review.pdf*
8. *https://www.leewayhertz.com/ai-in-demand-forecasting/#AI-for-demand-forecasting-work*

***Cite This Article:***

***Mrs. Ahire P.M. & Mrs. Rode S.P. (2025).*** *AI-Driven Demand Forecasting in the Gig Economy*. **In Aarhat Multidisciplinary International Education Research Journal**: Vol. XIV (Number II, pp. 35–40).