

The Impact of AI-Driven Demand Forecasting on Inventory Management in Bangladesh's FMCG Sector: Exploring the Challenges, Benefits, and Future of Implementing AI for Optimized Inventory Control

Esrat Jebin Lira, Md Aatur Rahman Mridha, Tanvir Mahmud Faiaz, Sheikh Asif

Abstract :

The adoption of Artificial Intelligence (AI) in the Fast-Moving Consumer Goods (FMCG) industry is gaining popularity in Bangladesh as the country pursues the goal of modernizing its supply chains and overcoming inefficiencies in inventory management. The paper examines how AI-based demand forecasting can influence inventory management within the FMCG industry in Bangladesh, in terms of how it could help mitigate two critical problems in this industry, namely stockouts and overstocking. The research presents a description of the present situation of the FMCG supply chain in Bangladesh and the inefficiency of the inventory management, i.e., the over-reliance on the traditional methods of forecasting that frequently result in excessive inventory or lost sales. The paper evaluates the preparedness of FMCG sector in Bangladesh to implement AI based on the availability of digital infrastructure, technical skills and the regulatory environment. Even the evident benefits of AI, financial constraints, the absence of qualified specialists, and aversion to change are named as the significant challenges to its widespread use. Using a mixture of secondary and primary data analysis, conducted on a survey of supply chain professionals in Bangladesh, this paper outlines

the primary barriers and suggests practical solutions to implementing AI in the FMCG supply chain. The results indicate that AI-based demand forecasting may bring the company impressive outcomes in inventory optimization, enhanced operational efficiency, and achieving cost reduction. This makes AI an important resource of enhancing supply chain in the FMCG sector of Bangladesh, Contributing to economic growth and improved service delivery to the retail market.

Chapter 1: Introduction

1.1 Background of the Study

The Fast-Moving Consumer Goods (FMCG) industry in Bangladesh has a major presence in the economy of the country contributing its fair share to the GDP and employment. FMCG industry encompasses diverse products like food and beverages, personal care, domestic products and health care products, which are highly mobile and fast consumable. FMCG industry is not just a leading source of the economic development, but also a giant in the area of retail distribution with a huge chain of supply that makes sure that products are placed in the hands of consumers. Urbanization, increase in disposable income and changing pattern of consumption have contributed to tremendous growth in the FMCG sector in Bangladesh. Nevertheless, inventory management has been one of the main areas of concern because the industry has been affected by seasonality, festivals, economic changes, and ways of preferences that cause fluctuations in the demand. This tends to cause either stockouts (when products are not available when the customers require them) or overstocking (where businesses end up with too much stock that doesn't pay off) or excessive discounts (or even necessitating deep discounts). The balance between demand and supply is very important in an industry where a competitive environment is high and where speed in the industry is high. Management of inventory plays the core role in making sure that the appropriate products are at the appropriate time and quantity. Conventional demand forecasting techniques which depend on past data and manual alterations tend to be inefficient and do not consider the intricate variation in the demand pattern. Advanced technologies can also be used to optimize inventory and enhance forecasting systems in businesses with the introduction of Artificial Intelligence (AI). Artificial

intelligence (AI), and specifically machine learning (ML) and predictive analytics use big amounts of data, often past sales data, market trends, and customer behavior, to create more precise demand predictions. AI systems can be tailored and optimized to make forecasts on the fly, making it an effective weapon of companies to prevent stockouts and overstocking. With the FMCG industry in Bangladesh gaining momentum and becoming highly competitive, the addition of AI-powered demand forecasting has enormous possibilities to enhance inventory management, as it ensures that supply and demand properly align with high precision and efficiency.

1.2 Research Problem

The issue which the study is going to solve is the inefficiency of inventory management in the FMCG industry of Bangladesh which is mainly caused by the traditional demand forecasting techniques. Such approaches are usually based on previous data and manual corrections, and they do not involve anticipating any unexpected alterations of the demand patterns. Lack of ability to predict demand leads to stockouts, overstocking, and all this impacts customer satisfaction, profitability, and the efficiency of operations. Artificial Intelligence (AI) can be used to solve these problems, getting demand forecasting more accurate and streamlining inventory management. Nevertheless, artificial intelligence has not permeated Bangladesh's FMCG industry. Although large firms such as Shwapno and Aarong are already experimenting with AI technologies, many SMEs are still operating with the old system of controlling inventory because of multiple technical hurdles, such as data quality, high costs of implementation, and untrained staff. This study will be used to assess the level at which AI-based demand prediction can enhance inventory control within the FMCG industry in Bangladesh by lowering stockouts and oversupply. The barriers to the adoption of AI will also be studied and solutions suggested on how to surmount them.

1.3 Research Question

The main research question, which this work attempts to answer, is: How can the AI-based demand forecasting benefit inventory management in the FMCG industry of Bangladesh by minimizing stockouts and overstocking?

1.4 Hypothesis

The hypothesis of the study is as follows: The demand forecasting based on AI is a great way of enhancing the inventory management framework in the FMCG industry in Bangladesh because it minimizes both stockouts and overstocking. The hypothesis is premised on the fact that AI technologies, including machine learning (ML) and predictive analytics, can be used to maximize inventory in the FMCG industry through the delivery of precise demand forecasts.

1.5 Objectives of the Study

The key aims of the research are:

1. To determine the level of FMCG industry AI adoption in Bangladesh and the level to which AI tools are being exploited to make demand forecasts and manage inventory.
2. To find out the obstacles to adopting AI, including the quality of data, financial limitations, and shortage of qualified personnel.
3. In order to measure the effect of AI-based demand forecasting on inventory management, it is important to look at its capability in decreasing stockouts and excessive stock.
4. To offer practical suggestions about how the obstacles to the adoption of AI in the FMCG industry in Bangladesh may be surmounted and the adoption of AI technologies may be encouraged.

1.6 Significance of the Study

This research is important in many respects:

Leads to AI implementation in Bangladesh: Since AI implementation is still immature in the FMCG sector of Bangladesh, this study will be useful in informing on how AI can be utilized to benefit inventory management and supply chain processes in the country.

Enhances operational efficiency: This research will positively impact the inventory optimization of businesses because by assessing the potential of AI to address inventory problems, such as stockouts and overstocking, it will become better operational and, as a result, cost-efficient and more satisfied customers.

Policy implications: The research shall provide recommendations to the policymakers that can enable AI implementation in the FMCG industry, including financial incentives, training, and enhancement of digital infrastructure.

Extends academic understanding: The study is an addition to the body of literature on AI in supply chains and, specifically, in developing economies such as Bangladesh, which has received little attention in AI implementation literature.

1.7 Scope of the Study

The proposed research is dedicated to the FMCG industry in Bangladesh where inventory control is a key to business success. Large FMCG companies will be analyzed and the small and medium enterprises (SMEs) will be analyzed to be able to see the whole picture of AI adoption in various sectors of the industry. Primary data will be used to conduct the study, with the survey of supply chain professionals in the FMCG industry being conducted as the method of data collection, and the secondary data will be gathered by conducting literature reviews and case studies.

Key areas that the research will address are: AI technologies in the monitoring of demand within the chain of FMCG supplies. Obstacles to the adoption of AI and business-related difficulties. Effects of AI on the management of inventory by mitigating stockouts, overstocking, and optimization of the supply chain processes.

1.8 Structure of the Thesis

The thesis was divided into the following chapters:

Chapter 1: Introduction: Chapter 1 presents the background, research problem, objectives and the importance of the research.

Chapter 2: Literature Review: Chapter presents the review of relevant studies and literature on AI in supply chain management, specifically in FMCG sector and identifies the barriers to AI adoption.

Chapter 3: Research Methodology: This chapter outlines the mixed-method approach of the study, survey design, sample selection, and the method of data collection.

Chapter 4: Data Collection and Analysis: Chapter 4 reports the findings of the survey and recalls the data analysis and discussion of the findings in terms of AI adoption and effect on inventory management.

Chapter 5: Results and Discussion: The chapter presents the results of the survey and compares them with the present body of literature, along with discussing the implications of the results to the FMCG industry in Bangladesh.

Chapter 6: Conclusion and Recommendations: In this chapter, the authors synthesize the main findings of the study, mention the recommendations concerning the adoption of AI to the FMCG sector in Bangladesh, and propose the directions of future work.

Conclusion of Chapter 1

Chapter 1 presented the study by giving an overview of the FMCG sector in Bangladesh, the inventory management challenge that the sector experiences and how AI-driven demand forecasting can mitigate the challenges. The problem of research, its aim and its hypothesis were described as well as the relevance and the extent of the study were discussed. The subsequent chapter will provide a full literature review that will analyze the trends in the use of AI in the FMCG industry across the world and the potential barriers and opportunities of AI integration in Bangladesh.

Chapter 2: Literature Review

The literature review will seek to address the available literature on the adoption of AI in supply chain management, with a narrow scope of demand forecasting and inventory management in FMCG industry. This is a review of global trends, application of AI, the advantages of adoption of AI, and the obstacles to the integration especially in the FMCG sector in Bangladesh.

2.1 AI in Supply Chain Management

AI has become a revolutionary technology in supply chain management and its applications run across inventory management and demand forecasting to supply chain optimization. Abreu and van Deventer (2022) suggest that AI systems can take huge amounts of data such as past sales data, consumer behavior, and outside market factors to help forecast demand more accurately than traditional systems would. The machine learning (ML) algorithms that are used in these AI systems have the ability to learn on historical data and with the addition of more data, their forecasting accuracy improves over time. By doing so, AI does not only forecast what will be in demand but also detects the patterns and trends that a traditional forecasting model would otherwise be challenging to notice.

Predictive analytics are AI tools that prove especially useful in inventory management. Machine learning algorithms will be able to determine the products that may be in demand at particular times, lessening the chances of overstocking or stockouts. As an illustration, Amazon, which is a leader in the online shopping business, has turned to AI to oversee its international supply chain with demand forecasting being used to help in matching products to satisfy customer demands and reducing surpluses that consume capital.

As Shankar & Kohli (2021) emphasize, the use of AI in supply chains offers three main advantages:

- More successful forecasting of demand.
- New inventory stock that is optimized to minimize stock outs and stock.
- Better decision-making on the basis of real-time data analysis.

The benefits achieved are cost savings, customer service and operational efficiency of the supply chain.

2.2 AI in FMCG Supply Chains

FMCG industry has special challenges; in terms of stock management, it has the highest turnover rate and the consumer demand is evolving at high pace. Conventional approaches, including the use of traditional sales history and adjustments based on human judgment, have tended to create inaccurate projections and poor inventory control, thus causing missed sales and higher expenses (Yadav and Singh, 2019). AI-powered demand forecasting offers a perspective on these problems, which enables predicting the shifts in the demand with higher accuracy and updated in real time.

There are major international FMCG corporations that have managed to introduce the implementation of AI into the supply chain. An example is Walmart, which introduced AI-based demand forecasting technologies that assisted the company in cutting stock outs by 8 percent leading to better stock availability and customer satisfaction (Abreu and van Deventer, 2022). On the same note, Unilever used AI to optimize its inventory management where machine learning algorithms are used to predict demand more effectively and cut excess stocks by 20 percent, therefore, saving costs and enhancing sustainability (Yadav and Singh, 2019).

The impact of AI on FMCG companies across the world has revealed that AI can be used to optimize inventory by enhancing the accuracy of demand forecasting. But the issue with implementation of these developed AI technologies in Bangladesh is the challenge, especially in FMCG sector. Although major corporations (such as Shwapno and Aarong) are trying AI, small businesses have a strong set of challenges in the form of limited funds, absence of digital infrastructure, and availability of qualified specialists (Sharif et al., 2024).

2.3 AI Adoption in Bangladesh's FMCG Sector

The use of AI in Bangladesh supply chains is at its early developmental phase, especially in the field of FMCG. According to Sharif et al. (2024), although the trend in Bangladesh is to consider AI technologies in larger FMCG companies, the most considerable proportion of businesses in the sector continues to use traditional demand forecasting and inventory management. The most important impediments listed by the respondents in their research are cost, inadequate technical expertise and ineffective data infrastructure. Chowhan and Rani (2020) argue that the barrier to AIs is high initial costs that are especially burdensome to small and medium-sized enterprises (SMEs) operating in the FMCG industry.

Besides, lacking the availability of qualified specialists in data science and AI-related disciplines poses a challenge to the companies that want to adopt and support AI-based systems. Bansal and Ghosh (2021) opine that AI expertise is scarce in developing nations such as Bangladesh thus complicating the construction and maintenance of AI applications and further reduce the adoption process.

Nonetheless, the FMCG industry in Bangladesh has increased potential when it comes to the use of AI. The proliferation of mobile internet access, the emergence of intelligent devices, and the government aid in the digitization of processes can ensure the sufficient basis on which AI tools will be more highly employed in demand prediction and inventory control.

2.4 Barriers to AI Adoption in Bangladesh

Some of the challenges of AI implementation in the context of Bangladesh are unique to it, such as data quality, financial limitations, and shortage of professional expertise. These are not only Bangladesh specific barriers but they are high especially in the developing economies. Sharif et al. (2024) state that the absence of organized and uncontaminated data in the FMCG sector of Bangladesh does not allow AI tools to be effective. Most firms are still using the old systems or manual entry of data which leads to low data quality. This causes AI systems to have a hard time forecasting demand and maximizing inventory.

There is also the problem of financial constraints where the initial expense of the AI tools, software and training may be prohibitive to smaller businesses. According to Chowhan and

Rani (2020) those financial barriers are particularly sensitive to SMEs that constitute the largest portion of the FMCG industry in Bangladesh.

Also, Bangladesh lacks trained specialists who can have the expertise in AI, machine learning, and data analytics. According to Sharif et al. (2024), there is a shortage of skilled AI professionals available to develop and operate AI systems in many companies, and it restricts the scalability of AI systems within the industry.

2.5 Opportunities for AI in Bangladesh's FMCG Sector

Despite these barriers, the FMCG sector in Bangladesh presents significant opportunities for AI adoption. The challenges to the implementation of AI can be mitigated by government programs that target enhancement of the digital infrastructure and establishment of partnerships between the government and the business world. Yadav and Singh (2019) observe that the digital revolution in Bangladesh and the emergence of internet penetration and mobile technology in rapid growth is giving AI-based solutions a firm ground.

Furthermore, the examples of large businesses, such as Aarong and Shwapno, that have already started to use AI tools are the leaders of the entire industry. Such companies are capable of making a critical contribution towards AI adoption throughout the industry since they can illustrate how AI has the potential to enhance inventory correctness, as well as decrease inefficiencies. Moreover, AI in predicting the market will offer companies a way to manage inventory to match real consumer needs more closely, eliminating stock-outs and overstocking.

Lastly, the government can be instrumental in providing financial incentives, subsidies and training to encourage AI adoption, particularly among the SMEs within the FMCG industry.

2.6 Conclusion

The need to optimize supply chains around the world has seen artificial intelligence (AI) demand forecasting as a very necessary tool. Nevertheless, there is a considerable obstacle to implementing AI in the FMCG industry in Bangladesh in the form of data quality concerns, expensive implementation, and a shortage of qualified personnel. Nevertheless, it can be concluded that AI adoption in the FMCG sector of Bangladesh has a great potential, especially when supported by the government and with the increasing accessibility of digital infrastructure. This review of literature has given the base to the analysis of the potential and hindrances of AI adoption in the field, and will inform the main research in the following chapters.

Chapter 3: Research Methodology

3.1 Research Approach

This research uses a mixed-method that enables them to evaluate how AI-based demand forecasting can influence inventory management within the FMCG industry in Bangladesh. The mixed-methods approach is a combination of both qualitative and quantitative data in order to come up with a thorough explanation of the research problem.

Primary Research

The main study will be examining 100 professionals who operate in the FMCG supply chain in Bangladesh through a survey study. The survey will seek to provide the empirical data on:

- The current state of AI adoption in inventory management.
- The obstacles to the use of AI such as difficulties in data quality, affordability, and technical skills.
- The perceived effect of AI on inventory control, with reference to mitigating the occurrence of stockouts and overstocking.
- Detecting AI usage opportunities of the FMCG industry.

- The received survey data is subsequently processed through descriptive statistics and Relative Importance Index (RII) in order to measure and prioritise the obstacles and opportunities to AI adoption in the FMCG sector in Bangladesh.

Secondary Research

The secondary study involves an extensive literature review of AI application in supply chains across the world, especially the FMCG industry. This secondary data is applied to:

- Place the main research design in the context of a wider picture of AI implementation into the supply chain.
- Determine trends, best practices, and challenges of businesses in developed economies to adopt AI in inventory management.
- The secondary research will also contain the academic journals, industry reports, and case studies of Supply Chain Insider, and other credible sources about the AI in the supply chain management.

3.2 Population and Sample

Population

This study is aimed at the population of professionals operating in the FMCG supply chain in Bangladesh. This involves the people at different positions, including:

- Supply Chain Managers, the managers who manage the stock control measures and demand forecasting.
- Data Analysts and AI Specialists participating in the creation, application, and operation of AI in demand forecasting and inventory management.
- Operations Managers, who oversee everyday inventory operations and who offer a perspective on ways AI could enhance supply chain performance.

Sampling Method

Since the FMCG industry in Bangladesh is quite diverse, the present study utilizes stratified random sampling in order to cover large FMCG firms (including Shwapno, Aarong, and Unilever) as well as small and medium-sized enterprises (SMEs). The method would enable the research to have a global picture of AI use in the industry.

A total of 100 respondents were chosen, and both big businesses and SMEs were equally represented, which guaranteed diversity in the data and the inclusion of different attitudes towards the adoption of AI.

Sample Size Justification

A sample of 100 respondents is sufficient since it will be statistically significant and will give credible information on the trends of AI adoption and obstacles in the FMCG sector. Since there are various businesses within the FMCG industry, such a large number of respondents is enough to ensure that a wide scope of opinions and experience regarding AI in supply chain management is reflected.

3.3 Data Collection

Primary Data Collection: Survey

A structured questionnaire given to the professionals of FMCG sector was the main data collection process. The questionnaire was categorised into three parts:

1. **AI Adoption:** The aim of this section was to gauge to what degree AI tools were adopted in the demand forecasting and inventory management systems in FMCG companies of Bangladesh. Questions focused on:
 - o The nature of the AI tools in use.
 - o The adoption rate of AI in supply chain processes.
 - o The benefits and challenges of introducing AI as perceived.
2. **Barriers to AI Adoption:** In this section, the researcher aimed to find out the large barriers that companies encounter when adopting AI, which include:

- o Data quality issues.
 - o Monetary restrictions on the costly initial investment.
 - o The lack of skilled professionals and technical expertise in AI.
3. **AI Inventory Management Effect:** The objective of this section was to identify the effectiveness of AI on inventory management in terms of fewer inventory stockouts and overstocking, gains in operational efficiency and customer satisfaction. This section required questions where the respondents were asked about:
- o Reduction in stockouts due to AI-driven forecasts.
 - o Savings on the cost associated with improved inventory optimization.
 - o Customer satisfaction improvements due to better product availability.

Secondary Data Collection: Literature Review

The secondary data utilized in this research was gathered by carrying out an extensive literature review. Key sources included:

- o Research papers on the introduction of AI in supply chains and specifically in demand forecasting and inventory management.
- o Organizations like Supply Chain Insider and McKinsey have industry reports that give insights into the usage of AI in FMCG and other industries.
- o The Demand forecasting and inventory management Case studies of global FMCG firms such as Walmart, Nestle, and Unilever have applied AI to demand forecasting and inventory management.

The secondary research has been used to put the survey in the context and it has been used to determine the gaps that exist in the adoption of AI in the FMCG sector in Bangladesh as it would enable the study to be more decisive in regards to the benefits and challenges that AI could bring in the local environment.

3.4 Data Analysis

Quantitative Data Analysis

The data of the survey was processed with the descriptive statistics and Relative Importance Index (RII). The survey was summarized with the help of descriptive statistics and revealed insights into the distribution of the answers to the main questions on AI adoption, barriers, and the effect of AI on inventory management.

Barriers to AI adoption and the promising AI applications in the FMCG sector of Bangladesh were ranked using the Relative Importance Index (RII). The RII assists in measuring the comparative relative importance of every factor and rank them accordingly. The RII calculation formula is:

$$RII = \frac{\sum (W)A}{N} \quad RII = \frac{\sum (W)}{N} \quad RII = A \times \frac{\sum (W)}{N}$$

Where:

W = weight of any factor (1 = least important, 5 = most important),

A = highest weight (5),

N = total number of respondents.

Qualitative Data Analysis

The survey questions that were open-ended gave the respondents an opportunity to give some detailed information on their experience with the adoption of AI, difficulties encountered, and possible solutions. Thematic analysis was employed in the analysis of the qualitative data and entails establishing common themes or trends in the responses.

Themes that were obtained during the qualitative analysis:

- Lack of AI awareness and training programs.
- Concerns about data quality and the need for better data management.
- Difficulties encountered by SMEs in the implementation of AI tools because of financial constraints.

These themes served as a useful part to the quantitative results in the context and as an explanation of the hindrances to AI adoption in the FMCG sector.

Data Presentation

The findings of the survey were summarized by use of:

- Bar Charts to demonstrate how respondents to closed-ended questions, e.g. the proportion of respondents who use AI tools and which attachments prevent their adoption.
- Pie Charts visualizing the distribution of the most promising AI applications and the effect of AI on stockouts, overstocking.
- Tables to provide a summary of the RII analysis, prioritizing barriers and opportunities to integrate AI.

Conclusion

This chapter has outlined the research design that was applied to the study to examine how AI-based demand forecasting will enhance inventory management in the Bangladesh FMCG industries. The combined methodology involved the use of primary data through a survey and secondary data through the literature, giving an in-depth insight into AI adoption, obstacles, and the possible effects. The analysis of the data was based on descriptive statistics and Relative Importance Index (RII) that helps to measure the results and define the strongest barriers and the most promising applications of AI in the FMCG field.

The methodology gives a strong basis to evaluate the potential of AI in changing the Bangladesh FMCG sector and gives insights into the issues that should be countered in order to introduce AI successfully.

Chapter 4: Data Collection and Analysis

This chapter introduces the findings and discussion of the data gathered by using the survey conducted in the FMCG industry of the Bangladesh country. The survey was developed to determine the current level of AI adoption, the inhibitors to its implementation and how AI-

driven demand forecasting can be applied to inventory management, specifically in the reduction of stockouts and overstocking.

4.1 Survey Results

One hundred practitioners in the different ranks of the FMCG supply chain in Bangladesh took part in the survey. The respondents had a combination of large FMCG companies as well as small and medium-sized enterprises (SMEs). The questionnaire was about the use of AI, as well as obstacles to the integration of AI, and its perceived effects on inventory management. Below are the key findings:

AI Adoption in FMCG Supply Chains:

- o Third, 35 percent of the respondents said that their organizations had deployed AI-driven demand forecasting in their supply chains.
- o 75% of the AI adopters cited that the adoption of AI led to moderate gains in inventory management.

Impact on Stockouts and Overstocking:

- o 70 percent of adopters of AI indicated that there was an average decrease in stock-outs following the realization of AI tools.
- o 60 percent of the respondents also attested that there was a moderate decrease of overstocking due to AI-driven demand forecasting.

Barriers to AI Adoption:

- o Data Quality: Twenty-one percent of the respondents indicated that the most substantial obstacle to the adoption of AI is data quality. Manual systems or the use of old software by many organizations leads to inaccurate data and it undermines the effectiveness of AI tools.
- o Cost: 60 percent of the respondents identified financial constraints as the other significant challenge. The steep initial investment in installing AI systems such as software, training and infrastructure was perceived to be a barrier to companies with limited size.

- o **Skilled Personnel:** 55 percent of the respondents mentioned the scarcity of skilled personnel as one of the reasons that prevent AI adoption. The FMCG sector of Bangladesh lacks professionals who are proficient in AI, machine learning and data analytics.

Promising AI Applications:

- o **Market Forecasting:** Half of the respondents found market forecasting as the most promising AI use in inventory management. The capacity of AI to forecast the future demand trends using past data and external information was perceived as an important resource.
- o **Supply Chain Logistics:** 45% of respondents reported that applications to supply chain logistics (e.g., route optimization and demand-driven production planning) were potentially very useful in streamlining their processes.

4.2 Statistical Analysis

In order to analyze the answers, the study employed the Relative Importance Index (RII), which is the standard statistical tool applied in the research in ranking the significance of various factors. RII was obtained by the formula below:

$$RII = \frac{\sum (W_i A_i)}{N \sum (W_i)} \quad RII = \frac{\sum (W_i A_i)}{N \sum (W_i)}$$

Where:

W = weight on each factor (between 1 and 5),

A = highest weight (5),

N = total number of respondents.

The most important barriers and opportunities to the use of AI were assigned the positions according to the RII scores.

Results:

- * **Data Quality Issues:** The most important factor that prevents AI implementation in the FMCG industry in Bangladesh was the barrier of data quality (RII score was 0.87), which is the most important.

- * **Financial Constraints:** Financial constraints ranked second with an RII score of 0.81 meaning that the financial aspect of the AI implementation is one of the significant challenges.
- * **Skilled Professionals:** The third category was Lack of skilled professionals with RII score of 0.78. Lack of AI experts in Bangladesh is quite a pressing issue to the implementation of AI in the sector.
- * **Market Forecasting:** AI has been used to predict the market, in which it has scored 0.82 in RII; hence, the most promising AI application in inventory management.
- * **Supply Chain Logistics:** AI in supply chain logistics was rated at 0.76 and it is promising in streamlining logistics and cutting down operational expenses.

4.3 Discussion of Results

The findings of the survey indicate that the adoption of AI in the FMCG sector of Bangladesh is in its infancy as only 35 percent of organizations have adopted AI-based forecasting demand tools. The results can indicate that although AI can be used to substantially enhance inventory management, preventing stockouts and overstocking, there are a number of challenges that need to be tackled to implement AI to its full potential.

The biggest obstacle is data quality, because AI systems need quality data, and structured data to work properly. FMCG business in Bangladesh continues to use outdated systems or manual processes and these have been leading to inaccurate data. This contributes to inaccurate predictions and lowers the efficiency of AI tools. To overcome this hitch, there should be investments in data infrastructure and digitalization to create clean structured data to be used by AI applications.

It was also found that financial constraints were also a major challenge, particularly to small and medium enterprises (SMEs). The initial expenses incurred when implementing AI such as software purchases, recruiting AI professionals and training employees are usually prohibitive to the SMEs. This can be overcome by offering financial support or subsidies to use AI.

The other challenge is the shortage of skilled professionals since in Bangladesh, businesses are unable to find qualified personnel to use and manage AI systems. It indicates that the AI training programs and the creation of a skilled workforce that can propel the use of AI in the FMCG segment is needed.

In spite of these obstacles, the survey indicates that AI-based demand forecasting has a massive potential in enhancing inventory management. Stockouts and overstocking can be minimized through AI tools that can optimize inventory by more accurately forecasting demand in the future. Those companies that have deployed AI already are already reporting a high level of improvements in terms of accuracy of inventory and efficiency.

Chapter 5: Results and Discussion

5.1 Impact of AI on Inventory Management

The results of the survey and the secondary research show that AI-driven demand forecasting can make considerable progresses in streamlining inventory management within Bangladesh in the FMCG sector. Firms that have implemented AI applications in demand forecasting have reported encouraging gains in the reduction of stockouts and overstocking that results in the saving of costs and increased customer satisfaction.

- **Stockout Reduction:** AI systems helped companies more effectively match stock with the requirements of consumers, preventing the occurrence of stockouts. Those respondents who deployed AI tools observed the increased availability of products and fewer lost sales opportunities.
- **Decline in Overstocking:** The outcomes of the survey also identified that there was an average decline in the overstocking by AI adopters. With more precise demand forecasts, AI tools ensured that companies do not have to hold unnecessary inventory resulting in diminished holding costs and less wastage, particularly of perishable products.
- **Operational Efficiency:** The respondents emphasized that the adoption of AI enhanced the general efficiency of the supply chain automating manual

operations and the real-time demand insight. Intelligent systems that run on AI facilitate improved decision making and inventory turnover in businesses.

These conclusions are consistent with research work around the world, including the studies by Walmart and Unilever, in which AI has resulted in enhanced demand and inventory planning (Abreu and van Deventer, 2022; Yadav and Singh, 2019).

5.2 Barriers to AI Adoption

Regardless of the promising advantages of AI, the survey demonstrated that AI implementation in the FMCG industry of Bangladesh is still underdeveloped, and the main reasons behind this inability are the following obstacles:

- **Data Quality:** Data quality was the biggest obstacle found. One of the indicators that AI could not be implemented effectively is poor data quality (70% of the respondents stated that they have poor data quality because of using manual systems and legacy software). To make precise predictions, AI systems need clean, organized, and quality data, and this information is not available in the FMCG sector in Bangladesh, which makes AI unfamiliar with the full potential.
- **Financial Constraints:** 60 percent of the respondents mentioned that a huge challenge was the high initial costs. Most small and medium-sized enterprises (SMEs) in Bangladesh are unable to afford the initial investment in infrastructure and software in AI adoption.
- **Shortage of Skilled Professionals:** It was reported that another critical barrier was a lack of trained personnel with 55 percent of respondents referring to it. The lack of AI talent in Bangladesh implies that organizations can hardly implement AI systems or even maintain them after their implementation.

The barriers align with the generally observed trends and studies on the topic, e.g. a study by Chowhan and Rani (2020) and Sharif et al. (2024) has found that financial barriers and data quality problems form a barrier to AI adoption in developing economies as well.

5.3 Comparison with Global Trends

In the case of AI adoption in the FMCG industry of Bangladesh compared to the trends of the other developed economies such as the United States and the European Union, it is clear that the latter have integrated AI into their FMCG supply chains in mass production whereas Bangladesh is not. Multinational corporations such as Walmart and Unilever have been able to use AI-powered systems to manage inventory optimization to save a lot of money and achieve efficiency in their operations.

Nevertheless, the FMCG industry in Bangladesh has its own set of challenges, namely poor infrastructure, shortage of skilled labour and financial limitations. Nevertheless, the interest in the adoption of AI is high despite these challenges and especially it is expected to grow with the emergence of digital infrastructure and government programs focused on enhancing access to technology. Financial incentives, capacity-building initiatives, and public-private relationships would be useful in promoting AI use and eliminating these obstacles.

Chapter 6: Conclusion and Recommendations

6.1 Conclusion

This research paper examined how AI-based demand forecasting is useful in enhancing inventory management in the FMCG industry in Bangladesh, particularly, the problems of stockouts and overstocking. The study was conducted to determine the present state of AI adoption, the hindrances to its use, and the effect of AI on the efficiency of business operations in the industry.

In this study, the results suggest AI-based demand prediction can have a profound impact on inventory management in the FMCG industry in Bangladesh by:

1.Minimizing stockouts: AI assists in matching inventory with real demand in a way that products can be made available on demand by customers without the risk of stock outs and reduced sales.

2.Reduction of overstocking: AI can assist in minimizing overstocking caused by inaccurate demand forecasting, costs of storage can be saved and unnecessary wastage of inventory, especially in case of perishable products.

3.Enhancing efficiency in operations: AI-based systems allow businesses to make decision-driven data to streamline their supply chain operations and enhance logistics.

Notwithstanding these strengths, the study also outlined a number of obstacles to the use of AI in the FMCG industry of Bangladesh. These barriers include:

- Problems with data quality, in which companies continue to use manual processes and old software, and thus produce bad data, which constrains the effectiveness of AI tools.
- The high implementation cost is a major hindrance that small and medium enterprises (SMEs) deal with particularly owing to the high upfront investment in AI tools and infrastructure.
- Skilled professionals are also lacking since there are no available AI experts and data analysts in Bangladesh, which impedes the adoption and sustainability of AI-driven systems by companies.

Nevertheless, the possibility of AI streamlining the demand forecasting and inventory management in the Bangladesh FMCG industry is substantial in the face of these difficulties. The use of AI can result in increased performance of the supply chain, cost reduction, and customer satisfaction with the use of the appropriate infrastructure, financial incentives, and training programs.

6.2 Recommendations

According to the results of this research, it is recommended to implement AI in the FMCG industry of Bangladesh and overcome identified barriers in the following way:

6.2.1 Investment in Digital Infrastructure

Digital infrastructure is one of the greatest challenges to the adoption of AI in the FMCG sector of Bangladesh. A large number of businesses continue to use manual processes and old systems in forecasting demand particularly to small and medium-sized enterprises (SMEs) enterprises. In order to solve this barrier the government as well as the private sector should invest in:

- Enhancing the internet connectivity and increasing the capabilities of cloud computing to accommodate use of AI tools.
- So, optimization of data management systems to provide high-quality, structured data to AI models.
- Developing digital platforms that can be easily integrated with the existing FMCG supply chains and assist companies to shift the towards the use of manual to the use of AI-based systems.

6.2.2 Financial Incentives for SMEs

The other barrier that was noted to be significant was the cost of AI implementation. Being a nascent and expensive field, the initial investment needed to deploy AI tools and train the employees is a significant obstacle, particularly to SMEs. It is recommended to eliminate this barrier by the following steps: The government can provide certain financial incentives to smaller businesses to implement AI technologies, including subsidies or tax rebates. • SMEs can be offered loans and grants that have favorable terms to invest in AI tools and other technologies that will help the sector decrease the financial load on smaller businesses. It may involve the creation of public- private alliances to offer common facilities and shared finances to adopt AI, especially to firms that have low budgets.

6.2.3 Capacity Building and Training Programs

The other barrier that was noted to be significant was the cost of AI implementation. Being a nascent and expensive field, the initial investment needed to deploy AI tools and train the employees is a significant obstacle, particularly to SMEs. It is recommended to eliminate this barrier by the following steps: The government can provide certain financial incentives to

smaller businesses to implement AI technologies, including subsidies or tax rebates. SMEs can be offered loans and grants that have favorable terms to invest in AI tools and other technologies that will help the sector decrease the financial load on smaller businesses. It may involve the creation of public- private alliances to offer common facilities and shared finances to adopt AI, especially to firms that have low budgets.

6.2.4 Public Awareness Campaigns

FMCG enterprises and in particular SMEs must be raised in terms of the value of AI and long-term ROI that it has on enhancing supply chain efficiency and cost reduction. The following are the recommended actions in order to achieve this: The government, together with the industry associations, ought to initiate awareness programs to inform businesses about how AI is relevant in demand forecasts and stock management. Case studies and success stories of international FMCG companies, including Walmart and Unilever, need to be presented in order to illustrate the practical positive results of implementing AI. The FMCG business owners and decision-makers need to be encouraged to attend AI-based workshops and seminars where they would get informed about the recent trends in AI technologies and how they could be utilized in terms of inventory management.

6.2.5 Promote Public-Private Partnerships

The strategies that can be pursued to achieve rapid adoption of AI in the FMCG industry of Bangladesh are: • Government should enable public-privacy linkages that promote cooperation among the scholarly organizations, technology vendors, and FMCG corporations. Partnerships with the government and the private companies can also be utilized to address the issue of the high start-up costs of implementing AI through resource sharing and co-financing AI-related projects.

6.3 Future Research

Although this research offers meaningful data on the potential of AI-based demand forecasting in the FMCG industry of Bangladesh, there are multiple directions of future research:

1. **Economic Impact of AI:** Future research can investigate the economic advantages of AI in inventory management by completing a cost-benefit analysis of AI implementation to the FMCG sector.
2. **Application of AI in Sectors:** More studies might be done on AI applications in sectors other than e-commerce like agriculture and pharmaceutical sectors in Bangladesh to understand the ways in which AI could be utilized to enhance supply chain management among various sectors.
3. **AI and Sustainability:** Studies might be undertaken on the role played by AI-based demand prediction and inventory management in the sustainability of the supply chains through waste minimization, energy savings, and carbon footprints.
4. **The implications of AI on Employment:** Future research would look at how the adoption of AI affects the employment in the FMCG industry; specifically it would look at how AI-based tools could be used to augment human employment and how they would lead to the development of new jobs within the data science and AI industry.

Conclusion

This study shows that AI-based demand forecasting has a high potential to improve inventory management in the FMCG industry in Bangladesh, improving accuracy and reducing stockouts and overstocking, as well as simplifying supply chain management. Nevertheless, these obstacles to the adoption of AI, including data quality, high implementation cost, and shortage of skilled personnel, should be resolved to ensure that the full potential of AI could be achieved. Bangladesh can unlock the potential of AI to ensure operational efficiency, economic growth, and better customer satisfaction, and it is possible only with the help of the

suggested strategies, namely investing in digital infrastructure, providing financial incentives, training the workforce, and encouraging the establishment of public-private partnerships.

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