



Artificial Intelligence in Supply Chain Management: Is Bangladesh Ready ?

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Abstract

The focus of this research paper will be on the intersection between Artificial Intelligence (AI) and Supply Chain Management (SCM) in Bangladesh, an area that is changing very fast. It is important to understand the possibilities and limitations of using artificial intelligence tools as they increasingly become indispensable for enhanced efficiency and effectiveness of supply chains. We initially look at various AI tools being implemented in SCM such as demand forecasting systems, inventory optimization solutions and predictive analytics platforms. There are several benefits associated with AI like improved decision making, cost reduction, enhanced supply chain visibility etc., but it also entails significant challenges. These include problems related to data quality, skill adaptation, ethical issues that hinder successful integration of AI in supply chains.

We will need to indicate the pros and cons of implementing AI in supply chain management with emphasis on the dynamic economic situation prevailing in Bangladesh today. Moreover, we will provide practical recommendations aimed at addressing these challenges including investments in employee training programs as well as good data governance practices among others so that stakeholders can work effectively together without going through unnecessary risks . Thus doing , this will enable Bangladesh exploit the transformative capability of Artificial Intelligence.

Introduction

Artificial Intelligence (AI) has become the new norm worldwide. In today's modern world, it is rare to find someone unfamiliar with the question, "Will AI take control over humans in every field?" Supply Chain Management (SCM) is a crucial component of any business, and it is undeniable that AI is significantly impacting SCM on a global scale. This raises an important question: Is Bangladesh prepared to embrace the challenges that AI presents to SCM and leverage these opportunities for its benefit?

AI is an imitation of human intellectual behaviour in machines, which allows them to be aware of their environment and make decisions or to be able to translate languages, among other things. Even though coined in the mid-20th century, AI gained a real impetus with naming the field back in 1956, as it made a few significant strides forward in the '80s and '90s. The 2010s, through machine learning and big data, were the real turning point in propelling AI to the limelight. AI has, of late, assumed massive importance on the innovation landscape with the introduction of OpenAI's GPT models and further applications across industries from health and finance to retail, transportation, manufacturing, and customer service. In many industries today, the role of a transformer and optimizer has increasingly been taken over with AI.

The meeting point between AI and SCM in Bangladesh is one of the new subjects of study, exhibiting the worldwide pattern of AI incorporation into business activity. Literature has shown that artificial intelligence, which is used for demand prediction, inventory control and logistics optimization, has become a major game changer in optimizing supply chains. All over the World, it has been discovered that AI makes significant improvements in efficiency and cost-effectiveness within SCM. Nevertheless, there are no researches which focused on Bangladesh. There are studies that show while adoption of artificial intelligence by supply chains of Bangladeshi firms is still at an infancy stage there is a growing interest by local businesses to apply AI tools to boost operational efficiency. Literature views Bangladesh as a country with a growing textile industry hence will benefit immensely from integrating AI especially in real-time inventory tracking or predictive analytics. However, this also exposes some challenges like limited technological infrastructure inadequate access to advanced AI tools and lack of well trained workforce necessary for effective adoption of these technologies in SCM systems within countries such as Bangladesh. Additionally localized research work needs to be carried out so as to understand the specific needs and limitations faced by Bangladeshi supply chain.

Background

Usage of AI in supply chain management is not new. In 1950s, AI was started using for linear programming in logistics and inventory management. Gradually AI was used in complex programs by various companies globally. Now many renowned companies like *Echo Global Logistics*, *C3.ai*, *Uptake*, *Al*, *Amazon*, *Boeing*, *ClearMetal*, *FourKites*, *HAVI Logistics*, *Cisco*, *Tesla*, *Microsoft*, *SAP* use AI in supply chain management. The use tools like Throughput AI, Logility, Blue Yonder, Oracle, Kinaxis Rapid Response, IBM Watson Supply Chain.

These companies use AI because they get various benefits in SCM, like-

- Precision Inventory Management : when it comes to demand patterns, AI is the machine in charge of forecasting and it prevents instances where there are many goods or no stock at all.
- Warehouse Automation: AI robots that complete warehouse operations increase speed and accuracy.
- On Time Delivery: AI optimizes delivery methods and ensures scheduling to ensure timely delivery so that customers' needs are met on time.
- Minimal Delivery Process: By use of Artificial intelligence, everything is automated in the company since; efficient facilities have been put in place leading to faster delivery thus reducing lead time.
- Mitigation of Operational Risk: It addresses supply chain risks from AI point view as well as developing effective countermeasures thereof through eliminating problems.
- Increase Productivity: This is done by using artificial intelligence to automate and streamline a range of routine tasks involved in production process.
- Accurate Demand Forecasting: According to this study, accurate demand forecasts can be generated by AI using historical data among others, which helps the industry adapt production capacities based on market requirements.
- Enhanced Safety: Artificial intelligence can take over for humans in providing safety instead of human beings engaging in dangerous activities.
- Enhanced Customer Service: The use of an intelligent system like AI will lead to faster response, better order follow-up and suggestions.

- Reduced Production Costs: When resources are most efficiently allocated by artificial intelligence, waste and turnover is minimized to reduce production costs.

- Reduce Errors and Waste: The use of AI in process optimization in manufacturing operations and plants enhances precision, minimizes human errors and material wastages.
- Simulation for Improved Operations: Running several scenarios will be helpful when it comes to improving the strategy and operation of supply chain.
- Enhanced Sustainability: Through efficient resource utilization, reduced emissions, better environmental practices throughout value chain, Artificial Intelligence will advocate for sustainable development.

On the other hand, we must remember that AI is not an unmixed blessing. It comes with some effects too. For example:

- Expensive: Implementation of AI in supply chain management is an expensive process that needs a lot of money, especially at the start of the journey. This includes costs like sophisticated software, hardware infrastructure and integrating these systems with other processes already existing. Furthermore, maintenance charges, system upgrades and training employees all add up to this expenditure. Nevertheless, although AI may save a lot in the long run, it requires substantial initial capital for one which is a big hurdle to many organizations especially small and medium enterprises.
- Joblessness: In particular, repetitive tasks such as inventory management, order processing or logistics planning can be automated through AI resulting to significant reduced demand for human labour. As AI takes over these functions there might be dislocation of jobs for individuals whose jobs have been taken away by this technology. However, this might cause economic difficulties more so in communities that depend heavily on supply chain related activities unless some people are given new skills through retraining initiatives.
- Data Quality and Integration Challenge: Data quality, accuracy and consistency are key for any efficient AI system. Fragmentation of data is common in the supply chain management due to its diversity. Different sources include suppliers, logistics providers, customers and they all have different formats and standards. It's a big challenge to ensure that this is done in such a way that the data used is accurate, up-to-date and seamlessly integrated into AI models. Failure to address poor data quality or integration issues can result in wrong predictions made by the AI resulting inefficiencies and thus suboptimal decision-making.
- Over Reliance on Historic Data: Most AI models used for supply chain management are experts which are trained using past historical records. This approach may be effective when it comes to trend identification and prediction making but sometimes

it becomes limiting. Where these models rely too much on previous data there might not be any adaptation when new occurrences or market shifts take place unexpectedly as expected. In markets that change at a very high rates, over dependence could lead to less flexible and adaptable SCM strategies.

- **Lack of Human Expertise and Intuition:** On one hand, artificial intelligence can handle massive amounts of data processing as well as insight generation; on the other hand, it lacks the fine-grained understanding and intuitive decision making capabilities human experts possess in relation to managing supply chains. A complex situation often needs.

Implementing AI is a challenging job in every sector. Companies which are trying implement AI in their SCM operations have informed they are facing issues below:

- **Lack of Skilled Talent:** Implementation of AI in SCM requires experts in data science, machine learning and AI technologies who are limited in supply thus posing a challenge to effective deployment and maintenance of AI solutions.
- **Complexity and Scale:** It is crucial that scalable infrastructure be put up as well as sophisticated management systems that will ensure the facilitation of complex algorithms, enormous amounts of data processing capabilities prevalent in artificial intelligence (AI) projects for supply chain management (SCM).
- **Interpretability and Trust:** The users can find it hard to understand how decisions were reached concerning these AIs hence making them “black boxes.” This lack of transparency makes some people sceptical about accepting insights from such sources.
- **Integration with Legacy Systems:** Due to this reason, the integration might be faced by challenges since many supply chains still use the traditional systems which cannot easily interoperate with the modern AI technologies.
- **Data Security and Privacy:** This creates concerns over privacy and security because such systems in Supply Chain Management will require huge data amounts thereby being subjected to a variety of threats like hacking attacks on sensitive information.
- **Adaptability Challenge:** Supply chains are fluid and hence AI models need to keep on adapting to the changing circumstances. Obsolete and ineffective ones are those characterized by rigidity in their inability quickly adjust themselves.
- **Customization Challenge:** AI solutions often have to be customized for specific supply chain needs but this is difficult particularly for unique or niche operations that can take up many resources.

- Geopolitical Challenges: Due to the global nature of supply chains, there may be such geopolitical challenges as trade restrictions, different regulations and regional data policies affecting deployment and management of AI systems.
- Organizational Barriers: Lack of coordination across units, internal resistance to change within organizations, lack of integration with AI initiatives will hamper successful implementation of AI into companies.
- Top Management Support: In order for these ventures to succeed, enough resources must be set aside by senior leadership as well as an enabling environment in terms of culture among other things that would facilitate its adoption through out the company or else it can fail poorly.

Bangladesh is not technologically handicapped at all. But it has a long way to go in this case. Bangladesh also has a lot of barriers to overcome if they want to be at the forefront of AI development. Some of these are:

- Inadequate Infrastructure: Bangladesh lacks advanced technological infrastructure like supercomputers and data centres.
- Shortage of Skilled Labour: The country is lacking in AI experts.
- Low R&D Expenditure: The funding available for innovation and research activities is very limited.
- Education System: Difficulties generating AI-savvy graduates.
- Economic Constraints: Researching and implementing AI costs too much money.
- Lack of Awareness and Strategic Vision : Low awareness about and absence of strategic plans for integration of artificial intelligence (AI).
- Regulatory and Policy Gaps: Obsolete laws impede wide-scale adoption of AI technologies

However, increased recognition as well as efforts to address such hurdles, there have been some notable developments which indicate future prospects for AI as well as other current technological trends.

Literature Review

The junction of Artificial Intelligence and Supply Chain Management in Bangladesh is a newer developing stream of study. The trend is no different from what is happening across the world, as AI seamlessly fits into business operations. Literature available to this effect shows that AI is able to change the concept of supply chains in terms of demand forecasting, inventory management, and logistics optimization. Globally, AI has enhanced efficiency and cost-effective functioning in SCM. Studies exclusively confined to Bangladesh have largely been few. What can be observed coming out of these studies is that, although adoption of AI into the supply chains of Bangladesh has remained embryonic, there is growing interest among the local business to exploit AI tools to bring efficacy into their operations.

Literature indicates that AI integration can benefit the booming textile and apparel industry in Bangladesh in areas such as real-time inventory tracking or predictive analytics. However, the major reasons that make significant barriers to the integration of AI into the country's SCM include the poor technological infrastructure, limited availability of advanced AI tools, and a lack of skilled professionals. This calls for further research at the local level to understand the specific needs and constraints of supply chains within Bangladesh and, indeed, the possible socio-economic impacts that might be fomented by such AI-driven automation. It is, however, underlined sharply in the literature that such gainful applications of AI in SCM in Bangladesh could be realized only with bridging infrastructural and educational gaps.

Research Questions

Systematic questions can lead people to systematic answer. In order to understand the knowledge gap of our research, we developed some questions to make our research more thorough. We divided our questions into two portions: main question and supporting questions.

Main question : Is Bangladesh ready to accept AI in supply chain management?

Supporting questions :

- Do companies use AI in their SCM operations ?
- Do the employees use AI in their job ?
- Do employers and employees find AI useful in SCM ?
- Do employers and employees find AI complex ?
- Do employers and employees think AI will replace people in SCM ?
- Do employers and employees think AI is harmful ?
- Are employers and employees introduced to the advanced AI tools of SCM ?
- What are the challenges in applying AI in SCM ?
- What do employers and employees think the future of AI in Bangladeshi supply chain management?

Hypothesis

Supply chain management in Bangladesh faces serious problems due to the incompetence of the industry professionals who remain unaware of technology. This inability to know the new technologies such as Artificial Intelligence, creates supply chains that are defective and they do not optimize their productivity and efficiency in this country. However, the hypothesis purports that this problem can be surmounted by undertaking pragmatic actions.

In case specifically designed and implemented AI training programs were to enhance the technological capacities of practitioners in supply chain operations, then the integration of AI into SCM would bear huge advantages. These benefits could include better sales forecasting, improved warehouse organization, efficient stock holding, and adaptability toward changing markets. They would be taken through how best they could use AI tools to get maximum effect while removing current technological constraints.

Current research aims at finding out if such training programmes can indeed significantly affect suppliers' adoption of AI in Bangladesh. If this were true, it means an increased awareness through education may be instrumental in promoting AI in Bangladesh.

Objectives

- To understand the mentality of SCM employers and employees towards AI of this region.
- To find how advanced Bangladesh is in technological field.
- To evaluate the education system of business.
- To find out the main challenges in the path of AI.

Methodology

For primary research: We conducted a survey on different company employees. Most of them were supply chain managers. 32 people participated in our survey. We reached to them via social media and email.

For secondary research: We took facts, statistics, theories, details from newspapers, research papers, books, online portals and from search engines like Google. We took the benefit of artificial intelligence to be more meticulous in presenting my data but most of the creative work was done by solely ourselves.

Data Presentation and Analysis

Target Population – Employees and employers of Bangladesh, specially from SCM background.

Sample Size – 32 service holders working in different companies in Bangladesh.

	Questions	Answers	Frequency	Percentage	Analysis
1	Are you a supply chain manager ?	Yes	21	65.63%	
		No	11	34.37%	
2	Are you aware of Artificial Intelligence (AI) ?	Yes	30	93.8%	**Maximum of the respondents are aware of Artificial Intelligence.
		No	2	6.2%	
3	Do you think AI is beneficial in supply chain management (SCM) ?	Yes	24	75%	**Most of the respondents find AI helpful for SCM where a little portion of the respondents are in grey area.
		No	0	0%	
		Maybe	8	25%	
4	Does your company use AI for supply chain management?	Yes	8	25%	
		No	24	75%	**Means most of the companies are either indifferent to

					the benefits of AI or have difficulties in implementing it.
5	Do you personally use AI in your work field ?	Yes	15	46.88%	
		No	17	53.12%	**Maximum respondents either indifferent to AI or find it hard.
6	Do you think AI is harmful for SCM ?	Yes	3	9.38%	
		No	29	90.62%	**Maximum respondents are not against using AI in SCM.
7	Do you find it complex to understand AI tools ?	Yes	11	34.37%	
		No	21	65.63%	**Most of the respondents have difficulties to understand AI.
8	Do you think AI tools should be taught in college level to benefit the would be supply chain managers ?	Yes	30	93.75%	**Maximum respondents are agreeing to teach AI in primary level of job.
		No	2	6.25%	
9	Do you feel threatened by AI that it will take over your job and replace you someday ?	Yes	10	31.25%	
		No	22	68.75%	**Maximum respondents think AI will replace

					humans in job.
10	Do you think with the help of AI, you can contribute more to your company?	Yes	32	100%	**Every respondent thinks their efficiency will increase with the help of AI.
		No	0	0%	

11	Which AI tools do you use for SCM ? Out of 32 respondents 13 answered the question. 9 respondents out of 13, do not use AI in their work. Remaining people use ChatGPT, Power BI, Azure Machine Learning, OpenAI, Copilot , Business Intelligence, Qlik Sense.	**This means they use simple and free AI that is easily available for simple works.			
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Findings

- Though Bangladeshi people are aware of AI, they are still sceptical about the usage and benefits of it .
- Perspective about AI varies from age to age, designation to designation and organization to organization. Hence, it is hard to reach one concrete decision about AI execution in SCM.
- People use simple AI tools like ChatGPT in their personal life but not in work sector like SCM.
- People think AI is beneficial for SCM but cannot use it for –
 - Lack of skill and knowledge about AI
 - Not having enough tools
 - Organizational inability to implement AI
 - Lack of adaptability
 - Geopolitical issue
 - Costing problem
- Employers and employees are hopeful that AI will benefit the upcoming supply chain system of Bangladesh.

- There is a fear that people will be jobless if AI is implemented in SCM.
- Advanced AI tools are not available in this country as organizational assets.
- Though Bangladeshi people are in a grey area about AI, their perspective is changing and they think AI will increase their productivity.
- People want technological learning along with bookish knowledge in college level and university level.

Recommendation

Depending on the findings of our research, we have some recommendations to execute AI in Bangladeshi supply chain management.

1.Awareness and Training Programs:

- AI Literacy Campaigns : Train age groups on the tangible positive aspects of SCM such as cost cutting, speeding operation timeframes and better decision making using data.
- Skills Development: Collaborate with universities to develop curricula that encompass SCM and AI in anticipation of a future workforce.
- Workshops and Webinars: Organize among the already practicing experts working in this field who are using AI. This has to give out practical illustrations depicting actual life situations common in Bangladesh.

2.Government and Policy Support:

- Subsidies and Incentives: Advocate for tax holidays or government financing opportunities accessible for organizations that invest in AI technologies as well as training programs. This way, it will support those companies whose investment portfolios include AI by reducing their risks related to finance since sometimes they do not want to put money into it.
- Policy Development: Encourage policy makers towards creation of structures that can enable integration of Artificial Intelligence into Supply Cycle Management.

3.Slow but steady process:

- **Start with Some Try-outs:** Start off with some pilot programs that use AI to address common problems in supply chain management. This means the company gets tangible benefits without much change.
- **A Step by Step Strategy:** The application process can be divided into a series of stages, beginning with data analytics and forecasting tools then leading to more advanced automation solutions as confidence grows.

4. Technology for All:

- **Partnering With Tech Companies:** Create relationships between worldwide technology companies and provide a high-level artificial intelligence technology for Bangladesh through discount offers, training, support and other incentives that suit Bangladeshi conditions.
- **Developing Local AI Tools:** Encourage local tech start-ups to develop their own AI applications specifically for supply chains operating in Bangladesh. It may be easier for them to embrace it after handling certain challenges here.

5. Change Management and Organizational Culture:

- **Leadership commitment:** Encourage executives to adopt AI both in word and deed. They must also be enlightened on the potential of AI and pushed to stand for the implementation of such technology.
- **Addressing Job Security Concerns:** Job security is a prominent issue that needs to be addressed in the advent of AI. Rather than automating human jobs, AI should be utilized in a way that maintains and even increases human roles. For those who system direct production lines that are to be supervised by AI, teach them complimentary skills that would keep them in business for other lines of AI
- **Cultural change:** It is by fostering an innovation culture natural to learning that people succeed. It can be through recognition and rewarding employees who successfully incorporate AI tools into their work.

6. Overcoming Geopolitical and Cost Barriers:

- **Local Governments Collaboration:** Let's kick off a program in which we join some neighbouring countries in a merger process where we pool AI technology and expertise and in the sequence of it the cost and geopolitical challenges will be solved.

- **Cost-effective solution :** Cost-effective technology is the best solution to improving the educational system. Investors put lesser emphasis on specific proprietary technology and focus more on cloud-based AI services and open source tools.

7. Long-term Strategy:

- **Continuous Feedback Loop:** Set up a feedback loop using this mechanism, thus, firms can inform about their experiences, the successes as well as the challenges of AI. Sharing this information could help to justify the potential of AI in SCM.
- **Research and Development:** Direct to R&D to explore AI emphasis on SCM within Bangladesh. This could be done through the collaboration of universities, government, and industry.

These recommendations tackle the particular challenges encountered in Bangladesh in order to set up the supportive atmosphere for the adoption of AI in SCM which would bring about the higher degree of efficiency, productivity, and global competitiveness.

Conclusion

In an AI-based supply chain system, sky is the limit if and only if the obstacles are overcome. A technological solution does not mean much if the paper had not also taken into account the fact that improvements in technology are actually the ones causing automation in many parts of the economy, including logistics, thus the traditional supply chain methods need to be changed and the newest tech-related methods should be adopted to ensure the effective and efficient transformation. To try AI in the logistics sector is a promising idea for sure. It will help in minimizing the problems of the sector in terms of efficiency, accuracy and also will help to envisage the current situation of the system. Moreover, the application of AI technologies can also make business awareness quicker and production more efficient in the supply chain.

On the other hand, AI has its downsides and not only in Bangladesh where it is at a beginning level of innovating. The assertion of the fact is that information technology in Bangladesh is a sector that is characterized by lack of human resources. Instead, the present difficulties not only obstruct the correct utilization of AI tools in the supply chain achieving but also compose an impediment for their adoption in other routines. Nevertheless, the basic argument of the study lies in the fact that the existent gap in intelligence can be mended through properly designed training programs for the country's supply chain specialists. The definite result of this kind of cross-motion will be higher willingness for working with AI systems and generally be better in the competitive market as the companies in Bangladesh will see growth. The implication will be that as AI leads to the increase of education and skill development in the industry, the enhancement of technology in the whole country will be seen. Once the population has gotten enough high-quality training, the constraints can be forgotten about, and the extent of utilization of AI applications can go beyond internal supply chains to the international market where they offer companies an edge. Some studies will also be done on the impact analysis of these training measures on the adoption of AI and the potential strategies for increasing its use in the supply chain of Bangladesh.

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