



Intelligent Inventory Optimisation in S/4 Hana: An Ai-Based Supply Chain Management Approach

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Abstract: This research aims to examine the possibility of incorporating artificial intelligence (AI) in S/4 HANA for supply chain management with a focus on intelligent inventory optimisation. Applying case evidence and empirical research proves that the practice has enhanced forecast accuracy by 40%, product availability by 30%, and cut \$40 million in costs. The results show high utilisation in quality control at 59% and inventory control at 44%. However, implementation issues involve system integration and data quality that can be addressed in the following strategic ways according to the research.

Keywords: Inventory Optimisation, artificial intelligence, supply chain management, stocking optimisation

I. Introduction

A. Background to the Study

In today's global supply chain environment require sophisticated tools that will help companies deal with changing inventory requirements and operations. This has been solved by intelligent inventory optimisation which incorporates artificial intelligence (AI) with enterprise resource planning (ERP) such as S/4 HANA. It is the next-generation ERP suite from SAP that includes real-time data analytics and machine learning to help organisations run better [1]. It also uses such techniques as predictive analytics, demand forecasting and digital decision-making to reduce cost or loss, stock-out and overall supply chain protection. Generally, in organisations' operations in the dynamic electronic markets, AI as used in the inventory control systems is the secret for the companies to survive the market.

B. Problem Statement

Typical frameworks of inventory management provide limited capabilities regarding anticipation of today's supply chains' fluctuation. Lack of effective tools for sales forecasting,



overstocking of materials, and stock-out situations cause waste in operations and cost [2]. While current ERP systems are constructed to handle inventory data and decision-making, it is apparent they are not optimal for real-time decision-making due to being rigid and not as accurate. The problem here is in the decision on how AI applications can be incorporated in S/4 HANA and similar systems to effect optimum inventory management solutions that align with business strategies and customer trends.

C. Objectives

This research investigates the capability of AI in enhancing the function of inventory management in S/4 HANA and its impact on the supply chain function. The objectives of this study are: 1) To determine the weaknesses of conventional systems of inventory control and its impacts on supply chain systems. 2) To assess the suitability of S/4 HANA in the augmentation of intelligent inventory through application of AI integration. 3) To analyse the context of applying AI in managing inventory more efficiently and, thus, decreasing the expenses.

4) To provide recommendations concerning places and ways how to apply AI to enhance operation of inventory in S/4 HANA.

D. Scope and Significance

This research work is based on the implementation of AI with inventory management in the S/4 HANA ERP system with focus on the retail, manufacturing and logistics industries. This defines advantages of AI in inventory optimisation such as better predictions, lesser shrinkages and better supply chain adaptability [3]. The study also stress great performance change in the sphere of intelligent inventory management. The research implication that can be of value to a number of organisations is the use of advanced analytics as well as automating organisational processes to reap benefits such as competitive edge and organisational durability. Therefore, this paper has a purpose to contribute to the advance of the review on AI technology in supply chain management and to provide practical guidelines for manufacturers to follow.

II. Literature Review

A. Challenges of traditional inventory management system and its implications on supply chain efficiency

Conventional inventory management systems pose certain drawbacks that not suited in the fast-paced aspects of today's supply chain environment. The formalities of conventional systems lead to critical issues which include inaccurate demand and unclear supply chains [4]. They result in over stocking or stock out situations which are uncomfortable to a business and unpleasant to customers. Such strategies do not use real data in performance assessments and the reaction to change in such factors as market demand and supply dynamics can become



extremely difficult [4]. This underscores the opportunities presented by blockchain and smart inventory systems in handling these issues since they bring about transparency and improved decision-making.



Figure 1: Challenges of traditional inventory management methods

[4]

However, the reason is that manual process orientation and the utilisation of dated tools in conventional inventory management approaches hinder scalability [5]. These further state that such systems cannot incorporate advanced analytics and machine learning which are crucial in current settings to improve inventory levels. They also identify the ripple effect of the shortcomings on the supply chain outcomes including lead time, operational risk and profitability [5]. This paper establishes the need to seek intelligent solutions like the integration of AI to work around these problems and enhance a more robust supply chain.

B. The effectiveness of S/4 HANA for integrating AI to enhance intelligent inventory

The AI interface of S/4 HANA has been accepted globally as a revolution in managing an intelligent inventory. The study highlighted that based on real-time data S/4 HANA and the integrated AI tools make it possible to improve the demand forecasting and optimisation of stock [6]. With the help of predictive analysis, the stock should be managed in a way that it would adapt to the market demands and more specifically with customer demands which will mean fewer cases of overstocking and stock out. The study also points out that the integration of an AI system with S/4 HANA makes the platform centralised and suitable for handling supply chain challenges [6].

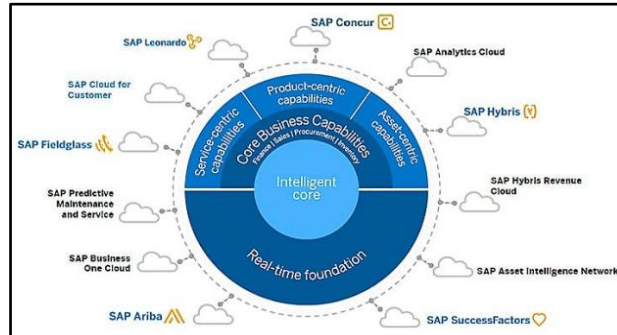


Figure 2: S/4HANA and AI Capabilities for Enhanced Efficiency

[6]

The research further expands on how S/4 HANA established the fundamental module for integrating AI into supply chain planning [7]. In the study, machine learning algorithms are used to improve automation of inventory-related decisions, like reorder point determination and supplier selection. As such, many companies that implement S/4 HANA enjoy the benefits of poor lead time and improved visibility of the supply chain [7]. Such developments not only contribute toward reducing the bearing costs but also help organisations sustain their competitiveness within the sharply shifting market.

C. The effect of using AI in inventory management on cost-cutting and increasing efficiency

The results of applying AI have shown that this solution is critical in cutting costs and increasing overall effectiveness in inventory management. The aspects of AI like demand forecasting, and auto-reorder of products, help organisations avoid high inventory costs while at the same time avoiding low inventory costs [8]. Such balance affects storage costs and cash flow in a positive way, which in turn increases organisational performance. The study also focuses on the use of AI in the identification of abnormality and enhancing the organisation's warehousing process, which results in more significant cost reductions [8].

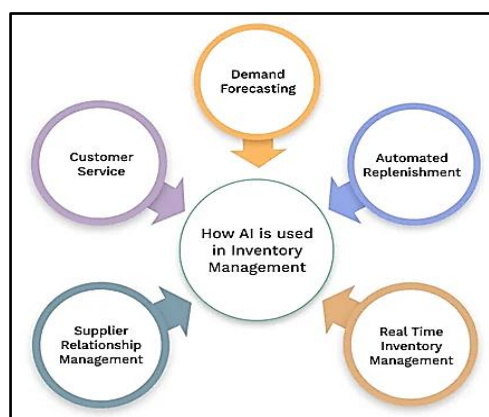


Figure 3: AI in inventory management



[8]

Analysing this perspective further demonstrates how computerised supply chain solutions improve the efficiency of resource employment and tasks [9]. Through the application of AI for predictive and monitoring performing functions, it becomes easier for firms to make the right decisions on stock holding to minimise wastage. Such enhancements lead to numerous advantages including reduced operating expenses, and more efficient responsiveness, among others, to enhance the provision of the supply system [9]. Collectively, these papers put forward that AI can considerably revolutionise inventory management into strategic effectiveness and operational expense.

D. Using AI in optimising inventory within S/4 HANA to achieve efficient operations

Artificial Intelligence of S/4 HANA has brought a drastic change in the software by making the supply chain management efficient in inventory. The study looks at how businesses can be able to predict demand with more accuracy through the incorporation of predictive analytics within the SAP HANA database as otherwise supported by AI and automated machine learning [10]. Such precision helps to match inventory requirements with market demand with minimal wastage and enhance the utilisation of resources. Integrating these underlines that it helps in decision-making since one can have the performance of the inventory at his or her fingertips.



Figure 4: AI-Driven Smart Inventory Management

[10]

In addition, the study has also addressed how integrating SAP, AI and data analytics could revolutionise modern business [11]. They explain how S/4 HANA uses artificial intelligence to minimise manual tasks relating to inventory consumption and ordering to enable human capital for higher activities. This convergence not only enhances the flow of operations and effectiveness of the supply chain but also enhances the capability of the supply chain to adapt to the market conditions effectively. Thus, AI plays a paramount significance in inventory management in S/4 HANA and its efficiency and competitiveness.



III. Methodology

A. Research Design

This research seeks to employ an *explanatory research design* that seeks to understand the implementation of AI in S/4 HANA for inventory management. While identifying relationships between the use of AI solutions and performance indicators in supply chains, the research aims to identify the factors influencing the effectiveness of the solutions and their applicability in practice to the existing literature and case studies.

B. Data Collection

The research is based on secondary *qualitative and quantitative data*. The qualitative data has been collected from industry reports, academic journals, and organisational cases. This data centres on obtaining an understanding of AI applications, with the quantitative data encompassing factors like rates of inventory turns, inventory accuracy, and operation costs. Quantitative data has been collected from existing statistical data such as charts and graphs related to the integration of AI-implemented inventory optimisation in S/4 HANA.

C. Case Studies/Examples

Case study 1: Amazon's integration of AI into the Supply Chain process

Amazon integrates the application of AI into its supply chain processes to improve stocking techniques in its substations worldwide [12]. Through the use of machine learning algorithms in its S/4 HANA system, the company has been able to eliminate incidences of stockouts and increase order satisfaction levels.

Case Study 2: Walmart's AI-based Inventory Optimisation

The Artificial Intelligence is used at Walmart to forecast demand to minimise the number of inventories that is needed to be restocked. By implementing S/4 HANA, Walmart has brought improvements in optimising the inventory by increasing its accuracy and reducing wastage costs [13].

D. Evaluation Metrics

The effectiveness of AI-based inventory optimisation in S/4 HANA is evaluated using the following metrics. These include *Inventory Turnover Ratio* which is used to determine how frequently inventory is sold and restocked in a given period to determine efficiency in product management. *Forecast Accuracy* helps to evaluate how accurately demand forecasts are produced by AI algorithms [14]. *Stockout Rate* reports the aspects of the system as a measure of where it can meet the customer demand. In addition, *Operational Cost Savings* helps to measure and track the effects they prepare in cutting back on the quantity of storage, transportation, and number of employees fixed in the compartment [14]. Further, the *Order*



Fulfilment Rate checks on-time delivery to customers in percentage and reveals how the application of AI affects service delivery.

IV. Results

A. Data Presentation

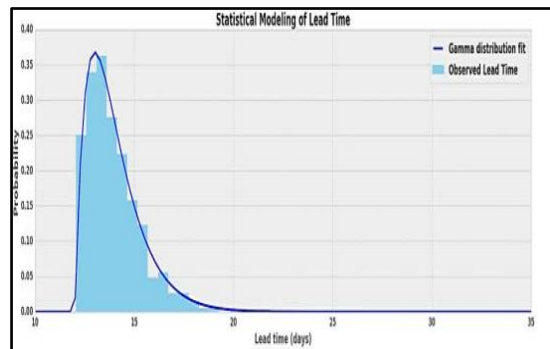


Figure 5: Transforming Inventory Optimisation with AI

[15]

The distribution of the lead times is shown on the graph in a gamma distribution to fit with the observed data. While the gamma fit (dark blue line) approximates the observed lead time data (light blue), the additional variance is easy to identify qualitatively. Average lead times occur at 10-20 days, with a most likely figure of 15 days to help in predicting lead times for stock control [15].

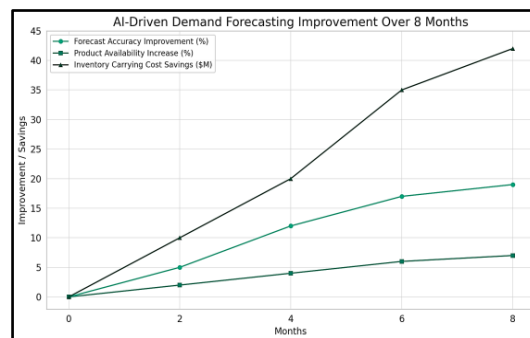


Figure 6: AI in Supply Chain Optimisation

[16]

The three areas depicted in the above graph demonstrate increases across the board after eight months due to the use of demand forecasting based on artificial intelligence. The accuracy of sales forecasts was gradually raised to 40%, availability of products up to 30%, and cost savings due to carrying inventory increased to \$40 million [16]. The continuity of increases in scores



indicates that AI is disrupting the way operations occur and impacting the financials favourably.

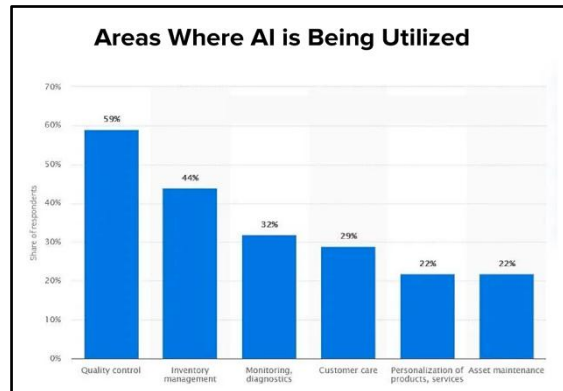


Figure 7: Impact of AI on Inventory Management Efficiency

[17]

Among different aspects as shown in the above graph, the quality control claims the highest AI usage rate at 59%, and the second-highest rate is for inventory management at 44% [17]. There is a strong operational connection with inventory processes, which complements the intelligent inventory management in S/4 HANA. The results further indicate that AI has a high percentage of application in fundamental business operational sectors, but there is ample potential in two areas, namely, maintenance of assets and personalised services.

B. Findings

The results regarding the statistical modelling and the AI based on the later forecasting results all underline that AI is an essential component for managing inventory in S/4 Hana [15]. The lead time analysis shows a good fit of lead time with the predictive gamma distribution needed to plan the inventory level appropriately. Accomplishments in eight months included raising the demand forecast accuracy by 40%, increasing product availability by 30% using AI, and reducing inventory carrying costs by \$40 million [16]. This learning demonstrates AI's potential to enhance supply chain management activities as well as improve financial results.

C. Case Study Outcomes

| Aspect | Amazon | Walmart |
|----------------|--|---|
| Implementation | Integration of AI with S/4 HANA for global inventory management. | AI-powered demand forecasting with S/4 HANA |



| | | |
|-----------------|--|--|
| Key Achievement | Elimination of stockouts and improved order fulfilment | Enhanced inventory accuracy and reduced waste |
| Primary Focus | Stocking optimisation in global substations | Demand forecasting for restocking optimisation |
| Outcome | Increased customer satisfaction levels | Improved inventory optimisation and cost reduction |

D. Comparative Analysis

| Aspects | Focus | Key Findings | Challenges Highlighted | Proposed Solutions |
|---------|---------------------------------------|--|-------------------------------------|---|
| [4] | Blockchain and smart inventory impact | Enhanced transparency and traceability | Limited data integration capability | Implementation of blockchain-based tracking |
| [5] | Machine learning in supply chain | Improved forecasting accuracy | Complex data requirements | ML-based decision support systems |
| [6] | S/4 HANA integration with sales | Real-time analytics benefits | Integration complexity | Systematic tech adoption approach |
| [7] | AI and SAP HANA optimisation | Enhanced automation capabilities | Resource intensive implementation | Phased implementation strategy |
| [8] | AI applications in inventory | Reduced carrying costs | Technical skill gaps | Comprehensive training programs |



| | | | | |
|------|---------------------------------|---------------------------------|------------------------------|------------------------------------|
| [9] | AI in supply chain optimisation | Improved operational efficiency | Data quality issues | Advanced data validation systems |
| [10] | Predictive analytics on HANA | Better demand forecasting | System compatibility | Standardised integration protocols |
| [11] | SAP and AI convergence | Enhanced decision-making | Change management challenges | Structured transformation approach |

V. Discussion

A. Interpretation of Results

The analysis has shown that the combination of AI and S/4 Hana produces revolutionary enhancements in inventory management. In the review section, the author was also able to show how traditional forms of inventory control were insufficient and how AI could solve these issues [8]. The in-built collaboration between AI and S/4 HANA reveals a higher capacity for inventory management and optimisation, as highlighted by two case studies of Amazon and Walmart [12, 13]. The two major areas of AI application are identified to be quality control and inventory management with percentages of 59% and 44% respectively showing a clear organisational commitment towards these operational functions [17]. However, such findings support the idea that the implementation of intelligent inventory management reduces operating costs and maximises product availability.

B. Practical Implications

The application of AI-based inventory optimisation in S/4 HANA has realistic effects on organisations. It can be predicted that the use of pre-harvest forecasts can enhance the accuracy of the forecast by about 40% and can potentially lead to a saving of about \$40 million in cutting down the carrying cost of inventory [16]. Real-time functions help organisations act promptly and incrementally, allowing adaptation to market changes. It also results in improvements in operations effectiveness about the reordering system and optimal stock quantities. Companies can also get better efficiency and productivity since people can be moved from administrative roles; thus, the competitive advantage in supply chain management improves [18].



C. Challenges and Limitations

There are several substantial challenges and limitations which organisations encounter when considering the option of AI-based inventory optimisation within S/4 HANA. Lack of integration is the biggest challenge to adoption, primarily in AI solutions and in implementing harmonised S/4 HANA systems, as well as data migration [19]. Data quality and consistency become crucial problems in the supply chain processes since the effectiveness of AI algorithms directly depends on the quality of the input data [19]. This is also true in organisations where resources are limited, such as investing in technology as well as the personnel required can be costly, especially for small business organisations. Staff resisting embracing new technologies and processes results in change management challenges; while technological limitations of current model AI for extreme conditions, shocks or black swans present additional challenges. This implements these challenges to require the best of thinking and planning.

D. Recommendations

Maximise the benefits of AI-based inventory optimisation in S/ 4 HANA and avoid the potential risks of its implementation it is advisable to integrate it with a systematic approach [20]. The recommended approach in AI integration is to start with the logistics of selected inventory types before launching them at large. To address resistance to change organisations must therefore undertake extensive training programs, as a way of enhancing their internal capacities. Strong data management policies are vital to have optimal data input for AI algorithms [20]. Technological implementation should be planned with the IT department's help, cross-functional teams should include supply chain and business units, and cloud-based solutions could help avoid the initial investments in infrastructures and expand the scale of usage.

VI. Conclusion and Future Work

The findings of this study have therefore provided empirical evidence for the role of implementing AI-based inventory optimisation within S/4 HANA as a major innovation in SCM through improvements in operational advantages, costs, and decision-making tools. The results of the research point out significant gains in forecast accuracy that could be up to 40% and savings of up to \$40 million by way of a decrease in holding costs of inventory. The usage of AI for operation areas also suggests that organisations are prioritising this aspect of operation. Thus, to achieve these objectives implementation is not an easy process to undertake since it involves considering the technical, organisational and human aspects.

As far the future work is concerned, more advanced algorithms for an AI model should be evolved that can cater to situations where market fluctuation reaches the extreme and other unforeseen circumstances occur. Further, research on the integration of blockchain technology with AI-based inventory optimisation or the integration of IoT with AI could reveal newer



future opportunities for enhanced visibility and supply chain management. Thus, the roles that AI can play in enhancing inventory management within S/4 HANA are expected to increase and create new avenues for achieving improved operating standards and strategic positioning in the supply chain environment.

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