

School of Built Environment, Engineering and Computing

Leeds Beckett University

**Impact of AI on supply chain integration to accelerate innovation of new projects development**

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# Candidate’s Declaration

I, Kshitij Pandey, confirm that this dissertation and the work presented in it are my own achievement.

Where I have consulted the published work of others this is always clearly attributed;

Where I have quoted from the work of others the source is always given. With the exception of such quotations this dissertation is entirely my own work;

I have acknowledged all main sources of help;

I have read and understand the penalties associated with Academic Misconduct.

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# Abstract

The AI-based architecture associated with higher intensive information ensures security and maintains agility within the supply chain by measuring optimal risk management of the supply network. The purpose of the research study is the find the impact of AI on supply chain integration to accelerate innovation of new project development. By learning regarding the measurement of the effectiveness of AI generative tools, adaptive in supply chain management helps the business corporations to select fair and accurate suppliers..

Case studies as a research strategy for qualitative research method has been one of the most widely used strategy utilised for qualitative data collection exploring in depth any program, activity, event and in this study, it has facilitated the researcher to collect the detail information from different instances and companies over a period of time. Using appropriate keywords, case studies such as from the news articles and research articles have been acquired from the internet and the academic databases such as *ScienceDirect*, *IEEE* and *Scopus* respectively.

With the use of the AI algorithms that has brought innovation in the ways in the existing supply chain processes had been carried out. On the other hand there are also same core issues related to the application of AI in supply chain integration such as data incapability, quality of data generations, functional silos, static infrastructure. The automation of the overall processes suggest through different kinds of AI technologies in strategies like machine learning algorithms, computer vision, machine vision, ANN, robotics use. The important areas in which the application of the artificial intelligence in SCM integration has been associated with innovation and significant results are balancing inventory levels, monitoring product quality and improving the decision-making process.

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# Chapter 1: Introduction

## 1.1 Background of the study

AI usage in supply chain management is transforming the procurement process of business corporations by utilising powerful data analysing tools, AI-driven technologies, and machine-learning algorithms that offer valuable insights to make smarter procurement decisions in organisations. The global spending on IIoT platforms predicted growth from $1.67 billion in 2018 to $12.44 billion in 2024, which is attaining a 40% compound annual growth rate in the last 7 years (Belhadi *et al.,* 2024). Accelerating supply chain success with the generation of AI and logistics applications delivers powerful optimization capabilities required for the enhancement lower supply chain cost and improving demand forecasting for the new project development Efficient management of the warehouse is the integral segment of the supply chain management that should assist with AI-based automation, simplify complex procedures and saving valuable time of the employees (Benzidia*et al.,* 2021). New technologies are now being used for enhancing the efficiency of supply-chain management activities such as the AI-based architecture associated with higher intensive information can ensure security and maintains agility within the supply chain by measuring optimal risk management of the supply network (Helo and Hao, 2022). This is because the AI algorithms have the capability of using historical data for making predictions, identify risk areas and also make predictions.

1.2 Problem statement

Applied the AI on the supply chain integration is to accelerate better performance and productivity by the development of innovation of new or innovative project development focusing on some core issues such as data incapability, quality of data generations, functional silos, static infrastructure and legacy systems, diversity of data sources, scalability and complexity in the data generations. Poor working relationships among different departments, conflicting goals, cost of integration and very first adoption, lack of clear communications among staff, and lack of knowledge of the employees are generating core issues for accelerating the new project work based on the AI generations (Shcherbakov and Silkina, 2021). In the present scenario there had been issues identified in seamless supply chain management such as, unfair supplier selections, issues in interoperability and difficulties in maintaining seamless integration in the data flow between the suppliers and companies often leading to delays in supplies . Implementing AI strategy in the organisation is needed due to the slow manual processes, errors in key supply chain activities, resource waste that is not able to meet with the demand and flow of the work generations in the new project development (Yang *et al.,* 2021).

Most of the existing studies show the AI technologies and its use in supply chain activities providing limited understanding of the impact of these technologies in specific areas and the way in which they support innovation in SCM integration and project development.

## 1.3 Aim, objectives and question

***Aim***

The purpose of the research study is the investigate the ***impact of AI on supply chain integration to accelerate innovation of new project development.*** In the current era, Artificial Intelligence is becoming one revolutionary technology to make a huge impact on different sectors.

***Objectives***

* Critically investigate the mechanism through which AI impacts inventory management, warehouse management, supplier management and other key aspects
* In-depth analysis of the different types of AI technologies which can accelerate innovation of new project development.
* Examine the impact of AI on the Supply Chain Integration to accelerate different types of innovation in project development.

***Questions***

1. How does AI influences different aspects of supply chain integration such as inventory management, warehouse management, supplier management and other key aspects?
2. What is the influence of AI on for accelerating innovation of new project development?
3. What are the core challenges of integrating AI into the supply chain for accelerating innovation of new project development?
4. What are the recommended strategies for integrating AI into the supply chain to accelerate innovation of new project development?

## 1.4 Research rationale

The rationale of the research paper highlights the need or essential to conduct research based on the topic development, here the researcher chose the impact of AI on supply chain integration to accelerate innovation of new projects development. As after the Covid-19 pandemic situation, people and companies are starting to be focusing more on the digital and innovative technological affections in every kind of projection. By learning regarding the measurement of the effectiveness of AI generative tools, adaptive in supply chain management helps the business corporations to select fair and accurate suppliers, hold the availability of projection by raising the networks in the supply chain that deliver multiple suppliers and reducing the cause of disruption in the logistics materials flow (Stute *et al.,* 2021). The manifold process and exchange of information essential for raising the speed, efficiency, and quality of the projection in terms of customisation development and making greater decentralisation strengthens situational awareness in the intelligence supply network. After measuring the security issues, data accessibility and scalability issues this study provides a solution at the end of the research that helps for making clear sense and understanding regarding the context of cognitive technologies and AI in supply chain integration.

## 1.5 Chapter structure

Table 1: chapter structure

|  |  |
| --- | --- |
| Chapter name | Exploration of the chapter |
| 1st chapter: Introduction | The 1st chapter of the study develops a purpose, questionnaire, research objectives based on analysing the problem statement of the research. The rationale of the topic, significance of conduct study based on topic is also elevated here. |
| 2nd chapter: Literature review | The 2nd chapter focused on exploring the previous existing literature sources and their findings based on the topic development, the gap among the current research study with the previous studies are discussed here. |
| 3rd chapter: Methodology | The 3rd chapter outlines the data collection method, analysing techniques and proceeds to evaluate the philosophy, strategy of the research. The ethical factors are also explored in this chapter. |
| 4th chapter: Data collection and discussion | The 4th chapter is the core section of the research paper that analyses the collected data, trying to find the best solution of the research questions and objectives to make an evaluation of the research topic. |
| 5th chapter: Conclusion and recommendations | The last chapter of the research summarised the entire paper, pointed out the linked among the solutions with the literature and objectives of the study, develop accommodations and outline the future scope of the study. |

**1.5 Research Significance**

The significance of the research paper evaluates the benefits or importance of the impact of AI on supply chain integration to accelerate innovation of new project development by identifying major strengths of developing the machine learning algorithms and AI processing in the supply network. The crucial advantages of using AI in supply chain integration include optimised operations through simulations, improving warehouse efficiency at a higher level, eliminating errors and less waste, improving the supply chain sustainability and mitigating the operating cost of the projections (Reyes *et al.,* 2020). The primary benefits of developing the AI features in the supply chain focus on balancing inventory levels, monitoring product quality and improving the decision-making process by delivering faster prototype assessments in the project work.

# Chapter 2: Literature Review

**2.1 Introduction**

The literature chapter outlines the primary concept of AI, draws an overview of supply chain integration, and the innovation application and analyses the influence of effectiveness of AI on supply chain integration to accelerate innovation of new projects development are measured here based on exploring the existing resources. The system complexity, the scalability elements, and operational costs of an exceptional network and AI-generated machine are indicating basic challenges or obstacles to developing the AI work in the new project development in real life. The recommended strategies are evaluated as future aspects for the development of AI and machine learning algorithms in the innovative features additions of new projects.

## 2.2 Concept of Artificial Intelligence

Artificial intelligence (AI) defines the approximation or simulation of human intelligence in machines, the purpose of AI is to make accurate perception, reasoning and company-increased learning to develop natural language processing, machine vision development and speech recognition. According to Verma *et al.* (2021), AI is a wide range of technology that performs complex tasks, constitutes high and advanced machine learning to train the data sets to allow the computer system to recommend and identify the fastest way of solutions. The Google translate, ChatGPT, Netflix and Tesla computer vision of self-driving cars are the significant example of the AI application in the real world. AI programming highlights cognitive skills, which consist of reasoning by choosing the accurate algorithm features for reaching appropriate outcomes, learning aspects that focus on creating rules and acquiring datasets to turn the programming towards actionable information (Ashok *et al.,* 2022). The advantages of AI usage and development associated with reducing time for data-heavy tasks, delivering consistent results by using AI translation tools in small business to large businesses, and improving the customer satisfaction by personalisation and AI-powered virtual agents are always available.

## 2.3 Concept of Supply chain integrations

Overview of the supply chain integration defines the association of suppliers and customers to work together and use management techniques to optimise their collective performance in the support, distribution and creation of the end production or projection. As per the research of Tiwari (2021), supply chain integration is divided into six segments such as measurement integration, customer integration, relationship integration, materials and services suppliers’ integration, internal operations integration and planning/technology integration. Integrated computer systems are used for establishing ongoing working relationships through raising communications that make awareness of the status of all orders, tracking of the shipment, and providing the best solution to the organisations. As noted in the early studies of supply chain management, Lejeune and Yakova (2005), elements of supply chain integration are four C's, which include collaboration, customers, communication and cooperation. Negri *et al.* (2021) pointed out that the development of supply chain integration helps the new projection to choose the right vendors, work with the integral teams, and waste eliminators by raising flexibility, reducing spending, improving the inventory management and suppliers' networks by control over the projection.

2.4 Concept of Innovation in new project development

Innovation is an important keyword in the current competitive world for getting the competitive edge of one organisation. In the opinion of Sankaran *et al*. (2021), innovation in new project development is important for being competitive and meeting the evolving market demands. For the development of integrating innovations into the development processes, Kavadias and Ulrich (2020) suggests that there are some frameworks such as identifications of needs and opportunities, defining of clear objectives, encouragement of cultural innovation and user-centric designs. Benitez et al. (2020) proposes that after identifying the needs and the opportunities one organisation must be very clear about their objectives to have the optimal innovations in the new project development.

## 2.5 Analysis of the impact of AI on the supply chain integration for accelerating innovation of new project development

AI or Artificial Intelligence is one of the emerging technologies in the current era that can be used in every field and sector so far. Thus, Belhadi *et al.* (2024) argued that with the help of the AI on the supply chain integrations there could be accelerating innovations for the new project development. Therefore, demand forecasting, predictive maintenance, supplier management and enhanced customer insights can be done with the use of AI technologies optimally. Implementing AI can also improve the efficiency and agility of supply chains with the potential insights of the raw data of one organisation's supply chain management. It is opined by Benzidia *et al.* (2021) that some of the impacts of AI on supply chain integrations are inventory management, on-time delivery, enhanced safety and the reductions of operations costs. Moreover, AI is considered a rapidly emerging transformative technology with processes the vast amounts of data generated by a range of data sources. By leveraging the AI tools, the abundance of real-time images and the data within the inventory management can be processed successfully to make innovative solutions.



**Figure 1: Points of impacts of AI on supply chain**

(Source: Mittal, 2024)

According to Mittal (2024), the integration of Artificial Intelligence has made significant improvements in the speed, intelligence and safety of supply chain operations. With the help of AI technology, there are significant reductions in manual labour and the delivery process to the customers has become more streamlined so far. On the other hand, AI computers can now process information about clients, vehicles and drivers to create the most efficient routes for providing timely deliveries. In the opinion of Belhadi *et al.* (2024), AI-based automated technologies would be the ability to revolutionise warehouse management with the help of better planning and improving the safety for both the materials as well as the workers. Besides that, AI technologies such as robotics systems can automate routine and repetitive tasks to free up human resources to focus on strategic activities.

## 2.6 Discussion on the challenges of integrating AI into the supply chain for accelerating innovation of new project development

AI adoptions could also bring some challenges during the integrations of the supply chain for accelerating innovation of the new project development. Below some of the challenges with using AI have been discussed.

***Data Quality and Availability:*** According to Nozari *et al*. (2022), AI algorithms require a large volume of data with high quality but many organisations fail to manage the fragmented, inconsistent or incomplete data across the supply chain systems. However, without high-quality data, AI cannot make any accurate and precise predictions so far. On the other hand, ensuring high-quality data can be challenging, as it requires data integration efforts and investment into data governance practices.

***Complexities in Integrations:*** AI tools and algorithms are complex and one organisation could face challenges during the integration of the AI tools and algorithms with the supply chain systems. It is opined by Reyes *et al.* (2020) that one organisation could face technical challenges during the integration of AI into the supply chain management such as the compatibility, data connectivity and the requirements of the planning and collaboration between the IT and the business stakeholders. Legacy infrastructure and disparate data sources must be there for having different AI integrations.

***Skill Gaps and Talent Shortages:*** It is considered the most long-lasting issue for the implementation of the new and emerging technologies so for the AI technologies. As opined by Sharma *et al.* (2022), implementing the AI initiatives requires specialised skills in the fields of data science, AI development and machine learning algorithms and that may be scarce or costly to acquire so far. Thus, the organisations may face challenges in recruiting, up skilling the talent and retaining them with the necessary expertise within the market. Hence, the lack of domain expertise could create challenges for managing the situations with the associations of the AI tools and the technologies so far.

***Security and data privacy risks:*** According to Helo and Hao (2022), AI systems are vulnerable to cyber security threats including data breaches, unauthorised access and different online malicious attacks. On the other hand, AI technologies also raise ethical concerns relating to privacy, bias, accountability and fairness so far. Thus, protecting the sensitive data of the supply chain must be in priority for safeguarding against potential threats. However, Sharma *et al.* (2022) argued that AI technologies could have higher upfront costs with the return on investments. Thus, the particular deep learning models and the other technologies could require the overall management of the factors.

## 2.7 Recommended strategies for integrating AI in the supply chain for accelerating innovation of new project development

Integrating AI into supply chain management requires different recommended strategies for the development of innovation into new projects.

***Scale with Agility:*** It is opined by Shcherbakov and Silkina (2021) that the scalability of the AI gradually must be there on the quick wins and high impact opportunities for maintaining the flexibilities and agility. Moreover, there must be monitoring of the performance metrics and the KPIs development to track the impact of AI on supply chain management. Scale successful initiatives must be there across the organisations systematically for the AI tools and technologies.

***Enable Cross-Functional Collaboration:*** It is required to enable cross-functional collaboration to get the right amount of AI tools and algorithms collaborations. In the opinion of Ghoreishi and Happonen (2020), fostering of the collaborations and the communication across the functional teams, stakeholders and the departments involved in the AI integrations. On the other hand, the breakdown of the silos and the encouragement of knowledge sharing, alignment and collaboration required a holistic approach to AI-driven innovation within the supply chain development.

***Continuous improvement and learning:*** Technology is the subject of continuous change and so the developers must have continuous improvement and learning for that matter. It is opined by Naimi-Sadigh *et al.* (2022) that AI or Artificial Intelligence is one of the emerging technologies that can have continuous change in manner so that the developers must have to make continuous improvement and learnings over the AI tools and the technologies. On the other hand, fostering a culture of continuous improvement and learning could lead towards experimentation, knowledge sharing and innovations. In the opinion of Ghoreishi and Happonen (2020), establishment of the mechanisms for collecting feedback, incorporating the lessons, sharing of the best practices into future AI initiatives with the help of continuous improvement, and learning so far is needed.

***Monitor and manage Risks:*** Despite the continuous development of AI tools and technologies, there are requirements for monitoring and managing the risks associated with AI tools and technologies. It must have continuous development over the identifications and the mitigations of the potential risks associated with AI integrations such as data privacy, ethical concerns, regulatory compliances and cyber security. As opined by Rane (2023), implementing robust risk management practices and controls over AI technologies could ensure the responsible and ethical usage of the AI supply chain.

***Prototype and Pilot Projects:*** The pilot projects and prototype of the AI technologies can lead towards the further development of the AI tools and their implications. The organisations must have to make investments into the prototyping and pilot projects after developing skilled labourers within the organisation. In the opinion of Allal-Chérif *et al.* (2021), experimenting with the different AI algorithms, approaches, and technologies must be required for the assessment of their feasibility and effectiveness within one real-case scenario. Furthermore, the iterative process based on the feedback and lessons learned can refine the AI solutions with having of the iterations.

## 2.8 Literature Gap

The key gap in the literature is regarding the lack of case studies showing example of companies that have used AI in SCM and accelerating innovation for understanding the implications of AI in real world.

## 2.9 Summary

From the entire learning of the literature, it could be summarised that the development of AI-powered, machine learning algorithms and other AI models in the supply chain integration helps to raise forecasting accuracy to improve the inventory efficiency and optimise levels, develop predictive maintenance and relationship with multiple suppliers. The focus driving enhanced integration in the supply chain through used personal computers helps for rapid growth in the customizations, minimises waste, delivers higher quality of the product and identifies trends of the market. The issue that had been identified in the existing review of literature is that the mechanism through which AI can impact the key areas of SCM had not been dealt in details so it is not possible to determine how AI can support key activities and concerns of SCM. Moreover, there has also not been association established between Ai technologies and its use in supply chain and innovation as determined in the research objectives. Overall, the data as collected from secondary sources would be directed towards establishing the connection between AI, innovation and SCM that had not been achieved in the review of literature.

# Chapter 3: Methodology

## 3.1 Introduction

The research methodology chapter explains the way in which the researcher had in tender to conduct the research. It is a logical and systematic plan for resolving the research problem and the methodological framework details the approach adopted for conducting the research for ensuring that and reliable results are obtained addressing the aims and objectives (Mishra and Alok, 2022). This chapter states the research philosophy, approach, design, research method and strategy adopted for conducting the study along with explaining the method of data collection and analysis as well as the research ethics.

## 3.2 Research philosophy

The philosophical stand point of the research is interpretivism that has helped in determining the nature of the assumptions and nature of study. The philosophy shows the specific way in which research approach had been developed and also the nature of data that had been acquired. The assumptions as related to interpretivism are perceived as the preliminary statement of the reasoning behind the data collection and analysis. Positivism as a philosophy of research had not been adopted in this research because it is more suitable for researchers in which quantitative data is being collected through primary research for objective data collection and analysis (Alharahsheh and Pius, 2020). However considering that in this research secondary sources had been planned to be used for gathering qualitative data that would require more insightful information and in-depth understanding of the research topic, interpretivism has been used as the philosophy (Junjie and Yingxin, 2022). By using interpretivism philosophy it has been assumed that the understanding of supply chain integration and the impact of AI on innovation on project management. In the interpretation of the data sources the subject to experience of the researcher has been very significant (Alharahsheh and Pius, 2020). Interpretivism has supported sociological method in the research for which the event reaction had been analysed suggesting that the social factors related to the case scenario have been significant in the interpretation of the impact of AI.

## 3.3 Research approach

The approach to the study is defined by the type of data being collected and the approach considered more suitable for data collection and analysis (Bingham and Witkowsky, 2021). Considering that it was considered more suitable together qualitative information that would allow more in death assessment of the case studies for the analysis of the impact of AI on innovation in project management and supply chain integration, inductive approach had been adopted in this study. By using inductive approach as against the deductive approach the researcher had initiated the research by collecting the data relevant for the study and post the process of data collection there has been broad assessment of the data to look for the patterns in the collected data for developing theory and comparing it with previous research data for explaining the pattern (Okoli, 2023). The reason for which deductive approach had not been used in this study is because of the nature of the data collected. Deductive approach is mostly suitable for studies in which quantitative or numerical information had been gathered because it allows general and theoretical information to be tested by the quantitative and statistical information (Bingham and Witkowsky, 2021). By using the inductive approach it has been possible to adopt a bottom-up approach moving from the specific data collected to more general understanding. The observation of the country reality to the case studies on the impact of AI on project Innovation and supply chain integration has been followed by the extrapolation of the observation for imagining the overall scenario.

## 3.4 Research design

The approach to the design of the overall research is exploratory design and more specifically the exploratory case study design has been used in this research. By using the exploratory design it has been able to answer the how and what questions related to the objective of the research (Szabelska et al. 2021). To elaborate the exploratory design has made it possible to answer how use of AI impact supply chain integration and facilities innovation in projects? Moreover it also helped in answering what are the innovative technologies or strategies that can be used for the same? The exploratory design had been used with the intent of addressing the research problem that had not been studied in details before. The exploratory case study is a qualitative design that had been used for getting different perception of people with respect to the particular phenomena of research (Varpio et al. 2020). By describing the problem that is being explored, it was possible explain how that problem indicates the requirement for qualitative approach for understanding the research phenomena (Swedberg, 2020).

## 3.5 Research method

Research method is either qualitative, quantitative or combination of both that is mixed research method. In this research being conducted to understand the impact of AI on supply chain integration and innovation in project, it was determined that the collection of quantitative data that is numerical information and statistics will not be suitable for answering questions with respect to the impact of AI and understanding its associated challenges that would require more in depth understanding of AI and its potential. Hence it was decided that qualitative research method would be most suitable as it would facilitate digging deep into the key concepts and make broader generalization (Mezmir, 2020). Accordingly qualitative research method had made it possible to include words, thoughts, feelings and opinion of people involved in the case studies selected for the data collection. By using the qualitative method it has been possible to get lot of details about the specific cases and the involved people. On the other hand the disadvantage that was faced is that it was not possible to make any general statements and that the overall method had been time consuming. Other hand, it had facilitated subject to analysis of the data but based on the facts included in the case study.

By using the qualitative research method it has been possible to cover the topic such as the perception of the consumers and companies about the integration of AI and also analyse the feelings and experience about the impact of AI on the supply chain activities and integration. The key reason of using the qualitative method of research has been to explore and illustrate as well as provide detailed and rich information about the particular instances and so it was considered to be a good choice for using this method of research (Nassaji, 2020). By using the qualitative research method it has been possible to address the research objectives without being objective in the approach to the study (Hennink et al. 2020). By the generation of the non numerical data it was more convenient and relevant to interpret the data collected for more detailed assessment of the overall research scenario and the topic being investigated (Nassaji, 2020). It has been possible to explore different sources of the studies providing deeper insights into the real world instances of the implication of AI integration on supply chain and project innovation. Quantitative research providing numerical information would only have provided data that could be analysed objectively and for testing the relationship between the variables making the study to be measurable but not insightful (Hennink et al. 2020). It is with this reason that the qualitative research method had been used.

## 3.6 Research strategy

Case studies as a research strategy for qualitative research method has been one of the most widely used strategy utilised for qualitative data collection exploring in depth any program, activity, event and in this study, it has facilitated the researcher to collect the detail information from different instances and companies over a period of time (Skarbek, 2020). The cases that have been selected for the qualitative data collection had been bound by activity and time and because of that it has been possible to collect detail information by using different procedures of data collection over a sustained time (Schoch, 2020). As a strategy for data collection together qualitative research case studies have been used as it was considered suitable for the social research in order to understand the opinions and believes of the peoples and companies involved with the implementation of AI and supply chain integration and innovation in projects. It has been possible to use some of the most authoritative and relevant literature produced by being specific to certain organisations and research area using the case study (Priya, 2021). However the key issue that had been contentious in this is regard of selecting the case study as the strategy of conducting research is the determination of the findings from single social unit to be generalized over larger population of the similar units. Nevertheless, case studies as part of the quality research methodology had benefited in the exploration of any program, event, tools and strategies related to the use of AI in supply chain integration and project innovation by collecting unbiased and adulterated study of the phenomenon just by using the data from the case studies. The purpose of the use of case study had been to explore or identify the fresh research questions that can be used in the research study subsequently and extensive manner hence there has been use of exploratory case study strategy for qualitative data collection (Skarbek, 2020).

## 3.7 Data collection method

There has been use of secondary sources of data for data collection such as the case studies that are already available in research articles and on the Internet had been used for collecting data. There had not been use of any primary source of data collection that would require original research to be conducted by the research for fresh data collection for the purpose of the research. Using appropriate keywords, case studies such as from the news articles and research articles have been acquired from the internet and the academic databases such as *ScienceDirect*, *IEEE* and *Scopus* respectively. The case studies are on any specific company or specific case of implementation of AI or on any specific AI technology is used for supply chain integration or innovation in project management. There has been attempt to select case studies that can give specific information about any company that has used AI in supply chain integration or for innovation. Only recent case studies such as in the last 5 years have been used for gathering the most recent and updated information.

## 3.8 Data analysis method

The data analysis method that had been used for analysing the secondary qualitative data is thematic analysis. The thematic analysis has provided a rigorous and flexible approach to the understanding of the subjective experience applicable to the understanding of the specific information such as related to the experiences and beliefs of people involved in the case studies. Thematic analysis as used for the analysis of the data from the case studies has been a method through which there has been identification and analysis of the data as well as the reporting of the patterns or the themes within the data. There had been various approaches for conducting theme at analysis but in this study there has been use of the six-step process developed by Braun and Clark (2022). At first there has been familiarisation with the data through repeated reading of the case studies followed by the coding (identification of keywords). This is followed by the step of generation of themes by arranging the codes and then themes have been reviewed (Braun and Clark, 2023). In the following stage, there had been naming of the themes followed by the write up under individual themes.

## 3.9 Research ethics

For protecting the research integrity and for keeping the results valid and truthful, it has been ensured that the data that had been taken from the case study not be modified for shooting the research objectives and there is no falsification of data (Vlahou et al. 2021). Privacy of the participants and original case studies had been a maintained and it had been ensured that any sensitive information from the original case studies are kept confidential that might require ethical approval otherwise (London, 2021). There has also been an attempt to reduce the level of subjectivity and biasness in the interpretation of data from the researcher by interpreting the data with limited biased inferences and linking the data from the case studies with the previous literature.

## 3.10 Research timeline

Table 2: research timeline

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Key tasks | Week 1-2 | Week 2-3 | Week 3-4 | Week 4-5 | Week 5-6 | Week 6-8 |
| Development of research objectives, questions |  |  |  |  |  |  |
| Submission and approval of research proposal |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Introduction chapter |  |  |  |  |  |  |
| Literature review |  |  |  |  |  |  |
| Research methodology chapter |  |  |  |  |  |  |
| Selection of case studies and data gathering |  |  |  |  |  |  |
| Thematic analysis of data and discussion |  |  |  |  |  |  |
| Drawing conclusion and recommendations |  |  |  |  |  |  |
| Proofing of draft |  |  |  |  |  |  |
| Submission of final draft |  |  |  |  |  |  |

## 3.11 Chapter summary

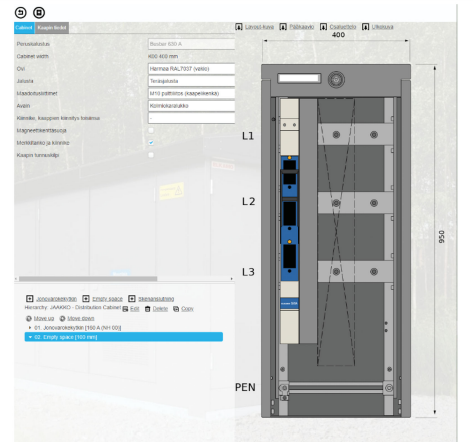
There has been use of interpretivism research philosophy and inductive approach to research because of the qualitative nature of data gathered. The research strategy that had been used for gathering qualitative data is the case studies and the study had used exploratory case studies design for data collection. Data collected had been analysed using themes.

# Chapter 4. Thematic analysis of findings from case studies

**Theme 1: Mechanism of AI application in the supply chain integration**

**CASE 1 : Configuration Of Sales**

Sales configuration is important part of the sales and distribution process and the sale configurated tools are used for maintaining fast communication between the production in the company and the customer interface (Toorajipour et al. 2021). The software packed is developed to store the key information of the products for which ERP is now being used for production, planning and scheduling (Helo and Hao, 2022). Based on the history of configuration there can be clustering of products and the information related to products is bundled to be used in the R&D process as noted in the configuration system shown below:



**Figure 2: configuration system for sales using AI**

(Source: Helo and Hao, 2022)

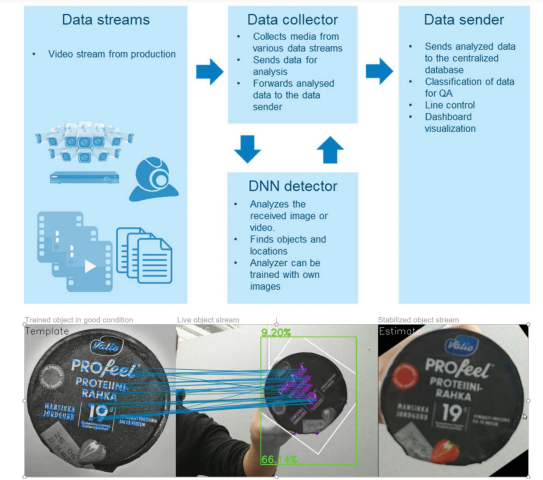
The main reason for using the AI technology is to reduce the speed for the process of quotation, reduce the manual work requirement and improve document quality. The configuration system is set and updated during the product life cycle.

**CASE 2 : Planning of Production and Control**

The second case is about a metal manufacturing company that uses machine for cutting and bending. It is very important to understand pattern and principles of machines and the process of design related to the production of manufacturing instructions and other schedules. The company had invested in the AI technology for supporting the planning of production with the help of automated decision support (Zhang et al. 2021). Smart connected machines connected to the cloud based AI that response to the changes in the order list of the customers and the production systems. AI use the genetic algorithm based optimization for suggesting new alternatives for the tool changes, material changes and production schedules (Dora et al. 2022). The key objective of the case is driving AI implication are improvement in the utilization of machines and an approach which is quickly adapted to the production planning. Another reason to invest in the AI technology was building the connected service for the equipment of the customers for providing online guidance to the planning of tasks.

**CASE 3 : Maintenance Orders and Spare parts**

The company in this case manufactures mobile machines used for construction sites. The machines have a planned system of schedule for maintenance and the basic maintenance service includes the activities that need to be completed by the authorized personal. Every service needs some spare parts and tools to complete the order. The company have invested in the IOT connecting the portal of manufacturing of the installed based in the initial phrase, raw information is collected and used in giving guidance to the customers and management of assets (Nahr et al. 2021). Later there is an addition of processing level capability to EDGE level to the machines. There is continuous monitoring of the machines by the IOT and because of that any signs of possible breakdown are alerted as early as possible. The anomaly events are characterized by local machine AI based on the training data. The machine AI sent messages to the centralized portal of manufacturers by identifying any possible area of failure (Patil et al. 2021). In case of condition based analysis service can also booked by the AI construction machines and the spare parts can be automatically delivered and the spare parts can be automatically delivered. In the case study by, Helo and Hao (2022), the figure below shows how local AI can be use video stream in the real time using trained data using machine vision:



**Figure 3: feature detection for product quality using machine vision**

(Source: Helo and Hao, 2022)

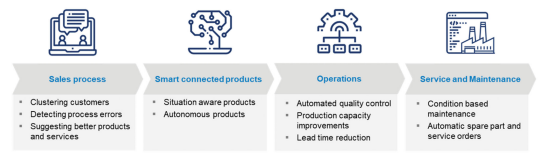
**CASE 4 : AI for inventory management**

AI is used for the optimization of the inventory in various industries such as manufacturing, retails and healthcare. Multi-national Retail Company such as Amazon had employed AI for the optimization of the inventory level to ensure that the products are available when require improving operational efficiency and increasing customer satisfaction (Ivanov et al. 2022). Amazon has AI for the prediction of the demand for the products based on the customer behaviour, markets trends and historical data. The information gathered is used for the optimization of the inventory level and streamline. The inventory management ensure that the company has the right quantity of inventory for meeting the demand. Machines used by Amazon for the analysis of the historical data like past sales, market trend and customer behaviour and it uses the natural language processing for understanding the social media buzz and customer review planned by inventory. The information is sued for the identification of trends and the predication for the demand of new products for managing the inventory accordingly. The demand for nay product is likely to increase if it is getting positive reviews. Computer vision is also used in Amazon for tracking for product movement in the warehouses (Boute and Udenio, 2022). The information is used in the identification of bottle necks and the optimization of inventory level. For instance if any product is not moving quickly then company can identify any problem in the supply chain and take necessary steps for resolving the problem and optimize the KPIs of the inventory management.

**Theme 2: Case studies of companies using AI for SCM and innovation**

Walmart which is one of the largest retailers has been leveraging the potential of AI for processing considerable amount of data. The company had designed Social Genome’ that is a solution based on Data Analytics for providing customers with better services through the analysis of the activities of the customers on social media. ABB had collaborated with IBM Watson for building an AI platform for the ABB ability that is aimed at obtaining cognitive insight in real time for the companies in the utilities, transport and retail Industry (Ramkumar et al. 2023). There is use of the artificial intelligence capacity of Watson for finding defects in any asset from the product images in real time captured through the ABB system and also from the historical data from IoT devices used on the factory floor. Real time alerts and messages are received by the manufacturers regarding the critical faults by using the solution (Nogueira and Borchardt, 2021). A very interesting case of the use of AI solutions for improving the business and SCM improvement is Infinera that is a manufacturer of the equipment used in telecom industry. Infinera is using and optimising a predictive solution for the supply chain management by using the Intrigo Systems that is a combination of OLPP platform powered by AI from a company named Splice Machine (Helo and Hao, 2022). Machine learning is used by Infinera for making better predictions about the delivery dates through the analysis of the past variability in the lead times in production and the performance of the logistic providers. In this way the company can survive and compete in the business while overcoming the depression environment. For the improvement in the inspection quality and to improve the product quality, NEC that is a Japanese company had developed system for the inspection of products in warehouse by using image recognition technology in the logistic operations (Sato and Sato, 2021). In this system there can be instant judgement on the match between the product shipped and the product mentioned on the schedule list of shipment. It is different from the other technology because it does not use any attached ID information or barcode but uses technology of image recognition.

As noted in the case study analysis by Helo and Hao (2022), Amazon uses AI as part of its SCM integration process and the following are the key areas in which AI is applied:



**Figure 4: AI as part of SCM integration**

(Source: Helo and Hao, 2022)

It is evident that AI algorithms are used for managing sales process, developing smart connected products, operations management and service and maintenance.

**Theme 3: Different types of AI technologies which can accelerate innovation of new project development**

The most commonly used methods and tools of artificial intelligence for supply chain integration and project innovation are machine learning (ML); artificial neural networks (ANN); Machine Vision (MV); Natural Language Processing (NLP); Speech Processing (SP) and robotics (Cannas et al. 2021). ML is a very crucial Technology that falls under AI enabling machine to not just process data but also process the unstructured knowledge. Systems that are based on machine learning can learn from the data file the pattern from the huge number of examples helping to make decisions based on the structured feedback. ANN as a technology has been inspired by the nervous system and uses the interconnected network of the computer memories for achieving learning from the proceeding experience is an example to recognise pattern and distinguish cluster objects and abstract information (Rodríguez-Espíndola et al. 2020). Machine vision also refers to the technology used for the recognition of the objects and it interprets the content as well as to extract information from image or video on automated bases. However it should not be confused with image processing in which the output is any other image. Machine within technology is mainly been used in supply chain management for object recognition and understanding of image. NLP powered system are being used for extracting meaning or information from the patterns in the text or the speech (Modgil et al. 2022). This is mainly being used to the statistical analysis of the terms and words based on the semantic assessment and decomposition of the relationship between words and phrases. There has also been increasing use of speech processing that refers to the use of technique of digital signal processing to transmit the speech into the digital signals (Belhadi et al. 2022). The technology of speech recognition is a technology used for data capturing and implementing the voice director system that are now currently being used in Alibaba’s warehouses (Zhang et al. 2021). They can provide audio prompts that give direction to the users. Robotics is the most to common kind of artificial Technology being used in supply chain management that is an interdisciplinary branch of science and engineering including mechanical engineering, information engineering, electronics engineering and computer science.

**Theme 3: Impact of AI on the Supply Chain Integration to accelerate innovation**

The use of the AI system in Amazon for predicting the demand is very advantageous for the company. It has been helpful for Amazon to reduce the inventory cost as Amazon has been able to avoid under stocking and over stocking of the products saving a lot of money of the company (Ivanov et al. 2022). The company has been able to identify the trends and launched the new products. The routing optimization by AI has helped to reduce the transportation cost and improve the delivery timeline for companies like Amazon and Walmart. It has also empowered the business to fine tune the production system, delivery and production schedule and streamline co-operations (Oosthuizen et al. 2021). It has also helped companies to be more agile allowing them to respond quickly to the supply and demand. It is also helpful for the business to be known resilient allowing them to overcome the disruption in the supply chain.

***Case of Siemens:*** Siemens that is a multinational conglomerate has embraced AI across the different aspects of the operation that includes the supply chain management, product life cycle management and collaboration across the supply chain. The company had actively worked for reducing the dependence on any specific supplier by employing methods that are driven by artificial intelligence such as chatbots for locating any alternative suppliers and identification of vulnerabilities in the supply chain (Annanth et al. 2021). It has also collaborated with other companies such as Supplyframe that has facilitated it to leverage the capacity of artificial intelligence for understanding and predicting challenges and patterns in the value chain of global electronics (Sadiku et al. 2023). It has been successful in the integration of the supply chain intelligence in real time with Siemens Xcelerator that has enabled better availability of the components and analysis of cost.

***Case of Unilever***: Another way in which AI had helped to accelerate innovation through integration of AI with the supply chain management is through AI-driven approach adopted by Unilever. The key focus of Unilever has been on integration of AI in the supply chain by collaborating with key partners such as Google Cloud. Google Cloud is responsible for creating 360 degree view of the supply chain of the company and also to support scientific discovery for decreasing emissions from its logistics support (Olutimehin et al. 2024; ). Innovatively from the incorporation of AI technologies like image capture within the freezer for inventory management to the use of satellite imaging and AI for monitoring farms to improve traceability, Unilever has been innovative in the use of AI (Saha et al. 2020).

**Theme 4: Challenges in using AI in supply chain integration**

The first challenge that had been identified in majority of the case studies discussed is with the availability of the data. AI needs huge amount of data in training and operation. Most business especially the small business does not have the required data for implementing the AI tools. The implementation of AI needs technical expertise and businesses may not always have the in-house expertise for the successful implementation of AI. Another challenge identified is with the high cost of implementing AI tools and technology and operate it in daily bases. It is not affordable for all the businesses to manage the AI costs (Pournader et al. 2021). The process of implementing AI needs change management such as changes in the existing processes. Many businesses may not be prepared for the change in the existing operations because of the resistance from the employees to support complete automation or because of lack of skills to support AI implementation. The level of intricacy related to innovation is the thought of being particularly challenging for comprehension and use. Complexity is referred to as the impediment or hindrance for the adoption of AI (Riahi et al. 2021). The likelihood of AI adoption increases with the easiness of integration into the corporate corporations. On the other hand the lack of IT specialist, in experience and lack of technical know-how are the main causes related to the complexity of AI implementation (Helo and Hao, 2022; Cannas et al. 2024). It is the main characteristic of AI that is its veracity and complexity that are related to the largest obstacle faced in its adoption. One of the most current examples of the failure of AI related to its complexity is with the challenge of Watson (Lohr, 2021). Watson has faced a lot of criticism as it gradually started to overtake the task from the human workers. It is still on the way of proving itself to be useful in the commercial setting. It has mainly been said to be worthless outside the academic field (Ramkumar et al. 2023). This is nicely because of the fact that Watson is presently not able to interact with humans in the natural manners and because of its complexities there are trouble with Watson making sense of the environment and difficulties in understanding event the simplest commands from the human operator (Helo and Hao, 2022). Irrespective of the advancement made by Siemens, the company had faced challenges in the implementation of AI across the operational landscape which is huge. The key challenge that had been identify this with the management of the complexity of the integration of the different technology of artificial intelligence and then navigation of the changing global market to ensure collaboration of Artificial Intelligence and human into organisational structure.

# Chapter 5. Discussion of findings

***RQ 1: How does AI influences supply chain integration?***

Artificial intelligence has positive impact on the integration in the supply chain. There is similarity in the findings between the review of literature and the assessment of the case studies which respect to the significant impact of AI and supply chain integration. For instance, Belhadi et al. (2024) had pointed that with artificial intelligence, supply chain integration can lead to accelerating innovations which respect to technology use such as in areas of demand forecasting, predictive maintenance. This is witnessed in the case of the use of artificial intelligence by Walmart that has used Social Genome’ as the solution for improving its services through demand forecasting and study of customer patterns (Awan et al. 2021). There is similarity between the findings of by Benzidia et al. (2021) with respect to AI and its improvement in the supply chain integration and real term monetary with that of the case study of Amazon and Walmart implementing AI. The studies unanimously suggest that AI improve the efficiency and agility of supply chains and improving areas of inventory management, on-time delivery, enhanced safety and the reductions of operations costs. Mittal (2024) had pointed the advantage of using AI for getting real-time images and the data within the inventory management. This has been true in the analysis of the case study of manufactures of mobile machines investing in AI that sends messages to the centralized portal of manufacturers identifying areas of breakdown. Even similar finding they have been noted in the use of artificial intelligence capacity of Watson in which AI is used for predicting defects showing images in real time captured through the ABB system (Ramkumar et al. 2023; Nogueira and Borchardt, 2021).

***RQ 2: What is the influence of AI on for accelerating innovation of new project development?***

The most significant way in which AI influences SCM integration is through predictive Technology as pointed by Negri et al. (2021) in the review of literature and also witnessed in the interesting use of AI solutions by Infinera. Infinera uses Intrigo Systems that combines OLPP platform powered by AI and machine learning for making better predictions regarding the delivery dates using historical data. Sankaran et al. (2021) and Nozari et al. (2022) had pointed in the review of literature that innovation is about making changes in existing processes and products for meeting the evolving market demands. In this context, AI can be helpful as an emerging transformative technology such as through supporting demand forecasting, predictive maintenance. This has been evident in the case of NEC that had developed a transformative technology using image recognition technology for inspection quality and to improve the product quality (Rodríguez-Espíndola et al. 2020; Sato and Sato, 2021). Interestingly, as pointed in the case study analysis, AI has tools like ANN, MV, NLP, SP, ML and robotics that are supporting innovative ways in which unstructured knowledge can be processed and technology can be used for the recognition of the objects and interpret the content as well as to extract information. Specifically the case study of Amazon using computer vision for tracking for product movement in the warehouses shows how AI is supporting innovation (Attaran, 2020).

***RQ 3: What are the core challenges of integrating AI into the supply chain for accelerating innovation of new project development?***

The first challenge identified in both the review of literature and in the case studies is regarding the data availability and quality. It has been pointed out by any many authors in the literature review that AI cannot give accurate predictions without huge volume and high quality of detail (Riahi et al. 2021; Saha et al. 2020). The AI algorithms need huge volume of data otherwise organizations will fail at managing the unstructured and fragmented data by different sources. There is a striking similarities between the case studies analyzed regarding the need for technical expertise and high cost of implementation of AI tools discouraging organizations to use AI for supply chain integration (Helo and Hao, 2022; Rane, 2023; Ghoreishi and Happonen, 2020). However in the review of literature there has also been discussion of skill gap and shortage of talent in organizations created barriers for AI initiatives to be supported as they require specialized knowledge in the field of machine learning, data sites and algorithms (Ghoreishi and Happonen, 2020; Sharma et al. 2022). This challenge had not been identified or mentioned in any of the case study discussed. Another difference that had been identified from the comparative analysis of findings from literature review and review of the case studies is regards to data privacy and security risk (Helo and Hao, 2022; Cannas et al. 2024; Modgil et al. 2022). The review of studies by many authors (Ghoreishi and Happonen, 2020; Nozari et al. 2022) have pointed that organizations consider AI system to be vulnerable threat to the cyber security such as data breach, attack from cyber criminal and unauthorized access from third party providers. It is interesting to note that the case studies have not mentioned the risks of cyber security and data breach with respect to challenges of AI integration in supply chain. Another difference with respect to the analysis to the challenges for AI use in SCM integration has been pointed in one of the case studies suggesting that AI integration brings complete automation of processes that requires change management in the existing process in an organization. The employees are resistant to AI implementation for handling supply chain processes that are handled by them manually due to fear of job-displacement (Belhadi et al. 2022; Canns et al. 2024). Change management is a very interesting challenge identified from the case studies that had not been noted in majority of the literature review. This challenge can be pointed as a major contribution to the study been conducted or AI implementation in SCM integration. One drawback from the case study analysis is that it has not identified the complexities relate to integration such as technical challenges as pointed by Reyes et al (2020) for using AI in supply chain activities like warehouse management or logistic operations. The lack of recognition of technical complexities in the integration process in the case studies also suggests that many organizations often fail in using AI in SCM integration because they do not recognize technical difficulties before-hand because of which there are problems in using the best AI technologies in the best possible way to manage the supply chain activities (Toorajipour et al. 2021; Zhang et al. 2021). From the comparative understanding of challenges of integrating SCM has been analyzed that technical complexities of AI integration, the data management risks need to be more properly researched before AI tools and technologies are introduced in supply chain management (Anica-Popa et al. 2021; Ivanov et al. 2022).

***RQ 4: What are the recommended strategies for integrating AI into the supply chain to accelerate innovation of new project development?***

The review of literature, most of the studies reviewed had mainly focussed on the strategies through which AI can be introduced in supply change management. For the acceleration of innovation whereas the case studies analyzed have mainly discussed the innovative AI technologies that can bring innovation in the management of supply chain activities for example the study by Shcherbachov and Silkina (2021) have advocated scalability of AI tools for maintaining flexibility and eligibility in the supply change management. On the other hand it has been learn from the case study analysis that for supporting the scalability of AI there is need for using AI tools like machine vision and machine learning that can use the AI unstructured data such as related to sales and market trend for planning the inventory, making the supply chain flexible and agile (Zhang et al. 22021; Dora et al. 2022; Patil et al. 2023). The use of computer vision as noted in the place of Amazon to track the movement of products in the warehouse can be associated with the strategy suggested by Rane (2023) regarding the use of AI tools and technologies for risk prediction and management. Irrespective of the continuous development of the AI tools and technologies the management of risks related to data security and inventory compiles need to be addressed and identified before AI technologies integrated into the production of planning, configuration of sales, spare parts and maintenance order and for inventory management. Any strategic use of the AI tools in the SCM integration or for supporting innovation in the workplace need to be supported by strategies for cross-functional collaboration as noted by Ghoreishi and Happonen (2020) and Stute et al. (2021) in their respective studies. Their findings have been aligned with the example as noted in the case of using computer vision for predictive maintenance. There should be proper application of computer algorithms on the huge amount of structured data gathered from different aspects of the supply change processes. The primary objective of using AI should be for building connected services from a centralized portal to identify any possible area of failure. From the case studies there had been identification of IoT devices connected to the portal of the manufacturing system for collecting raw information that can help in guiding future planning processes (Anica-Popa et al. 2021; Ivanov et al. 2022; Patil et al. 2023). Computer vision and robotics have been the most commonly used AI technology for important supply chain processes such as logistic management, warehouse cooperation, identification of issues in products, tracking of the product movement, generating alerts from breakdown, development of production schedules (Boute and Udenio, 2022; Oosthuizen et al. 2021; Attaran, 2020). Hence it can be analyzed that simple yet effective technologies like computer vision and robotics that use AI algorithms for supporting predictive technology and automation can be suggested as strategies for AI integration in SCM. There are other technologies that can be suggested such as NLP, ANN and machine vision although they would be require no technical expertise and huge amount of data.

# Chapter 6. Conclusion and recommendations

## 6.1 Conclusion

With the advancement of technology there has been a revolution in different aspects of the supply chain management processes. Particularly in the case of the use of the artificial intelligence in the supply chain management that has been a transformation in which the procurement process, logistics and operations, warehouse management, relationship with the suppliers and customers and other aspects of SCM had been transformed suggestive of the innovation welcomed because of AI implementation. There has been growth in the investment on the IoT platform by artificial intelligence for the acceleration of the success and innovation in the supply chain with respect to the use of Advanced technology such as in logistic, warehouse and supply chain processes for the powerful optimisation of the existing capabilities, reducing the cause and increasing the overall efficiency. AI-based architecture had provided highly intensive information, agility, flexibility and efficiency with the use of the AI algorithms that has brought innovation in the ways in the existing supply chain processes had been carried out. On the other hand there are also same core issues related to the application of AI in supply chain integration such as data incapability, quality of data generations, functional silos, static infrastructure. The perpetuation of the historical data and the interoperability supported by the AI application is found to be supportive of innovation. The automation of the overall processes suggest through different kinds of AI technologies in strategies like machine learning algorithms, computer vision, machine vision, ANN, robotics use. The important areas in which the application of the artificial intelligence in SCM integration has been associated with innovation and significant results are balancing inventory levels, monitoring product quality and improving the decision-making process as well as supporting automation of processes and reducing the overall errors.

The integration of AI in existence supply chain processes that can be acceleration of innovation for new projects such as to use of capabilities like demand forecasting, predictive maintenance for effective supply chain management using consumer insights for informing supply chain decisions. Overall it had been concluded that the implication of AI in SCM is mainly associated with the agility and efficiency in the supply chain with AI providing potential inside into raw data. The abundance of images in real time and data related to the location and product quality is bringing innovation into the management of inventory making AI applications to be significant for supporting innovative solutions in SCM.

## 6.2 Linking with objectives

***Objective 1: To understand about Artificial Intelligence***

It has been concluded that artificial intelligence is a technology enabling digital devices in computer to learn, create in analyse. It helps in the simulation of human intelligence and the problem solving capabilities of digital devices using data. On its own or used along with other other Technology such as robotics or sensors, AI are able to perform task which would otherwise human intelligence or human intervention. Artificial intelligence belongs to the field of computer science encompassing deep learning and machine learning and involves the development of the algorithms model after the processes of decision making of the human brain that can learn from the data available and make accurate predictions and classifications over time. The key advantage of the utilisation of artificial intelligence is with the reduction time of doing laborious tasks and delivery of consistent results for improving customer satisfaction and bringing efficiency into the key processes in which AI is applied.

***Objective 2: To analyse of impact of AI on supply chain integrations for accelerating innovation of new project development***

It is concluded from the analysis of the different case studies of reputed companies that have applied artificial intelligence that AI technology had brought improvement in the speed, efficiency and intelligence of the supply chain operations. It is through the application of AI tools that heater has been possible to decrease the manual labour and increase the overall automation of processes bringing efficiency and reducing time while also enhancing the delivery process of products to the consumers. It is possible to develop configuration system for the sales with the use of AI Technology that can reduce the manual work requirement and improve document quality. Companies that have invested in the AI technology had been able to facilitate planning of production with automated decision support. AI support smart and connected machines had helped responding to changes in order list of the customers using predictive maintenance so that can be quickly adapted to production planning. It is also possible to detect areas of maintenance and need for spare parts by early detection of errors and places of possible breakdown by innovatively using technology and the application of predictive maintenance facilitated by AI. Multinational company such as Amazon, Walmart, Unilever, ABB, Infinera and many other companies have used AI for bringing efficiency in the supply chain integration. Mostly there has been a use of AI for the prediction of the demand such as by Unilever, Walmart and Amazon. These companies have used historical data like past sales, market trend and customer behaviour and it uses the natural language processing and machine vision for planning inventory and warehouse management (Vishwakarma and Singh, 2022). Computer vision, machine vision, cloud based technologies and smart sensors and devices are some of the most innovative technologies used for enhancing the capacity of supply chain integration. Advantage had been in the detection, prediction and informing the decision making with respect to warehouse management, logistic operations, scheduling of products for supply chain management. Robotics is the most to common kind of artificial technology being used in SCM for automation of key processes and also for minimising the risks of errors in the SCM. Routing Optimisation facilitated by AI helps in reducing transportation cost and improves the delivery timeline for companies like Amazon and Walmart (Anica-Popa et al. 2021). On the other hand, MNCs companies like Siemens and Another have used AI for supply chain management, product life cycle management and collaboration across the supply chain. By predicting challenges the value chain of the Global electronics using supplies chain intelligence.

***Objective 3: To detect the challenges of integrating AI into the supply chain for accelerating innovation of new project development***

Most significant challenges identified from the assessment of the case studies with respect to Ai implementation include the requirement for need huge volume of data and issues related to the data quality. The management of the unstructured and fragmented data from the different sources is also very challenging that actually defines efficiency of AI implementation. The skill gap and shortage of talent, data privacy and security risk vulnerable thread to the implementation of AI in the supply chain. AI integration also requires effective strategies was Change management in the organisation because the employees tend to resist total automation process facilitated by the use of artificial intelligence as it puts risk to the job displacement. It is also concluded from both the case study and review of literature that AI implementation requires technical expertise and lack of recognition of technical difficulties can be in the way of proper limitation of AI in managing supply chain activities.

***Objective 4: To recommend strategies for integrating AI into the supply chain for accelerating innovation of new project development***

For accelerating innovation in a new projects and ensuring that AI can support supply chain integration, it had been recommended that the use of AI technology is should be towards cross-functional collaboration specifically focusing on the use of AI algorithms and the right tools fitting the purpose of implementation. This needs to be supported by the breakdown of the silos and the encouragement of knowledge sharing in the workplace. There is also been suggestions for agility in the use of AI tools and technologies and use of appropriate strategies for addressing and medicating the risks to data privacy and cyber security. Referring to the case studies, various innovative technologies can be recommended to be implemented by companies for improving acceleration of innovation such as machine vision, computer vision, ANN, machine learning algorithms and cloud-based infrastructure as well as some other technology like robotics, supply chain intelligence.

## 6.3 Recommendations

It is a recommended that for ensuring Innovation and accelerating agility in flexibility in the supply chain management, the selection of the AI tools and Technology should be 'fit to purpose'. The selection of appropriate tools and technology is very important for bringing efficiency in the supply chain. It is recommended that technology is like machine vision, computer vision, predictive algorithms and supply chain intelligence need to be encouraged in the key supply chain operations specially with respect to developing supply schedule, order list, logistic and warehouse management operations.

## 6.4 Research limitations

The key limitation identified with respect to the existing study is the primary depends on the analysis of the case studies for answering the research questions. The data from the case studies are restricted to the settings and conditions in respective organisations for which there can be issues in generalization of the data to other companies. On the other hand, there has not been use of any primary source of data collection either for gathering quantitative or qualitative finding such as through survey or interviews respectively. The lack of primary data used in the study has generated doubts about the reliability and validity of the study

## 6.5 Future research

Based on the finding of the present research, the future research can be conducted on the specific applications of different technology is in SCM integration and innovation suggest to suggest the most feasible and effective technology or tool that can bring efficiency, agility in the supply chain operation. Cost-benefit analysis of the different tools and technology can be the focus of future research for supporting inform to decision making with respect to investment in AI technology.

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