

## APPLICATION OF ARTIFICIAL INTELLIGENCE IN ENGINEERING: A COMPREHENSIVE REVIEW

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### Abstract

The implementation of AI-based tools has increased to increase the manufacturing potential of organisations. The main target of the engineers is to increase the production quality and quantity and this can be achieved through the use of automated machines or by using artificial intelligence. Artificial intelligence helps in engineering activities and this processes the entire production-related task as per the orders allocated from the computerized system. This technology helps the engineers to manage risky tasks as well as reduces the chances of any kind of accidents. AI-based tools and robotics technology are the future of the manufacturing industry. The working opportunities of engineers are gradually changing with the development of AI-based software and tools. Therefore, the application of AI is quite helpful to enhance the potentiality of engineering works and this increases the intensity of organisational performances which are interrelated with manufacturing activities.

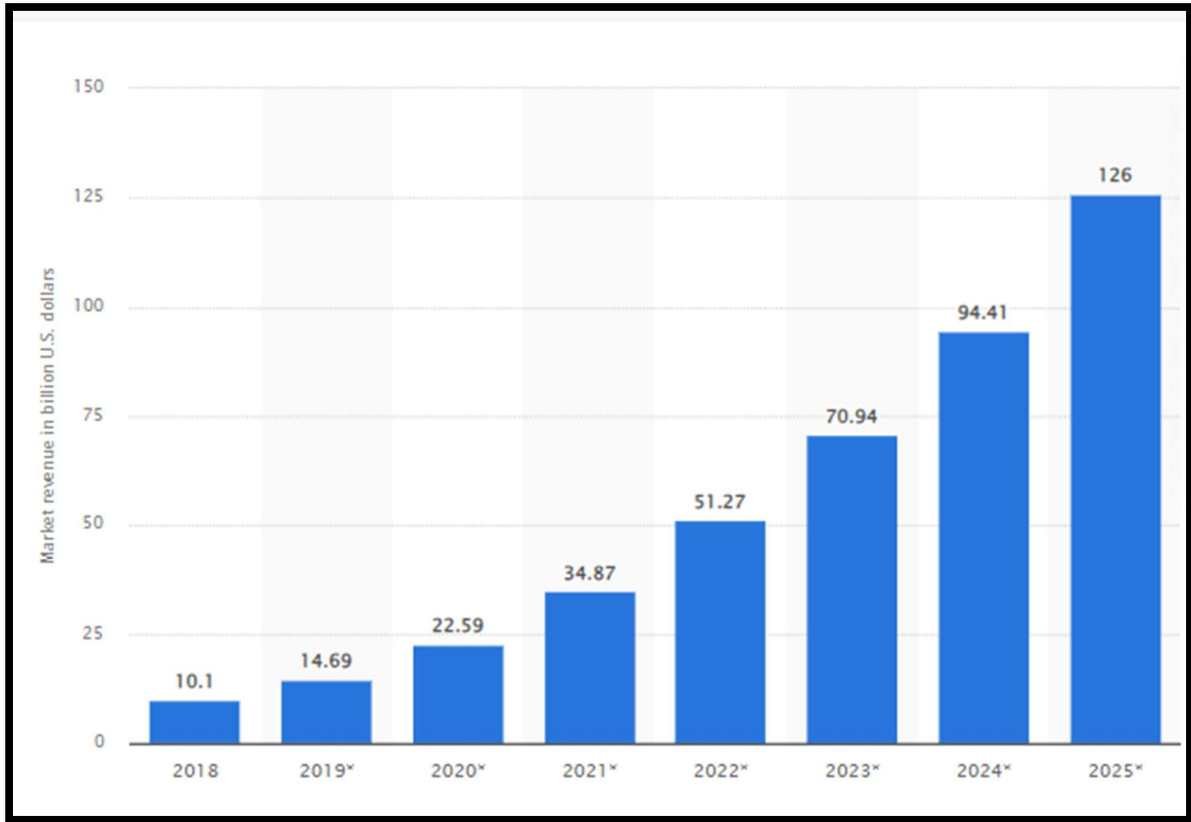
**Keywords:** *AI, Automated machines, Engineer's productivity, and robotics technologies.*

### INTRODUCTION

Technological advancement increases the opportunity for human beings to develop higher productivity. The development of AI brings a revolution in the field of engineering and innovative activities. The use of artificial intelligence (AI) has increased to enhance the production quantity and quality of all kinds of industrial activities. The use of AI is usually used by engineers to detect errors and inconsistencies in the design of engineering works. This study has analyzed the applications of AI tools in engineering works and through way AI helps to increase engineering productivity.

### Study background

This study has analyzed the effectiveness of AI tools on the improvement of engineering works. According to the views of Pan & Zhang (2021), AI tools are integrated with the inbuilt software where the activities can be operated and continue to automate as per the order of the controller. This means that AI-based software increases engineer's potential to increase the quality of tasks through using the AI-based software.



**Figure 1: AI market Revenue in billion US dollars from 2018 to 2025**

(Source: Statista, 2022)

The above figure helps to determine that the demand for AI software increases as the advantages of using this software have increased. The market revenue of AI software was 10.1 billion US dollars in 2018 and that increased to 51.27 billion US dollars in 2022 (Statista, 2022). This figure helps to understand the usefulness of AI software in the modern time of engineering works.

#### **Aim**

This study aims to analyse the applications of AI in engineering works and its effectiveness

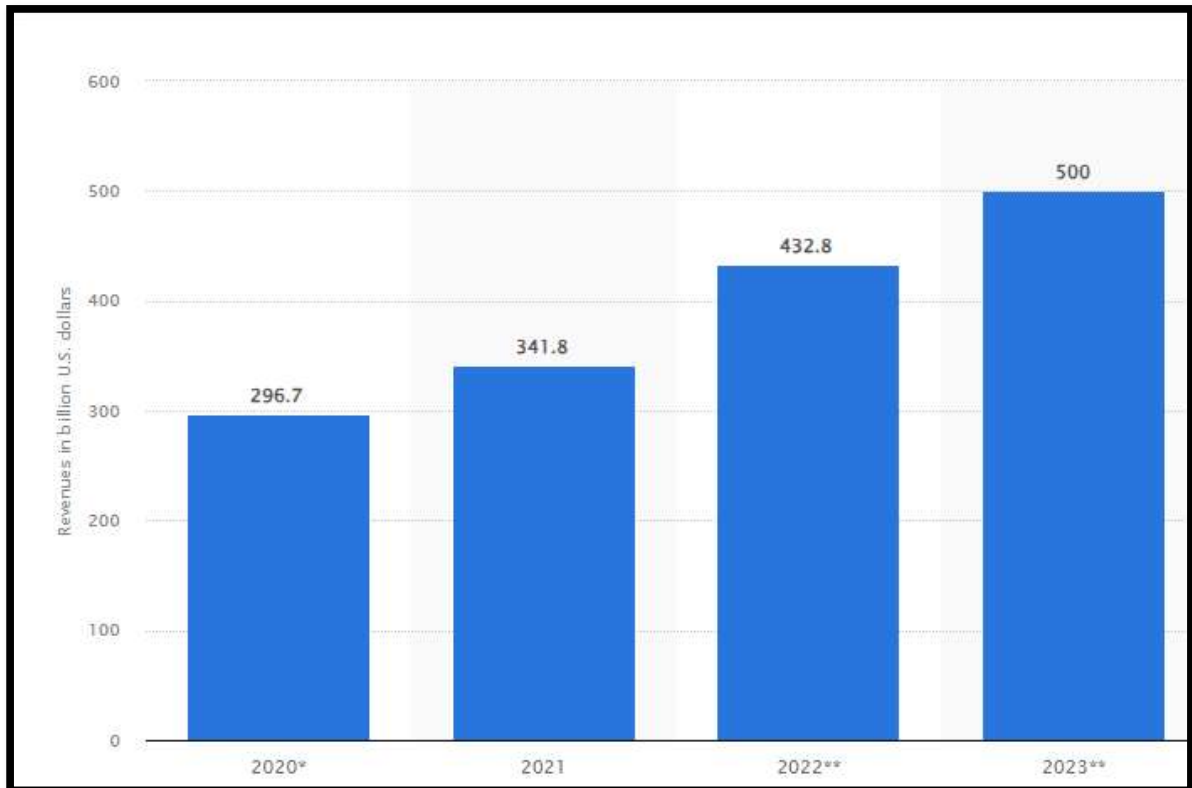
#### **Objectives**

- To improve the data management process industry has used artificial intelligence in the field of engineering.
- To develop artificial skills among the employees organization has included a training process.
- To enhance the accuracy of data analysis industry has applied artificial intelligence in various sectors of engineering.
- To effectively optimize the design of the data AI technology helps to increase the efficiency of the devices.

## LITERATURE REVIEW

### Concept of artificial intelligence and its uses in engineering

Artificial intelligence is a field which has included various principles such as system engineering, computer science, human-oriented designs and software engineering. According to the views of Thon et al. (2021), artificial intelligence has developed based on the needs of humans and people can get personal recommendations through this process. Artificial intelligence has provided this recommendation based on the previous purchase of the people. It has been used in several fields like optimizing products, logistics and planning inventory. On the other hand, Naser (2021) argued that artificial intelligence can help engineers solve problems based on complex situations and advise suggestions to the engineers based on data analysis. An engineer's capability can be defined through the collaboration of artificial intelligence and humans. This collaboration process can enhance the efficiency of the engineers and can bring innovative solutions to an organization.



**Figure2:Revenue of artificial intelligence from 2020 to 2023**

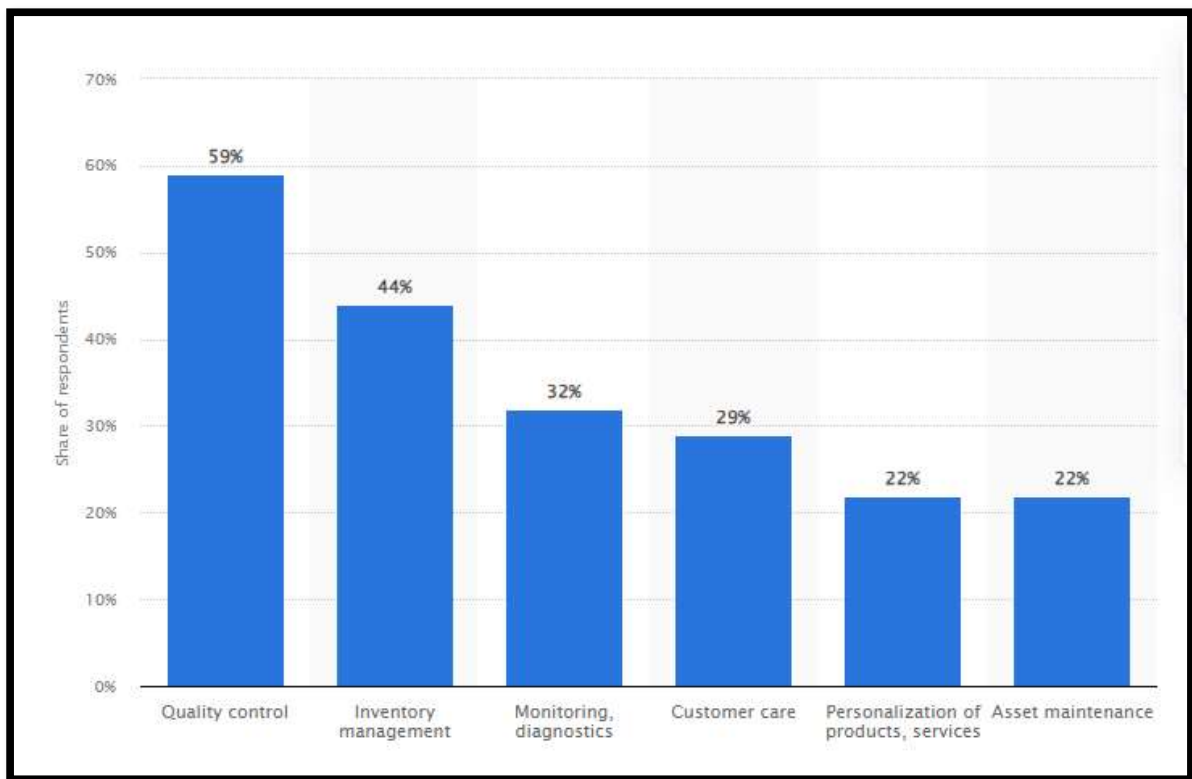
(Sources: Statista,2024)

The above figure represents the revenue based on the uses of artificial intelligence in the market in 2020 and has also shown a forecast of revenue from 2022 to 2023. This figure has shown that the revenue was 296.7 billion U.S. dollars in 2020 and it will increase 341.8 billion U.S. dollars in 2021 (Statista, 2024). The above figure has depicted a forecast of the revenue which was increased by 432.8 billion U.S dollars in 2022 and the highest revenue was found in the year 2023 which was 500 billion U.S dollars. Based on the views of Shehab et al. (2020), an artificially intelligent system has been designed based on creating an alignment with human behaviours and values. The development of AI systems has needed large investments

based on time and money. On the other hand, Ahmad et al. (2023) argued that effective artificial intelligence systems can be reused to solve problems and it has shown the process of AI systems to solve complex problems. Computer systems can be developed through the use of artificial intelligence and it helps to perform tasks without the help of human interference.

### Effect of artificial intelligence in engineering

AI has played a significant role in several industries and the advancement of the technology can improve the productivity and sales of the organizations. The algorithms based on artificial intelligence have brought a revolution in the engineering field and have provided new possibilities in the fields of engineering. According to the views of Yu et al. (2021), optimal designs can be identified through the process of artificial intelligence in an industry based on complex situations. It can help the manufacturing as well as transportation process of an organization and not only focus on efficient engineering designs.



**Figure 3: The uses of AI in the manufacturing industry in 2020**

(Sources: Statista, 2022)

The above figure has shown that manufacturing industries have used artificial intelligence for various purposes in 2020. This figure shows that 59 % manufacturing industry has used artificial intelligence based on quality control whereas 44% industry has used it for the aim of inventory management (Statista, 2022). Based on the views of Darko et al. (2020), artificial intelligence has been used to perform automating tasks in the field of engineering and this task has been performed based on the analyzing data from other sources and sensors. It can determine the potential issues which are occurring in the engineering system and help to provide recommendations based on resolution. On the other hand, argued that Chinthapatla (2024), artificial intelligence uses in various industries can decrease the human interventions

for maintaining the equipment as well as operations. This process can minimize the errors in the production process where engineers can pay attention to the value-adding tasks in an industry.

### **Challenges of artificial engineering based in the engineering field**

#### **Trust deficit**

AI needs various skills such as machine learning, AI ethics and data science and this requirement of skills can create difficulties for the engineers. It has created challenges in the existing engineering education, contents, and training models. According to the views of Kuang et al. (2021), AI has created difficulties in industries based on trust deficit and could not able to predict the outputs based on the deep learning models. The implementation process of AI technologies can be cost effective which can create difficulties in an industry.

#### **Lack of knowledge**

Artificial intelligence is an advanced technology and it requires the skills of the employees to understand the procedure of the system. As per the views of Arinez et al. (2020), artificial intelligence has created a replacement in the field of traditional systems and the lack of understanding of the system can create problems in an industry. Employees need training to properly understand the system procedure which can enhance the skills of the employees in an organization.

#### **Data privacy and security**

A large amount of data has been used in the process of artificial intelligence and it has created problems to protect the data from unauthorized access. Based on the views of Lv et al. (2020), artificial intelligence requires a massive amount of data to analyse the data and this data can be misused by hackers which creates problems in an industry. Engineers need to focus on the barriers to solve the problems of cyber-attacks.

### **METHODOLOGY**

AI is generally used for detecting errors and to proceed the organizational work. According to the views of Willard et al. (2022), AI tools help to analyse changes, help in decision making and find errors in engineering activities. Robotics automation, test-to-design applications and material science are the most important engineering fields where AI tools are being used. AI tools can affect the engineering profession by transforming traditional practices and bringing innovation in this field. It helps to design as well as optimize the systems of engineering and through the process of analyzing of large amount of data engineers can enhance the growth of the organization.

### **FINDING AND RESULTS**

AI can improve the accuracy as well as the speed of the engineering systems and the algorithms of artificial intelligence can identify the patterns of data. It has created problems for humans to identify the trends of data and the use of AI technologies in engineering practices can enhance the efficiency of the industry. This study has shown that artificial intelligence can help the engineering industry to make decisions by analyzing the data of people. According to the views of Duan et al. (2021), AI algorithms help to depict valuable insights in the organization based on the system behaviour and help the engineers build efficient solutions. This technological process can help to engage skilled engineers in the productivity process of

an organization and has provided powerful tools as well as resources to the engineers. Based on the views of Belgaum et al. (2021), AI technologies can provide advice to engineers to solve the problems of extensive data and have created collaboration between humans and the systems. These systems can enhance the capabilities of engineers and improve their efficiency in tasks.

AI systems can predict the failure of the equipment and can suggest recommendations to reduce the maintenance cost of the equipment. Based on the views of Olan et al. (2022), AI technology can transform the practices of maintenance in an industry by analyzing the historical data and sensor data of the organization. The predictive analysis based on the maintenance of the equipment can increase the lifespan of the equipment and enhance the overall efficiency of the operational process in an industry. According to the views of Elhegazy et al. (2022), manufacturing industries can improve productivity through the implementation of an automation process and this process can bring revolution to the industry. AI technology helps the organization to analyse a vast amount of data within a short period and helps to improve sales of the product and revenue in the market.

## DISCUSSION

The impact of artificial intelligence in the field of engineering has gradually increased over the years and engineers need to acquire advanced skills to use this technology in a proper way in the fields. Based on the views of Kumar et al. (2023), AI algorithms can help meet the goals of organizations by increasing the productivity of the industry. Engineers need to work with artificial technologies to bring innovation and solve the complex problems of the industry. The partnership between human expertise and artificial technologies can bring advancement in several fields of engineering. According to the views of Dhamija & Bag (2020), artificial intelligence can help to boost efficiency as well as bring innovative solutions to increase the profit in the market. Through manipulating the methodologies of machine learning engineers can optimize their operational process and bring safety as well as reliability to the industry. The autonomous principle of the operational process can maximize task efficiency.

Continuous learning of artificial technologies can bring improvement in the industry and the improvement of the technology can bring progress in the industry. Based on the views of Wan et al. (2020), AI algorithms help to predict the potential failures of equipment in an industry and help to make maintenance strategies for the equipment in the industry. The advanced tools of artificial technology can change the landscape of the engineering field and this technology helps to bring creativity as well as helps to increase efficiency in the industry.

## CONCLUSION

Artificial intelligence can transfer the traditional process of an industry based on manufacturing and autonomous systems can help to handle huge amount of data in an industry. It can increase the quality of production through the use of AI technologies in an organization. This technology has brought accuracy to engineering tasks and has focused on the quality control of production. It has described a real-time analysis based on the manufacturing process of the industry. The contribution of AI technologies in the industry can increase product quality as well as enhance operational efficiency. The use of modernized fully automated technologies is developing through using the fundamental ideology of AI. Thus, the implementation of AI

and its interrelated ideas are being essential for improving the creativity in the engineering works.

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