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To what extent do business operations benefit from the integration of AI and its technologies?

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Abstract

Artificial intelligence (AI) is an evolving technology that almost everyone is now aware of as AI and its technologies have infiltrated every aspect of our lives. As part of this, the application of these technologies in the business world is also been discovered as it has specific benefits for several operation activities including production and manufacturing, supply chain management and customer service. This research paper analyses the aforementioned in the context of case studies of companies such as Tesla, Walmart and Amazon. The paper concludes that business operations can greatly benefit from the integration of AI and its technologies if implemented, maintained and administrated correctly.

Introduction

We are all aware that the integration of Artificial Intelligence (AI) into our daily lives is inevitable. After all, AI is the simulation of human tasks being carried out by computer programs. With the ability to build AI programs for any task you can possibly imagine, using any programming language known, carrying out these tasks has been faster than ever (Laskowski and Tucci, 2022).

AI is usually structured around machine learning or datasets. In machine learning, as the name suggests, the program automatically learns from new data it receives or processes, without the help of humans (Investopedia, 2023). However, AI models built around datasets can only process information as it is predetermined in the given dataset. Tesla uses machine learning in the Tesla car's autopilot to make human-like decisions during autonomous driving by learning from the car's environments and decisions taken by the human driver in specific scenarios.

Current research highlights the myriad benefits that integration of AI in company operations can have for a business, particularly in the form of reduced costs, increased efficiency and productivity. That being said, to realize the aforementioned benefits, the implementation of AI should be well thought out. Furthermore, many argue that there has to be a limit to the advantages such technologies can bring to businesses. This begs the question, **"To what extent do business operations benefit from the integration of AI and its technologies?"**

This paper aims to analyze and evaluate how AI is integrated into the operations, such as manufacturing and production activities, supply chain management and customer service, of companies in various fields.

Integrating AI into Manufacturing and Production Processes

According to an article published by Jenkins (2022), manufacturing is the conversion of raw materials or components into finished goods using tools like machinery. Production is not very different from manufacturing, as by definition, it is the conversion of inputs or intermediates into finished goods. Both, manufacturing and production play a big role when it comes to businesses depending on the nature of the business. Businesses usually use manufacturing and production to make processed goods that we use in our daily lives, like refrigerators. Some businesses use these methods to make components that are incorporated into another business' products. However, there are some problems to keep in mind during manufacturing and production. For instance, the machinery should be adequate for what is being processed, constant maintenance may be required in case the machinery fails at any point and safety measures for the workers must also be implemented.

To solve the aforementioned problems, AI-enabled assistance in the manufacturing and production operations of a business comes in the form of predictive maintenance, automation and robotics.

AI-Enabled Predictive Maintenance in Manufacturing and Production

Predictive maintenance, as the name suggests, is simply the prediction of maintenance needs. Essentially, what happens is that information from machines and devices used in manufacturing and production is monitored and then fed into an AI-driven machine which then predicts when and where maintenance will be needed (Wan, 2023). This can be used to test various factors to inform the maintenance team of any upcoming maintenance needs and if any maintenance is needed immediately by constantly monitoring the machines and devices. Consequently, this can prevent permanent damage due to lack of maintenance.

AI-Enabled Automation in Manufacturing and Production

Automation can be extremely useful in manufacturing and production. Having a task done fully autonomously without the need for manpower is automation. Simple tasks like cutting can be automated using machines or robots. However, machine learning, which is a subset of AI, can be used to automate more complex tasks like perfecting

a material's dimensions. An AI application can use machine learning to process data and build an AI model, which then can make decisions based on what it learned to carry out the designated complex task.

AI-Enabled Robotics in Manufacturing and Production

Cobots are not your usual industrial robots. Instead, they are robots that are used to automate manual tasks in manufacturing. They are designed to work with humans in a safe environment which implements our abilities with their own (Marr, 2023). One big advantage they have over other robots is that they don't need their own dedicated space and hence are way cheaper than your traditional robots. They can safely work without the need for protective cages or segregation from humans. They can carry out tasks like screwing, sanding, moulding, press stamping, etc. They can also carry out inspections using cameras that enable computer vision.

A Case Study of Tesla

Tesla is an American electric vehicle and clean energy company currently led by CEO Elon Musk. It is known for its innovative electric vehicles as well as energy storage solutions. It is a leader in sustainable transportation and renewable energy technologies.

Tesla utilizes AI-powered robots extensively in its manufacturing facilities to automate various tasks. Robotic arms are used for welding because of their high speeds and consistency in dangerous environments. In painting for Tesla, robots apply consistent amounts of paint with a consistent degree of pressure which reduces waste and protects humans from harmful chemicals (Standard Bots, 2023). There are many more places where Tesla uses such robots. These robots are equipped with computer vision systems and machine learning algorithms that enable them to perform tasks with high precision and efficiency, reducing human intervention and improving production throughput.

Tesla employs AI-driven predictive maintenance systems to monitor the health and performance of equipment in the production line. For example, Tesla uses AI to optimize the performance of its energy products that use Tesla energy. The AI algorithm can predict energy demand and alter energy usage and storage accordingly by analyzing real-time data from sensors and historical maintenance records (Abdullah, 2023). This ensures that everything remains clean, safe, and cost-effective.

The Integration of AI in Supply Chain Management

Supply Chain Management is the process of managing goods, data, and finances, regarding a product or a service, to and from a business. It includes every step involved in turning the raw materials into final goods and ultimately getting them to their final destination. Effective Supply Chain Management can help streamline a company's

activities to eliminate waste, maximize customer value, and gain a competitive advantage in the marketplace (Fernando, 2024).

AI, with its ability to process massive amounts of data, understand patterns and make predictive decisions, is completely transforming the world of Supply Chain Management (Skillfloor, 2023). It revolutionizes how companies forecast demand, optimize their inventories, manage logistics, and much more.

AI-enabled Demand Forecasting in Supply Chain Management

Demand forecasting is a crucial element of supplier management, aiding in filling orders quickly, minimizing costs of inventory, and planning for price changes (Gralak, 2023). However, forecasting demand can be a relatively difficult task. It can take long periods of time and often end up providing inaccurate results due to long lead times, proliferated offerings, and demand information distortion in various industries. That being said, AI algorithms can analyze large datasets and historical patterns faster and more efficiently than traditional methods which leads to more accurate demand forecasting, reduces errors, and increases overall efficiency in general.

AI-enabled Inventory Management in Supply Chain Management

AI can analyze enormous amounts of data, recognize patterns and trends, and make accurate predictions. Through this, AI has led the way into a new era of efficiency and precision in the Inventory Management section of Supply Chain Management. It automates complex tasks, provides insightful analytics, and makes real-time decisions to provide the business with benefits like cost-effectiveness, enhanced customer and employee satisfaction, improved accuracy, and much more (Dunlea, 2023).

AI-enabled Logistics Management in Supply Chain Management

AI's capability to process large datasets, learn from patterns, and make efficient decisions based on data has completely changed how companies carry out the logistics in Supply Chain Management. By leveraging these abilities of AI with a few extra factors, like customer preferences, logistic operations have been streamlined, which has resulted in much better optimizations and reduction in costs (Skillfloor, 2023). AI has made it pretty evident that it is the tool that companies need to navigate the complexities of modern distribution networks.

A Case Study of Walmart

Walmart, currently led by President and CEO Doug McMillon, is an American discount store operator. It is one of the largest corporations in the global retail industry. It uses AI in its Supply Chain Management in a fairly interesting way.

Integrating AI in inventory management can reduce costs and bring up sales significantly if done correctly. A prime example of Walmart using this was during the holiday season. It used its newly implemented system to stock up gifts and festive decor to delectable treats so that its customers and members could be confident in finding the perfect items to make their holiday season merry and bright (Musani, 2023). AI did this by analyzing numerous amounts of inputs, including customer and shopping trends, seasonality, and in-demand items.

One of the major parts of Logistics Management is Route Optimization. Walmart uses an AI-powered logistics tool which helps optimize delivery routes, pack trailers efficiently, and minimize mile driven. This helps Walmart by reducing costs, improving efficiency, and increasing environmental stability. Walmart estimates that by using this technology, they have avoided over 90 million pounds of CO_2 emissions by avoiding over 30 million miles driven. They even recently opened this technology up for other companies to buy and use in their businesses (AbsoluteLabs, 2024).

The Integration of AI in Customer Service and Support

Customer Service is the support that organizations provide before and after a customer purchases a product or a service. Customer Service Agents mainly assist customers with understanding and using their products or services, troubleshooting their products or services for any technical issue they may have faced, maintaining or even upgrading their products or services, and numerous other miscellaneous issues (Hiver, 2024). By providing customer service, a business ensures customer satisfaction and a good reputation in the market. However, some issues may arise with customer service. For example, if a company grows too big, it may need to repeatedly hire more employees to meet the needs of its consumers or risk running into issues such as extended time lags in problem-solving or the incorrect department inefficiently handling a customer's concern.

AI can be integrated into this field to speed up the process and reduce the number of customers an actual human needs to address through the implementation of chatbots, virtual assistants and natural language processing. In fact, it has been reported that “73 percent of leaders foresee AI-assisted services becoming a customer expectation within five years, indicating a shift toward more AI-integrated customer service models” (McEntee, 2023).

AI-enabled Chatbots in Customer Service

Customer Service over chat can be significantly important due to customers not having a good enough connection to call Customer Support or just not willing to do so. However, an employee cannot handle multiple customers at once efficiently, and hiring a lot of employees would be extremely ineffective. AI-powered chatbots can be integrated here, as chatbots can handle multiple customers at once, resolve any simple issues without human interaction needed, and redirect any complex issues to the correct department for addressing. All the aforementioned makes integrating chatbots into Customer Service extremely effective and efficient.

AI-enabled Virtual Assistants in Customer Service

Virtual Assistance also plays a crucial role in Customer Support. However, the same issue that comes with chatbots also comes with Virtual Assistance. AI helps with Virtual Assistance in a slightly different way. The integrated AI, with pre-recorded audio, with a predetermined script, can ask questions to determine the exact issue that needs to be addressed. After determining the issue, it can provide a solution to the customer or redirect the customer to the appropriate support person who can assist them.

Natural Language Processing in Customer Service

When integrating AI into Customer Service, a business is making the AI talk or chat with humans. One important issue that comes with this is making the conversation with the customer natural. Natural Language Processing is a subset of AI that is meant to deal with language-based interactions between computers and humans (Porter, 2023). Specifically, it's meant to make the conversation between AI and humans more natural. Like all other subsets of AI, Natural Language Processing is also trained on data. It ingests written or spoken text, extracts the information, and learns from this data on how to respond to queries.

A Case Study of Amazon

Amazon is the world's largest online retailer and cloud service provider (Yasar, 2022). Being one the most prominent technology companies, Amazon has made some great strides in integrating AI into their customer service and also created technologies allowing other companies to do the same.

In 2020, Amazon began testing an AI Chatbot with the intention of helping customers receive the help they needed faster. The technology was created using 5 million conversation-response pairs from more than 350,000 conversations in order to generate unique responses that could answer customer queries with much greater sophistication than witnesses before (Kulp, 2020). Since then, in an endeavour to show their commitment to using advanced technology to enhance customer service, Amazon has repeatedly bettered their AI chatbot technology and has recently launched the Amazon Web Services AI chatbot Q. Q integrates generative AI and large language models, providing accurate and timely responses (Pagidyala, 2024). By offering this service to companies, Amazon gives them an opportunity to make substantial improvements in automating and streamlining their customer support processes.

Beyond the traditional understanding of customer service, Amazon has also integrated AI and machine learning models into their website to ensure that customers have a smooth shopping experience. For example, by developing a deep learning-based algorithm, Amazon offers customers the enhanced service of finding their best-fitting size in any style they wish to shop. Amazon says that this algorithm takes into consideration large data sets considering

the sizing relationship between brands and their size systems as well as a product's reviews and other details along with the customer's own fitting preferences (Law, 2024). This once again stands as a testament to Amazon's commitment to enhancing its customer service using advanced technologies.

Conclusion

AI is becoming a popular integration in various parts of our lives and business operations are not spared. This research paper aimed to analyze how AI and its technologies are being integrated into various business operation activities and evaluate the same through real-life case studies of companies such as Tesla, Walmart and Amazon.

This research paper discussed three operation activities wherein AI can be integrated. In Manufacturing and Production, for instance, AI's integration is most evident in the form of facilitating automation through robots as well as in enabling predictive maintenance. Tesla is a prime example of a company making extensive use of AI in their manufacturing and production activities and reaping the benefits of increased efficiency and quicker production. AI also plays a valuable role in Supply Chain Management where it can help with forecasting demand and managing inventory and logistics. Once again, Walmart is a good example of a company making use of AI in their supply chain management specifically for route optimization. Lastly, AI has a lot of potential to enhance customer service - an essential operation for any business - and Amazon has made some great strides in enabling this for themselves as well as other companies.

Overall, it is evident business operations benefit from the integration of AI and its technologies to a great extent. However, that being said, AI still needs to be maintained, requiring constant updates for the changing world and constant improvements as humans learn more. Furthermore, the amount of training data also limits where an AI can be added and cannot be added. So, a business can only integrate AI if they have enough training data and machines to run the AI. Even after that, human supervision is needed to make sure the AI runs properly.

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