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Exploring the Significance of AI through Chi-Square Testing in Business Decisions

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Abstract

A computer system capable of performing operations like speech recognition, visual perception, decision-making, and language translation would typically need human intellect. Thanks to artificial intelligence (AI), this is now feasible. AI, the general term for any intelligent computer program, includes machine learning as a subset. To put it another way, not all AI is machine learning, but all machine learning is AI, and so on. The study of machine learning (ML) is a burgeoning discipline with many promising directions for future advancement in various techniques and uses. This study explores the effects AI and the ML in the decision made in the business. It also provides insights into how ML as well as AI are changing the landscape of analysis in business. A thorough examination of the literature survey and case study analysis, and expert interviewing as part of the materials and methods. The study's population consisted of all business owners in Lagos, Nigeria. A sample size of 185 business owners was selected using the convenience sampling technique. The primary instrument for data collection was a self-structured questionnaire. Online data was gathered, cleaned, coded, and recorded. Statistical Package for Social Scientists (SPSS 25.0) was used to code and evaluate the data collected. Descriptive statistics (frequency and percentage) were employed to assess the quantitative data collected from students and teachers, while the Chi-square test was used for inferential statistics with a significance level set at 5%. The findings revealed that machine learning algorithms employed does not significantly improve business analysis, and Natural Language Processing (NLP) significantly improves business analysis. It also revealed that the integration of AI with robotics significantly influences business processes and operations, and the effectiveness of planning and decision-making models within AI

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systems significantly improves business contexts. The study concludes by emphasizing the necessity of cooperation between companies, legislators, and other stakeholders and offers suggestions for businesses wishing to implement AI.

Keywords: Artificial Intelligence, Business Analysis, Machine Learning, Descriptive Statistics, Chi-Square Test.

1. Introduction

By making it possible to extract the most pertinent information from huge datasets, artificial intelligence (AI) may be utilized to improve data analysis methodologies (Yang, Wang, and Li, 2018). Similar to this, AI is being utilized to improve business process efficiency through the automation of human labor and the prediction of customer behavior (Khabaza, Hoens, and Gupta, 2014). Businesses may use AI to save expenses, boost accuracy, and enhance customer happiness (Tsetsos and Giaglis, 2017). Furthermore, AI has the potential to offer significant insights into intricate issues including consumer behavior, industry trends, and product creation (Kambhampati, 2019). The uses of AI in business management and data science will only grow as the technology develops. Apart from the aforementioned uses, it has been shown that incorporating AI into data science and corporate management offers several advantages. For example, by providing more accurate forecasts and suggestions, AI systems can speed up and increase the accuracy of decision-making (Granitz and Breitner, 2017).

More precise insights may be obtained by integrating many data sources, such as textual, numerical, and temporal data, with the use of artificial intelligence (Verma and Sharma, 2015). By analyzing massive amounts of data and offering individualized customer care, AI also helps organizations to optimize their operations (Chu and Rajagopalan, 2018). By automating the complete workflow from manufacturing to distribution and eliminating the human operations, artificial intelligence is being utilized to save operational expenses (Ganguly and Pal, 2017). When combined, the AI application to business management as well data science may save costs as well as boost production and efficiency. Furthermore, AI has been shown to be successful in risk management in these fields. According to Sandhu and Sadowski (2018), artificial intelligence (AI) algorithms may be able to recognize certain types of behavior that point to possible security risks, such fraudulent transactions or data breaches. This can help companies recognize any risks and take prompt action. Furthermore, AI is being used to

examine big dataset in order to find hidden connections, enabling companies to manage risk more effectively and make smarter decisions (Schott adn Appelrath, 2017).

AI-driven automation may increase risk assessments' precision and speed, enabling companies to identify threats before they escalate into issues (Zanarini, 2019). This form of risk management powered by AI contributes to bolstering security in various fields. AI is also being utilized to provide more individualized consumer experiences. To offer precise and customized recommendations, such as suggestions for products or services based on previous purchases, AI algorithms may gather, process, and evaluate client data (Hu, Yang, and Xu, 2018). This can help companies enhance customer loyalty by providing customers with a more personalized and individualized buying experience. According to Shi, Zhang, and Wang (2018), artificial intelligence (AI) may be used to determine consumer preferences and recommend new goods and services that suit those preferences. Additionally, according to Li, Zhang, and Mao (2019), AI may be used to gauge consumer happiness and offer insightful commentary on how companies might enhance their goods and services. As a result, AI has the potential to significantly improve both consumer satisfaction and the overall customer experience.

Artificial intelligence (AI) has the ability to drastically lower operating expenses by automating processes and offering effective solutions for challenging issues. Businesses may save money by using AI algorithms to automate repetitive and routine jobs like data input and customer assistance (Zaheer, 2018). AI may also give firms real-time insights into market trends and client behavior, enabling them to make better-informed decisions that maximize operations (Athanatos, 2018). Businesses may further save expenses by streamlining procedures and minimizing manual interventions thanks to AI-driven automation (Gupta, Khabaza & Hoens, 2014). As a result, AI has the ability to save operating expenses and boost corporate productivity. Furthermore, the data science and business management processes are becoming more accessible thanks to AI. Businesses of all sizes may benefit from artificial intelligence (AI) without having to invest in expensive equipment or hire professional data scientists because to the availability of accessible and inexpensive solutions like machine learning platforms (Singh and Kumar, 2019).

This can help small and medium-sized businesses gain insights from AI and more efficiently run their operations. Artificial intelligence (AI) has facilitated the creation of novel solutions, such artificial general intelligence (AGI), which can make computers understand and behave like people. This will increase automation and raise the bar for commercial operations (Greco, 2019). As a result, AI is giving companies previously unheard-of chances to boost productivity and boost earnings through wise decision-making. In conclusion, the way business management and data science are incorporating AI is completely changing the way the firms operate. Businesses are benefiting from AI technology in many ways, including increased decision-making speed and accuracy, lower operating costs, better customer experiences, efficient risk management, and more accessible data insights. Businesses will be able to use AI as it develops to streamline processes, save expenses, and increase productivity in order to stay competitive in the market.

AI in "data science and business management" is also helping companies to handle client data and privacy in an ethical manner. AI systems may be used to identify dishonest activity and guarantee that only legitimate client data is analyzed (Mazzoleni, 2018). AI may also be used to create safe networks that shield client information from unwanted access (Bu, 2018). Additionally, companies may use AI to create new privacy rules that are customized to the interests of each individual consumer (Yadav, Chawla, and Amirtham, 2017). Thus, although organizations may still take use of the promise of AI-driven insights, AI can help them manage consumer data and privacy in an ethical manner.

1.1 Objectives of the Study

The study examines the integration of AI and ML in business decisions. It offers insights into how artificial intelligence and machine learning are changing the landscape of business analysis. Specifically, other objectives are:

1. To investigate how machine learning algorithms are employed in business analysis.
2. To evaluate the use of Natural Language Processing (NLP) in business analysis.
3. To assess how the integration of AI with robotics influences business processes and operations.

4. To evaluate the effectiveness of planning and decision-making models within AI systems in business contexts.

2. Literature Review

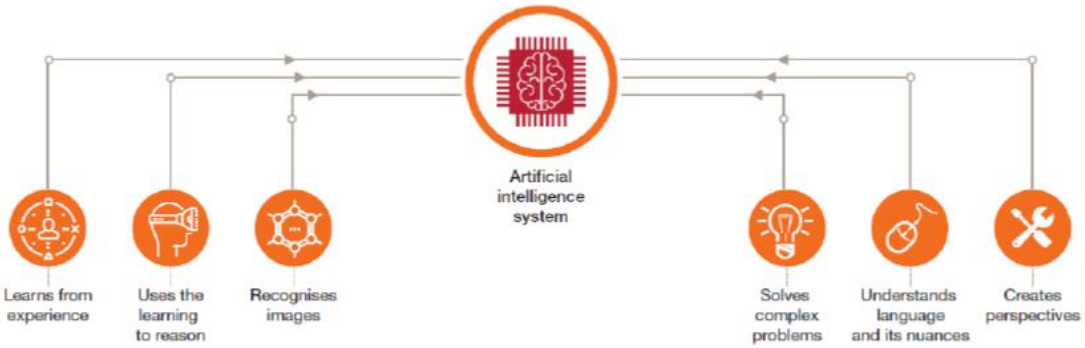
2.1 Artificial Intelligence and Machine Learning

It is an area of computer science dedicated to the development and study of intelligent machines. Software or programs with artificial intelligence that are installed in computers, robots, or other similar systems to give them the capacity for thought (Zhang et al., 2016). However, because there is still much to learn about how these modern artificial intelligence (AI) systems, specifically in robotics, solve problems, many aspects of them are still under dispute. Artificial intelligence devices or systems should thus be accurate in making decisions. Furthermore, robotics offers multiple services without the need for human guidance or assistance. Artificial intelligence is advancing rapidly these days, as seen by the robotic automobiles of today, which are highly advanced with high performance capabilities like regulating traffic, reducing speed, and creating self-driving cars to the SIRI (Turan et al., 2017).

Human reliance on technology is further increased by the present focus on artificial intelligence being portrayed in robots to create human-like traits. Furthermore, people's reliance on technology is greatly increased by AI's capacity to do any more complex and limited tasks (Parkes and Wellman, 2015). AI technologies that can process big data on computers can provide all the information needed for analysis to individuals in charge of them. This is a significant danger and greatly expands the potential for huge data extraction and analysis. In an attempt to duplicate human brain capacity, artificial intelligence is now portrayed as a human brain that learns from experience. Everyone has to be reassured that artificial intelligence is not reducible to that of the human brain, which cannot be produced (Zhang et al., 2016).

Within the field of artificial intelligence, machine learning enables computer systems to acquire knowledge through direct observation of examples, data, and experience. Machine learning systems are capable of carrying out complicated operations by learning from data instead of relying on pre-programmed rules, by empowering computers to do certain jobs intelligently. According to Bridge, Sean, and Lawrence (2014), machine learning learns from

experience and examples in the form of data. Conventional programming methods rely on hardcoded rules that provide a step-by-step solution to a problem. In contrast, machine learning systems are assigned a job and provided with huge amounts of data to either identify patterns or serve as examples of how the task might be accomplished. The system then determines the optimal way to get the intended result. Machine learning contributes to narrow artificial intelligence (AI), assisting intelligent systems in learning a specific function from a given collection of data (Deng and Yu, 2014).



2.2. How AI will Impact a Variety of Businesses?

Automation has rendered it unnecessary for humans to engage in repetitive activities, freeing up workers' time to focus on more important tasks while handling tedious or error-prone activities. Data analytics, through the process of uncovering new patterns and relationships within data, enables organizations to gain previously unattainable insights. Experienced salespeople and sales organizations are increasingly reevaluating the human to machine ratio in sales. Sales are already being impacted by AI automation, and this trend is expected to continue. A study published in the Harvard Business review claims that businesses using AI in sales might see a 50% plus increase in leads, a 70% reduction in contact times, and a 40%–60% reduction in costs. These numbers underscore the potential for company owners aiming to enhance profits to explore the benefits of artificial intelligence.

- **Health Care Sector**

Ineffective procedures and excessive medical expenses have long plagued the healthcare industry. Artificial intelligence (AI) is now being employed to provide healthcare solutions in impoverished nations. Workflow assistants help doctors free up 17% of their

schedules, and pharmaceutical firms can study life-saving medications in a fraction of the time and cost it typically takes. Virtual assistants with AI capabilities are are reducing unnecessary hospital visits while saving nurses 20% of their time (Han et al., 2021).

- **Transport**

Artificial intelligence is trulypropelling the field of self-driving cars ahead. These cars are equipped with sensors that continuously monitor their surroundings and utilize AI to determine necessary adjustments. These sensors take hundreds of measurements per millisecond (vehicle speed, traffic, pedestrian location, and so on), which AI then analyzes to determine what has to be done. The presence of self-driving cars signals the realization of a futuristic vision. Self-driving technology, earlier considered to be science fiction, s rapidly approaching a driverless reality. t is predicted that the number of autonomous vehicles on the road will exceed 33 million by 2040, showcasing the significant role AI plays in the advancements of this futuristic technology (Han et al., 2021).

- **Finance**

AI and the banking industry are a match made in heaven. In the financial industry, making choices necessitates accuracy, prompt reporting, and handling massive volumes of quantitative data. As the financial services industry becomes more aware of the precision and efficacy of artificial intelligence, it is swiftly incorporating chatbots, automation, machine learning, adaptive intelligence, and algorithmic trading into financial operations ("7 Applications of Artificial Intelligence in Business," n.d.).

- **Social Media**

Across sites like Twitter, Facebook, and Snapchat, there are more than 2.77 billion active profiles. Social media is always fighting to personalize and provide meaningful experiences for consumers. The future of this sector might be made or broken by the advancement of artificial intelligence. Because AI can organize massive amounts of data, recognize photographs, deploy chatbots, and foresee cultural trends, it is tremendously useful to a sector with billions of users and annual revenue of about $45 billion ("What Is Artificial Intelligence for Social Media?" n. d.).

- **Retail and AI**

Have you ever been on a website and suddenly seen an image of the identical clothing you were looking at on another website? You may give artificial intelligence credit for that. Businesses may create personalized connections with their consumers by using machine learning into their retail and e-commerce operations. Algorithms driven by AI personalize user experience, increase income, and create long-lasting relationships. Businesses employ artificial intelligence to collect data, anticipate purchases, and deploy chatbots in order to make the shopping experience more user-centered. Here are some examples of how the top brands in e-commerce and retail are utilizing AI to boost revenue and customer loyalty.

- **Face Recognition and Detection**

These days, we frequently employ artificial intelligence in the form of facial ID to unlock our phones and virtual filters on our faces when snapping pictures. Face detection in the former allows for the recognition of any human face. The latter uses facial recognition technology to identify a specific face. Airports and government buildings use facial recognition technology for security and monitoring.

- **Word Processors**

Text editors or autocorrect AI algorithms are used by texting apps and almost all other written media to identify incorrect language usage and provide repairs. Natural language processing, deep learning, and machine learning are all used by these systems. Computer scientists and linguists work together to teach computers language in the same manner that you were taught.

3. Challenges of AI in Business

Artificial intelligence technology has grown and gained creative significance, but it has also encountered some serious obstacles, particularly in poor countries like Nigeria. To advance artificial intelligence, Nigeria as a country has to work to overcome these obstacles (Robinson, 2018). Below are a few of the difficulties:

- **AI Human Interface:** The difficulty here is that humans lack the data science expertise needed to maximize artificial intelligence's potential. It is evident that Nigerians lack the sophisticated abilities necessary to interact with AI technology (Robinson, 2018).

- **Decline of Investment:** The fact that not all managers or businessmen of Nigeria are prepared to use AI. The obstacle in using AI is. Not every Nigerian company owner or organization are wealthy enough to use AI as it requires a hefty startup and implementation costs.

- **Software Malfunction:** Human technology is never flawless. Researchers may find a software or hardware disaster to be extremely unpleasant, particularly in Nigeria where there are inadequate methods for storage and retrieval (Robinson, 2018). As such, human software tasks may be hard to track down. This type of issue may be demoralizing and infuriating.

- **Cultural and Religious Barriers:** AI technology is not exempt from the two most prevalent obstacles to progress in Nigeria, which are religious intolerance and cultural attachment. While language might not be a major barrier to the development of artificial intelligence in Nigeria, members of the same tribe frequently show bias while working with members of other tribes, especially when it comes to information gathering. In a similar vein, Nigeria has a high level of religious intolerance, which can work against AI technology.

4. Research Methodology

The study employed a descriptive research design. The study's population consisted of all Lagos, Nigerian business owners. A sample size of 185 business owners in Lagos, Nigeria was selected convenience sampling technique was used to select Nigeria. The self-structured form with questions were used for data collection. Online data was gathered, cleaned, coded, and recorded. "Statistical Package for Social Scientists (SPSS 25.0)" was used to code and evaluate the data collected. In order to assess the quantitative data that have been collected from students and teachers, descriptive statistics (frequency and percentage) was used. Chi-square test was used to check for significance level at 5% for inferential statistics.

5. Results and Discussion

5.1 Data Presentation and Analysis

The results of the survey conducted to "the impact of Artificial Intelligence and machine learning on business analysis" were presented and analyzed in this study. Descriptive statistics (frequency tables and percentages) and inferential statistics (Chi-square analysis) were used to analyze the responses and test the hypotheses. The questionnaire was disseminated using an online Google form (WhatsApp). One hundred and eighty-five (185) responses were downloaded via the Google form link shared to different business owners in Lagos, Nigeria.

5.2 Presentation of the Demographical Data of the Study

Table 1. Respondents Demographic Characteristics

Factors	Characteristics	Frequency	Percentages
Gender	Male	94	50.8
	Female	91	49.2
Age group	18-25 years	19	10.3
	26-33 years	87	47.0
	34-41 years	59	31.9
	42-49 years	19	10.3
	Above 50 years	1	0.5
Marital Status	Married	81	43.8
	Single Divorced	102	55.1
		2	1.1
Highest Educational qualification	OND/NCE	3	1.6
	BSC/HND	93	50.3
	MSC/MBA	81	43.8
	Others	8	4.3

Source: Field Survey, 2024

As shown in the Table 4.1 above, 50.8% respondents were male while 49.2% respondents were female. This shows that female and male sexes were represented in samples. Also, 10.3% respondents fall below 18-25 years, 47.0% fall within 26-33 years, 31.9% fall within 34-41 years, 10.3% fall within 42-49 years while 0.5% respondents fall above the age bracket 50 years. This research suggests that the bulk of responses fall into the 26–33 year old age range, which is the modal age. In addition, the table shows that 43.8% respondents were married, 55.1% were single, while 1.1% were divorced. It further shows that majority of the respondents are single and due to the inclusive of bank tellers. More so, 1.6% of the respondents are OND/NCE holders, 50.3% are HND/BSC holder, 43.8% are MSC/MBA holder, while 4.3% are other degree holders. This demonstrates that the majorities of responders are well educated and are aware of the study's significance and implications.

5.3 Test of Hypotheses

It is critical to test hypotheses applicable to the objectives of this study in order to attain the goal of this study. The SPSS was utilized as an aid for the Chi-Square analytical tool in evaluating the hypotheses. The null hypothesis is rejected and the alternative hypothesis is accepted if the p-value is less than the significance threshold. Additionally, the opposite is true (null hypothesis is accepted and the alternative hypothesis is rejected) if the p-value is greater than the threshold.

- **Hypothesis One**

Ho: Machine learning algorithms employed does not significantly improve business analysis.

Table 2. Chi-Square Tests on Machine Learning Algorithms Employed and Business Analysis

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	18.742a	12	.095
Likelihood Ratio	20.121	12	.065
Linear-by-Linear Association	1.665	1	.197
Number of Valid Cases	185		

Less than 5 is the predicted count in 11 cells (55.0%). A minimum of.58 is anticipated

The table.2 above illustrates the "Pearson Chi-Square" of 18.742 at p = 0.095 (p = 0.095, p > 0.05). The p-value (0.095) > significant level (0.05), as a result the alternative hypothesis was rejected and the null hypothesis was accepted (p=0.095; p>0.05). This implies that, machine learning algorithms employed does not significantly improve business analysis.

- **Hypothesis Two**

Ho: Natural Language Processing (NLP) does not significantly improve business analysis.

Table 3. Chi-Square Tests on Natural Language Processing (NLP) and Business Analysis

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	44.428a	16	.000
Likelihood Ratio	38.370	16	.001
Linear-by-Linear Association	10.018	1	.002
N of Valid Cases	185		

Eighteen cells (72.0%) exhibit an expected count below 5, with the minimum expected count recorded at 0.02.

The table.3 above illustrates the "Pearson Chi-Square" (44.428) at p = 0.000 (p = 0.000, p < 0.05). The p-value (0.000) < significant level (0.05), as a results the null hypothesis was rejected and the alternative hypothesis got accepted (p=0.000; p<0.05). This implies that, Natural Language Processing (NLP) significantly improve business analysis.

- **Hypothesis Three**

Ho: The integration of AI with robotics does not significantly influences business processes and operations.

Table 4. Chi-Square Tests on the Integration of AI with Robotics and Business Processes and Operations

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	28.397a	16	.028
Likelihood Ratio	24.962	16	.070
Linear-by-Linear Association	.277	1	.599
N of Valid Cases	185		

Thirteen cells (52.0%) exhibit an expected count below 5, with the minimum expected count recorded at.08.

The table.4 above illustrates the "Pearson Chi-Square" (28.397) at $p = 0.028$ ($p = 0.028$, $p < 0.05$). The p-value (0.028) < significant level (0.05), as a results the null hypothesis was rejected and the alternative hypothesis got accepted ($p=0.028$; $p<0.05$). This suggests that the incorporation of AI with robotics has a substantial impact on business processes and operations.

- **Hypothesis Four**

Ho: The effectiveness of planning and decision-making models within AI systems does not significantly improve business analysis.

Table 5. Chi-Square Tests on the Effectiveness of Planning and Decision-Making Models within AI Systems and Business Analysis

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	42.498a	16	.000
Likelihood Ratio	36.420	16	.003
Linear-by-Linear Association	12.670	1	.000
N of Valid Cases	185		

For sixteen cells (64.0%) count expected < 5. The least count expected is .01.

The table.5 above illustrates the "Pearson Chi-Square" (42.498) at "p = 0.000 (p = 0.000, p < 0.05)". The p-value (0.000) < significant level (0.05), so null hypothesis was rejected and alternative hypothesis was accepted (p=0.000; p<0.05). This implies that, the effectiveness of planning and decision-making models within AI systems significantly improves business contexts.

6. Discussions of Findings

The findings revealed that machine learning algorithms employed does not significantly improve business analysis. According to Mahmood et al. (2019), this aids businesses in locating inefficiencies, streamlining operational procedures, and raising overall performance. Organizations may find hidden insights, identify abnormalities, and improve operations with the use of automated data analysis and anomaly detection (Mughal, 2018). Businesses may make better decisions, increase operational efficiency and effectiveness, and proactively detect and handle issues by utilizing machine learning algorithms and real-time monitoring. Moreover, Bazzi and Chafii (2023) concurred that businesses may use AI and machine learning in business intelligence to streamline operations, save expenses, find new sources of income, and provide outstanding customer service. The findings also revealed that Natural Language Processing (NLP) significantly improves business analysis.

The findings also revealed that the AI incorporated with robotics significantly influences business processes and operations. According to Boulton (2018), robotic process automation (RPA) automates business operations. It is guided by business logic and consists of organized inputs. In addition to the numerous discussions held at the most recent "World Economic Forum 2015 (WEF, 2015)" and the articles and update that are recently beginning to be issued on the similar subjects, Roubini (2014) and Stiglitz (2014) said in their writings that the intersection of robotics and artificial intelligence would offer up new avenues for the study of business, economics, and society, along with new implications for lifestyle and society. An obvious consequence will be a rise in the unemployment rate inside the economy.

The findings also revealed that the effectiveness of planning and decision-making models within AI systems significantly improves business contexts. Businesses have several

opportunities to alter their operations across multiple industries thanks to AI technology (Brock and von Wangenheim, 2019). Decision-making driven by AI in sales, credit, or loan projections is one example. By automating formerly laborious operations and allowing improved processes where humans and AI engage positively, AI can offer substantial advantages (Jarrahi, 2018; Makowski and Kajikawa, 2021). Businesses stand to benefit significantly from AI; however, when substantial changes are needed, companies must cultivate a compelling shared vision to effectively harness AI, ensuring a high impact that preserves both investments and efforts. (Wamba-Taguimdje et al., 2020). Furthermore, companies need to employ a variety of cutting-edge technologies, such artificial intelligence (AI), to create sense-and-respond and adaptive transformation skills to increase productivity, encourage innovation, and increase consumer satisfaction and experience (Truong and Papagiannidis, 2022).

7. Conclusion

To various people, AI might signify different things. AI has limited learning potential and is now employed for information and automation. It will take several years to develop a completely self-aware AI software. AI is risky at every level. Skilled labor is mostly at danger from the main AI initiatives. Real risks to humans might arise from higher-level AI. The advantages of AI are only increasing, ensuring the technology's longevity. Businesses and society at large will need to adapt and learn how to employ the new technologies. AI will be necessary for businesses to stay competitive, and employees may need to adapt their skill set in order to find new jobs. Legal liability concerns and other related difficulties will come up as AI technology develops further.

Businesses have both possibilities and constraints from the use of AI. AI has a lot of potential advantages, including improved decision-making, cost reductions, and productivity gains. Adoption of AI, however, is not without its difficulties. These include worries about data security and privacy, moral issues, and possible employment displacement. Companies need to take a cooperative stance, collaborating closely with legislators and other relevant parties to guarantee that the advantages of artificial intelligence are fully realized while resolving any possible drawbacks.

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