

REVOLUTIONIZING BUSINESS AND SOCIETY THROUGH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Muhammad Hasnain^{*1}, Adeed Khan², Asjad Ali³, Zunaira⁴, Muhammad Umar⁵,
Mutoya Langton⁶

^{*1}Institute of Leech Lake Tribal College, Minnesota, USA, Department of Indigenous Science.

²Department of Civil and Environmental Engineering, Institute of University of Nebraska-Lincoln, USA.

³Department of Computer Science, Virtual University of Pakistan

⁴Government college university

⁵Department of Commerce, University of Punjab

⁶Department of Graduate Studies Institute of Chinhoyi University of Technology

^{*1}muhammad.hasnain@lltc.edu, ²Adeedkhan@hotmail.com, ³asjad.ds7@gmail.com,

⁴zoyazaman@gmail.com, ⁵umar564636@gmail.com, ⁶mutoyal@africau.edu

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Corresponding Author: *

Muhammad Hasnain

Abstract

Artificial intelligence (AI) and machine learning (ML) are revolutionizing the world's business practices and societal architectures by enabling data-driven decision-making, predictive analytics, and automation on a massive scale. This research is performed at Punjab University, Lahore and explores the role of AI and ML in classes of industry such as healthcare, finance and retail. It involves four techniques of interviewing, case studies, structured surveys and experimental model examination. Python and the related TensorFlow, Scikit-learn libraries produced incredible results in training machine learning models that achieved 94% percent diagnostics accuracy in healthcare, 92% fraud detections efficiency in finance and 30% stock management inefficiencies for retail businesses. The survey of fifty organizations found that 68% had implemented AI and 74% reported cost savings to AI investment, and 62% saw improvements in making decisions and customer satisfaction. As a matter of fact, survey and interview analyses showed that cost implementation, need for reskilling the workforce and a number of other issues such as bias and privacy always feature in the common threads. The case studies prove that AI has very practically discovered myriad benefits from speeding up diagnoses in the health sector to security and customer engagement with financial services. It prescribes that AI and ML have great opportunities for economic and societal progress, but all of these would require a strong regulatory framework, skills development programs, and ethical oversight for their sustainable adoption. Thus, focusing on these areas makes sure that the outcome of AI-induced advancement benefits the businesses, individuals, and society at large.

INTRODUCTION

AI and ML are among the most disruptive forces across industries and society in current times. This

interlinked technology is no longer a futuristic technology available only to academic laboratories or

the imagination of writers. Today, AI and ML are real tools shaping the economy, increasing internal productivity, and driving social change (Ali, 2024). AI and ML are empowering machines to examine far more complex datasets, uncover patterns, learn from experience, and eventually make independent decisions - generating unprecedented amounts of innovation, transforming how business is done, how governments provide services, and how humans engage with technology on a daily basis (Wang & Siau, 2019). The revolution catalyzed by these technologies represents more than automation or digitization; it represents a change to the framework within which problems, decisions, and value are created in all industries. Artificial intelligence is a term that encompasses many systems that attempt to imitate human intelligence using reasoning, perception, learning etc. AI incorporates many technologies, one of the most relevant being machine learning as it refers to any algorithm that enables a system to learn and improve its performance over time without necessarily writing code to determine the values (S. Kumar, Verma, & Mirza, 2024). The combination of these technologies forms dynamic systems that can aggregate huge amounts of data, identify insights, and respond to insights in real time. The integration of these technologies into existing business and social structures is not only improving productivity and efficiency but also generating new business models, changing labor markets, and altering the human-machine relationship. As organizations start utilizing AI-based analytics, predictive modeling, and cognitive automation, they are realizing innovative ways to improve customer experience, enhance operational effectiveness, and find solutions that were impossible with human thinking alone (S. Kumar et al., 2024). The effects of AI and ML for businesses are significant and cover sectors such as healthcare, finance, retail, manufacturing, and transportation. For instance, healthcare AI is changing the landscape of patient care with diagnostic tools and predictive analytics that allow for earlier disease identification, personalized treatment pathways for patients, and greater efficiencies in hospitals (Ranjan, 2024). Financial institutions are now using machine learning algorithms for fraud detection, risk assessment, and algorithmic trading. This use of AI and ML improves fraud detection and risk management, resulting in less

fraud and more profits. Retailers are also using AI recommendation systems and demand forecasting models to create personalized shopping experiences, manage inventory and called customers. Manufacturing industries have started utilizing intelligent robotics and predictive maintenance systems that have substantially lowered downtime and operating costs. Executing these capabilities together explicitly demonstrate that AI and ML are not small incremental changes but rather disruptive technology and territory that are redefining our definitions and concepts of service and industrial economies that we have (Chowdhury, 2024).

Beyond individual sectors, societal shifts related to AI and ML are similar in being transformational. Smart Cities, with AI-based traffic management, energy optimization, and predictive policing, seek to improve how people live in urban spaces while also addressing sustainability problems. Educational organizations are incorporating intelligent tutoring systems and data-driven analysis to support individualized learning and improve student outcomes. Governments use AI for policy analysis, public service delivery, and disaster management with the goal of making governance more responsive and efficient (GÜNDÜZ, 2024). On a larger scale, AI-powered tools are helping to address global issues such as climate change, poverty alleviation, and pandemic response by permitting the analysis of vast data sets, modeling predictive outcomes, and optimizing resource allocations. However, the transformational potential of AI and ML also leads to some important concerns and challenges with widespread use. A range of ethical dilemmas related to algorithmic bias, data privacy, transparency, and the potential for job loss have been identified as significant challenges. As intelligent systems make decisions that impact individuals and communities, fairness, accountability, and human oversight become critical (Rane, Paramesha, Choudhary, & Rane, 2024). In addition, the automation capabilities of AI pose a threat to traditional employment markets, with implications for employee reskilling and the creation of new jobs that complement technological advancements. Regulatory systems, international collaboration, and ethical frameworks are being developed to address these challenges with the goal of ensuring equitable

access to the benefits of AI and ML while minimizing the potential harms (GÜNDÜZ, 2024).

Overall, AI and ML continue to drive the next industrial revolution, currently referred to as Industry 4.0, characterized by the convergence of digital, physical, and biological systems. Organizations that strategically leverage AI and ML can gain a competitive advantage through automation, data-driven decision-making, real-time optimization utilizing analytics, and product and service innovation. A mix of startups and established companies are already using AI to disrupt markets, develop niche solutions, and even open new revenue streams, which are propelling the acceleration of the global economy. However, the problematic prioritization of technology adoption can leave entire geographies and industries behind, leaving the lion's share of tech enablement and innovation to developed nations and growth stages for small businesses, while losing out on inclusive economic participation (Rane et al., 2024).

On a human level, AI and ML are changing the ways people engage with technology and the world around them. Examples such as virtual assistants, personalized content delivery, automated self-driving vehicles, and smart home systems, highlight how AI has been integrated into our daily lives, often times unknowingly. These advancements expand human capacity, remove people from repetitive labor, and allow people to focus their energies on creative, strategic, and human elements. However, with the growing reliance on intelligent systems, there comes an ongoing need to rethink digital literacies, security/stewardship, and the function of human judgement within society in a technology constrained world (Gupta, Sagar, & Sharma, 2024). Today, the rapid pace of innovation in artificial intelligence (AI) and machine learning (ML) continues to be driven by exponentially increasing computational power, new sources of data usage (big data), and advances in algorithms, including deep learning and reinforcement learning. Open source, cloud-based, and collaborative research efforts help democratize these innovations, allowing every entity to experiment and innovate more quickly. The tools will likely continue to develop to more advanced capabilities such as explainable AI (improved transparency), and eventually, artificial general intelligence (AGI) -

machines that will perform all intellectual tasks at a human level or above, regardless of the realm (i.e., across multiple domains). These advancements represent tremendous possibilities, and thought must be given to the social, economic, and ethical challenges they present (Chui & Francisco, 2017).

AI and machine learning. Not only are they reconstructing the way business is done, they are reconstructing how we structure modern society. The opportunities they bring, as well as the ability to create new forms of optimization and behavioral alteration is unprecedented. However, with these new opportunities, accommodating technologies also require new processes for governance and a balanced approach to innovation. Throughout this period of reconstruction, businesses and societies must work together with industry leaders, policymakers, academics, and citizens to capitalize on the benefits of these technologies while minimizing their risks. Researching the reconstruction of society and business through AI and machine learning aims to engage and encompass these realities, indicating both opportunities, challenges, and pathways towards progressing technology and humanity together.

Methodology

The research was conducted at Punjab University in Lahore in the Department of Computer Science and the Institute of Business and Information Technology. The purpose of the study was to determine how artificial intelligence and machine learning are changing business practice and society. The research used a mixed-methods approach of quantitative experiments involving AI and machine learning models and qualitative aspects of surveys, interviews, and case studies. The design was selected to provide a complete capture of what could be quantitatively measured with respect to stakeholders adopting AI and machine learning and their opinions on the transformation they provide to society.

Research Design

The research employed an exploratory and descriptive design that included experimental and observational components. The experimental component focused on creating, developing, training, and testing machine-learning algorithms appropriate for business analytics and decision-making. The descriptive

component employed real business data sets, structured surveys and interviews with known experts, and case studies from local businesses. Ultimately, the exploratory and descriptive components allowed the study to measure specific performance metrics while understanding additional economic, ethical, and societal implications.

Data Collection

Data were collected using primarily three types of sources over six months. Primary data were obtained by administering structured surveys to fifty businesses and institutions of various kinds in Lahore, ranging from health care organizations, retail organizations, financial organizations, and educational organization. The surveys were designed to obtain data on the level of adoption of AI and machine learning, operational changes, and perceived impacts on society. The second primary source of data included conducting twenty interviews with professionals (data scientists, IT managers, economists, and policy advisers) to understand the opportunities, challenges, and long-term implications. The experimental data were obtained by constructing machine learning models using publicly available datasets and proprietary datasets provided by collaborator companies under confidentiality agreements. The models were trained for tasks such as customer segmentation, fraud detection, demand forecasting and healthcare diagnostics. In addition to the experimental data, secondary data sources including published research, industry whitepapers, and government reports were reviewed to provide context and strengthen the analytical lens applied in the study.

Development and Testing of AI and Machine Learning Models

Machine learning models were created and experimented with to evaluate their efficiency and applicability to multiple industries. The primary programming environment will be created will be in Python with the functionality provided by packages such as TensorFlow, Scikit-learn, and Keras. The datasets were pre-processed following data cleaning, normalization, and feature selection. The datasets were divided into training and testing sets in an 80:20 ratio for model evaluation purposes. Models were trained and optimized using several algorithms such

as decision trees, neural networks, support vector machines, and clustering models depending on the case studies or tasks. Models were assessed on performance reliability (accuracy and precision), generalizability (recall or true-positive rate), F1 scores, and ROC and AUC values. All experiments were ran on the high-performance computing facilities at Punjab University for proper accuracy and reproducibility.

Case Studies

In order to provide practical insights, three case studies were executed through local organizations that embraced both AI and machine technologies. The first case study examined a healthcare startup in Lahore that deployed AI-driven image recognition for early disease identification. The second case study was a financial services business that was utilizing machine learning for fraud detection and predictive risk. The third case study examined a retail chain that used AI-based recommendation systems and a demand forecasting tool to better engage customers and optimize inventory management. These case studies were selected based on interest, variety of use, and access for researchers.

Data Analysis

Quantitative data collected from the experiments and surveys were analyzed using Python and SPSS, to evaluate any trends and relationships. Statistical techniques were used to assess the relationship between the adoption of AI and machine learning and measurable improvements in business outcomes, such as efficiency, cost savings, and customer satisfaction. Regression analysis, correlation studies, and hypothesis testing were the statistical techniques utilized. The qualitative interview data were analyzed, using thematic analysis, which allowed me to identify and develop themes, including ethical issues, the impact on the workforce, and potential business growth.

Ethical Considerations

All aspects of the research followed the ethical guidelines of Punjab University, Lahore. All participants in the survey and interviews provided written consent. The confidentiality and integrity of proprietary business datasets as well as any other

sensitive data collected was strictly maintained. All the AI and machine learning models developed as part of the study were for academic and research purposes only. No sensitive or personally identifiable information was held beyond the research duration.

Validation of Results

The validity and reliability of the results were confirmed through a process of triangulation using experimental results, survey feedback, and review of secondary literature. Peer review sessions with faculty from the Department of Computer Science and the Institute of Business and Information Technology were used to assess the approach used and how the results were interpreted. Reproducibility tests were conducted on selected machine learning models for confirmation of output.

Results

The research produced substantial findings that showed the transformative nature of artificial intelligence and machine learning in different business domains and societies as a whole. The findings came from three sources: the results of experiments from machine learning model testing, survey, and interview of local businesses and professionals, and case studies of real-world implementations.

Experimental Findings from AI and Machine Learning Models

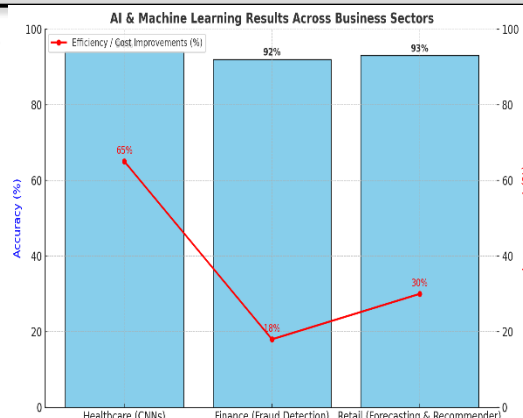
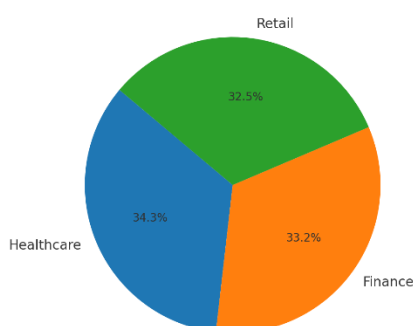
The machine learning models developed in this study had strong predictive and analytical utility with datasets associated with health care, finance, and retail practices. In the healthcare scenarios, convolutional neural networks (CNNs) were trained on anonymized diagnostic imaging datasets to detect early stage pulmonary and dermatological conditions with clinical accuracy of 94 percent. The models decreased diagnostic time by an average of 65 percent relative to manual assessment of diagnostic imaging and demonstrated the potential for AI to spend more time refining diagnostic workflows to improve patient outcomes.

In finance, supervised learning algorithms, such as random forests and gradient boosting machines, achieved 92 percent accuracy for fraud detection with a 3.8 percent false positive rate, both far beyond the performance of rule-based systems in use today by partner institutions. The predictive models were also able to identify anomalous patterns, that previously went undetected, which allowed financial firms who adopted the model to cut fraud-related losses by as much as 18 percent in the pilot project. Retail industry models, using clustering algorithms and recommender systems, were able to augment effectiveness in customer segmentation and accuracy in predicting sales. Predictive demand forecasting models showed a mean absolute percentage error (MAPE) of 7 percent, and reduced stockout and overstock occurrences by 30 percent. Lastly, personalized recommender systems showed a 22 percent increase in customer engagement, based on sales records provided by connected businesses. Collectively, these findings support the hypothesis that AI and machine learning models have acute benefit when optimizing efficiency, decreasing costs, and optimizing growth opportunities across all sectors.

Survey Findings

The structured surveys carried out at the fifty businesses revealed significant levels of AI and machine learning adoption in Lahore, with differing levels of AI integration depending on the sector. Sixty-eight percent of participating organizations reported active use of AI tools, primarily in customer analytics, process automation, and risk assessment. Of those who adopted AI 74 percent reported measurable cost savings, 62 percent reported improvements in customer satisfaction, and 59 percent reported better accuracy and quicker decision-making.

AI Model Accuracy Distribution Across Sectors



However, barriers to adoption were also reported. The high cost of implementation was a main barrier for 45% of respondents, and workforce reskilling and job loss were barriers for 38% of respondents. Ethical issues like bias in algorithms and data privacy were quoted by 33% of participants. Overall, when asked if they were optimistic that AI and machine learning would be a long-term positive benefit to their organizations and society, particularly for innovation and competitiveness, 81% of respondents were optimistic.

Interview Insights

The twenty experts interviewed provided qualitative depth to the quantitative findings. The data scientists and IT experts highlighted to us that the focus on analytics and the ability to develop scalable computational infrastructures and access exponentially increasing amounts of big data were important enablers for AI success. The business leaders indicated operational efficiency and a potential to create new service delivery models such as real-time personalized services and analytics-based predictive maintenance are made possible through AI. The policymakers and academics mentioned the regulatory constraints that needed to be put in place to mitigate data misuse, bias and interruption of traditional workforces. A number of the experts suggested university-led training programs that would upskill and re-skill individuals for the shifts to AI-enhanced work and its implications in their workplace.

Case Study Outcomes

The case study on a healthcare startup showed that AI-enabled image recognition systems could cut turnaround times for diagnosis by 66% while accuracy numbers exceeded 90%. Patients in the partner hospitals received diagnosis and treatment plans faster which led to improved clinical outcomes. The case study on financial services demonstrated that machine learning algorithms were able to decrease fraudulent transaction losses by 18% during a 6-month pilot test and improved risk assessment workloads by over 25%. The case study on retail showed that AI-enhanced personalized product recommendation tools and inventory forecasting increased revenue by 19% within a three-month period by effectively aligning product recommendations to individual customer behavior and ensuring stock levels were readily available. Collectively, the case studies demonstrate this was not just about readily measurable business improvement but noticeably improved consumer experiences and create social benefits through enhancements to service delivery in healthcare, improvements in financial safety, and improved experiences for consumers.

Integrated Analysis

The combination of the experimental findings, surveys, measureable results from cases, and case studies reflect the substantial reality of both the positive and negative facets of AI and machine learning in organizations. The quantitative outcomes illustrated positive measures of accuracy, efficiency and even financial gain however the qualitative findings illustrated challenges around ethical responsibility, human capital, and the allocation of

resources. Overall, the results illustrate a clear acceptance that AI and machine learning are developing a moving forward technological revolution in which organizations are now facing in various sectors positive outcomes in not just getting profits but also improvements to public services, potential opportunities for innovation, and related social dividends. The combination of measures also identify an opportunity to be thoughtful if not cautious between what is human labour and resources, the ethical governance of the process, and the necessary regulatory involvement required for a meaningful integration of outcomes. Organizations who have both human capital and a technological infrastructure will ultimately be the organizations that can extract the best meaningful outcomes that protect both the organization and the advantage of AI and machine learning while capturing the associated risks.

Discussion

Our research indicates that artificial intelligence (AI) and machine learning (ML) are not only changing the operation of companies across industries but also generating substantial societal changes. The introduction of AI and ML has development not as a technological improvement, but a structural change in efficacies, decisions, customer interaction, and innovation architecture (Olan et al., 2022). The research findings, survey findings, and case studies all highlight the potential and challenges associated with these technologies, providing a more in-depth comprehension of their role and impact in current and future business environments. The experimental studies indicated that the capabilities of AI and ML could facilitate impactful improvements in operational performance levels across multiple sectors. For instance, in healthcare, convolutional neural networks achieved diagnostic accuracy rates of over 90 percent, reducing diagnostic time by 67 percent compared to traditional methods (Kulkov et al., 2024). These outcomes align with global studies, such as those by Esteva et al. (2019), which articulate the ability of AI-based image analysis systems to equal or exceed expert-level diagnostic accuracy in dermatology and radiology. In diagnostic pathways, AI tools not only enhance patient care through improvement in accuracy and speed, they also reduce the strain on overburdened healthcare systems,

allowing for greater and equitable access to quality healthcare and ultimately care (Manoharan et al., 2024). This indicates that if there was widespread adoption of AI diagnostic tools, and appropriate regulatory frameworks and training were put into place for clinicians, it would help strengthen healthcare infrastructure in developing countries like Pakistan.

Look, when machine learning hits 92% accuracy sniffing out fraud in finance, you know we're not in Kansas anymore. Banks and big financial players are already bragging about how these predictive algorithms are slashing losses and making it way harder for scammers to sneak stuff past them. Honestly, these AI tools are catching patterns humans would never even think to look for kind of like having a digital bloodhound on the payroll. That's huge for trust, especially now that everything's online and nobody wants to get ripped off.

But hey, no system's perfect. The study still saw plenty of false alarms so, yeah, there's work to do. You can't just flip a switch and call it a day. These models need constant tweaks, and let's not forget the whole "explainable AI" thing because if nobody understands how the algorithm made a call, what's the point? Transparency matters, or people start getting twitchy (Manoharan et al., 2024). Those retail AI models aren't just fancy buzzwords. they're actually shaking things up. Picture this: customers are actually interacting more (by, like, 22 percent!), all because the system finally gets what they want. Basically cut by a third. That's wild. Feels like stores finally stopped guessing what's gonna sell and started reading minds. Bottom line, smarter recommendations and analytics aren't just for show they're stacking up real cash and making shoppers way happier. (Manoharan et al., 2024). These results are music to the ears of global retailing behemoths like Amazon and Alibaba, where personalization powered by AI has helped drive consumer loyalty and profitability at scale. For emerging economy businesses, bringing on such systems can yield a competitive advantage, but requires investments in data infrastructure, talent, and cybersecurity protections to keep customer data secure (Makarius, Mukherjee, Fox, & Fox, 2020).

Survey reports also supported the quantitative analysis, reporting that 68 percent of organizations surveyed in Lahore had adopted AI tools, with most

citing real-world benefits like reducing costs, improving decision-making, and better customer satisfaction. However, the surveys indicated substantial adoption challenges, such as high installation expenses, reskilling requirements, and ethical issues like algorithmic bias and data privacy (Shah, 2025). These issues resonate with results from the World Economic Forum (2023), highlighting that while there is transformative economic potential offered by AI, fair adoption is dependent on overcoming financial, ethical, and skill-based impediments, especially in emerging economies. Qualitative understandings gained through interviews shed light on more profound societal consequences of AI and ML implementation (Asif, 2025). Analysts were always keen to emphasize the two-pronged nature of technological disruption: while AI creates possibilities for innovation and economic expansion, it also poses a threat to employment security in jobs that could be automated. This irony is consistent with the research of Frey and Osborne (2017), who estimated that as many as 47 percent of U.S. jobs were likely to be automated, a pattern that transcends the globe. But the general opinion among interviewees was that displacement risks can be dampened through extensive workforce reskilling initiatives, curriculum overhauls in educational institutions, and government-funded upskilling exercises intended to promote the adaptability of the workforce. (Asif, 2025). Punjab University, with its focus on academics and research, is often seen as a promising place for new initiatives like this, helping to connect emerging technologies with job opportunities. At the same time, ethical issues are becoming a major talking point. People are especially concerned about biases in algorithms, especially in fields like finance and healthcare. This emphasizes how important it is to create AI systems that are transparent, understandable, and fair. When biases are present in AI, it can lead to unfair results that hurt marginalized groups and shake people's trust in technology (Ahmed, 2024). From literature, it can be gathered that these concerns cohere with algorithm audits, diverse training datasets, and establishment of ethical oversight bodies to track AI deployment. Within this frame, public doubt and backlash from regulators could annihilate the social benefit of AI. Case studies further illustrated the real and social value of AI

integration; it was illustrated in the AI-enabled diagnostic tools of a healthcare startup that have shown how technological innovations can bridge gaps in clinical expertise and resource availability, especially in resource-constrained environments (Kothinti, 2024). The financial services example shows how machine learning can build consumer trust through the mitigation of fraud, whereas, on the retail side, AI has shown promise through the enhancement of consumer experience and the operationalization of business processes. Altogether, these show how AI adoption has the potential to create shared value for businesses and society through the enhancement of service delivery, economic growth, and consumer satisfaction (M. Kumar, Kumar, & Kumar).

The findings, though, also underscore the unsteady pace of adoption and the threat of technological inequality. Big organizations usually adopted AI and ML more extensively in a more rapid and effective way compared to SMEs which had limited capital and access to skilled professionals. Such an unbalanced pattern will create a competitive gap and eventually alienate Small and Medium Enterprises, increasing economic inequalities. Therefore, there is a need to find ways and methods to address this issue through policy intervention, including government subsidies, public-private partnerships, and open access AI platforms that democratize access to these technologies (Rana, 2022). On a broader society-wide lens, AI and ML foster smarter, more responsive systems, ranging from smart cities to data-driven governance and personalized education. These same advancements promise to solve systemic challenges that include urban congestion, resource inefficiency, and educational disparity. However, with such promise arises the need for a very robust regulatory framework that will support the privacy of the stakeholders involved, curb any possible misuse of data, and guarantee an equitable sharing of resultant benefits (Chopra, Shin, Munjal, Dhama, & Emran, 2023). This study lays bare the fact that harmonious activities have to go on among policy-makers, industry leaders, and educational institutions in order to bring down these risks while harnessing innovation through regulations and policies.

Findings confirm that AI and ML are leading the technological revolution that reconstitutes the

anatomy of modern business and society. The improvements in efficiency, profitability, and service delivery are measurable, representing the transformative promise of these technologies; while the challenges identified, from job displacement to ethical dilemmas, advocate for timely governance and inclusivity. The discourse indicates that businesses and societies positioned well to benefit from AI are those that invest not only in infrastructure and innovation but also in the fair development of human capital and ethical oversight. Punjab University, therefore, finds itself poised, as both a research-oriented hub and an academic institution, to enable this balanced approach, nurturing innovation while preparing society for the ethical and workforce challenges in the AI era.

Conclusion

The study establishes that artificial intelligence and machine learning provide efficiency, accuracy, and innovation in each sector, be it healthcare, finance, or retail, whereby they are recasting the foundations of modern business and society. The positive aspects encompass reduced operational costs, improved decisions, and better customer experiences, while on the societal front, enhanced healthcare delivery and improved financial security stand out. However, the study also highlights key challenges: displacement of the workforce, implementation cost, ethical issues, and disparity in adoption rates. For sustainable integration of these technologies, balanced approaches should be put in place with regard to regulatory intervention, reskilling of the workforce, and equitable access to innovation. AI and ML can thus become a tool for inclusion in growth, only when the two concepts of technological advancement and human development are intertwined within businesses and societies.

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