

Using Artificial Intelligence (AI) in Cultural Diplomacy and Public Sector of Pakistan

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Abstract

In this digital age, Pakistan can create a progressive and positive image by utilizing Artificial Intelligence (AI). Artificial Intelligence (AI) integration presents an opportunity to digitalize various fields, spur innovation, and advance Pakistan's sustainable development. Pakistan, like many emerging nations, has a number of issues that impede its development into a strong and sustainable state. However, there is a chance to use the rapid technological breakthroughs, notably in AI, to get around these challenges. By analyzing case studies, different startups and wide scholarly exploration, this article examines the likely interventions of AI in public sector such as cultural diplomacy, healthcare, education, governance, technology transfer, and economic development. Pakistan can reconstruct its infrastructure, enhance service delivery, and eventually become a technology-driven country by implementing ethically informed AI-driven solutions.

Keywords: Artificial intelligence, cultural heritage, health, education, digital transformation, ethical future

Introduction

In the rapidly changing digital age, using Artificial Intelligence (AI) in constructing progressive image of Pakistan, and embracing the functionality of AI has become utmost important in various fields¹, including technology transfer.² In recent years, a substantial growth has

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¹ Joseph S Nye, The Information Revolution and Soft Power. *Current History* 113 (759): 19–22. 2014. Also see, James Pamment, Foresight Revisited: Visions of Twenty-First Century Diplomacy. *Place Branding and Public Diplomacy* 14 (1): 47–54.2018. <https://doi.org/10.1057/s41254-017-0092-4>.

² Margaret L. Hilton and James W. Pellegrino, *Education for Life and Work Developing Transferable Knowledge and Skills in the 21st Century*

been found in the uses and functions of AI regarding countries' public and cultural diplomacy.³ The government's efforts to develop national-level AI centers have played a crucial role in fostering innovation and technological advancements across various sectors in the country. AI scholars and technology experts shed light on AI's transformative aspect in technology and development.⁴ This article aims to explore AI's broader potential by focusing on how it can contribute to crafting a soft image of Pakistan. By leveraging AI tools and techniques to write about Pakistan's cultural heritage, tourism, archeological sites, historical monuments, museums, and shrines, Pakistan can create a convincing narrative showcasing the nation's finest attributes.⁵ As a rising technology, AI also has the prospective to reform various industries (public sector), including education, healthcare, agriculture,⁶ finance, and more. Though the potential for newly-emerged field of AI in the country has not been fully translated, and its use is still in its early stages, a

(Washington, D.C: National Academies Press, 2013); Michael J. Ahn and Yu-Che Chen, 'Artificial Intelligence in Government: Potentials, Challenges, and the Future', in *The 21st Annual International Conference on Digital Government Research*, 243-252 (2020).

- ³ Santanu Ghatak, *The Lessons We Learn: AI in Archaeology: Unraveling Ancient Mysteries with Artificial Intelligence*, 10 August 2023. <https://www.linkedin.com/pulse/>; Also see, Giancarlo Elia Valori, *The Artificial Intelligence which look back to the past: The development of contemporary archaeology, Modern Diplomacy*, <https://www.moderndiplomacy.eu>, Sep 2023; Hannna Hryshkevich, *How AI can Help in Archaeology*, *AI Time Journal*, Sep 2022.
- ⁴ Mariya Yao, Marlene Jia, and Adelyn Zhou, *Applied Artificial Intelligence: A Handbook for Business Leaders* (New York: Topbots Inc, 2017).
- ⁵ UNESCO Pakistan Country Strategic Document 2018-2022 explains the UNESCO's strategic framework for engagement with the Government of Pakistan. It contributes to the preservation and sustainable management of Pakistan's tangible and intangible heritage, promoting creativity and creative industries, integrating heritage and culture within education and development, promoting access to information, and advocating for science, technology and innovation to increase the sustainability and inclusivity of Pakistan's economic growth. Document can be found online at: (<http://www.creativecommons.org/licenses/by-sa/3.0/igo/>), (<http://www.unesco.org/open-access/termsuse-ccbysa-en>)
- ⁶ A. Mohamadi, Z. Heidarizadi, H. Nourollahi, 'Assessing the desertification trend using neural network classification and object-oriented techniques (Case study: Changouleh watershed - Ilam Province of Iran)', *Journal of the Faculty of Forestry Istanbul University* 66: 2 (2016), 683-690. DOI: [10.17099/jffiu.75819](https://doi.org/10.17099/jffiu.75819)

noticeable increase in interest and investment has been found.⁷ This article explores the current state-owned AI startups and national level initiatives. Furthermore, it examines the opportunities as well as challenges for the applications of AI, and discourses its future in Pakistan.

The simple answer for the question why AI in Pakistan is that, because it has the power to transform our governance, public administration, and revolutionize governments worldwide.⁸ This study see the sights how the government can harness the potential of AI to improve efficiency, transparency, and service delivery.⁹ By analyzing case studies, different startups and wide scholarly exploration, it examines the likely interventions of AI in public sector. It also debates the multiple risk factors related with its embrace and implementation. The overall goal of this research is to provide scholarly insights into how we can switch AI to drive constructive transformation and foster inclusive and sustainable development.

Research Objectives

From building strategies for using AI to enhance country image and discussing challenges and solutions in AI-driven country branding to evaluating the effectiveness of AI in country promotion and foresighting the future of AI in creating a positive country image, the study included the themes of ethical considerations in using AI.¹⁰

After why AI comes next question how AI? In general, AI can be used by implementing software or tools which are specifically designed for image and video processing.¹¹ AI is a technology that attempts to impersonate human intelligence. We can implement it by using in cultural diplomacy of Pakistan for image and video processing.

⁷ ‘Artificial intelligence in Pakistan, Number of startups providing services, building products is relatively small’, Published in *The Express Tribune*, 18 July 2022.

⁸ Tahir Amin, Ministry drafts ‘National Artificial Intelligence Policy’, for relevant and complete details: <https://moitt.gov.pk/Detail/OWIyNzRiMWMtNGRhZS00YjQxLWFIYTQtZjU3MzAwNmU3NjI3>

⁹ Julia Glidden, ‘Accelerating Digital Transformation in the Public Sector’, [audio] (Better Innovation: Season 5, Ep. 10, 21 May 2022). <http://www.teybip.libswn.com>.

¹⁰ Tahir Amin, Ministry drafts, ‘National Artificial Intelligence Policy’, *op.cit.*

¹¹ Badshah Sardar, *Archaeology of Pakistan* (Islamabad: AIOU, 2022). The book can be found online at: Level: B.S archaeology of Pakistan - online.aiou.edu.pk, accessed 20 September 2023, https://online.aiou.edu.pk/LIVE_SITE/SoftBooks/9357.pdf.

While some argue that AI can increase productivity, reduce costs, and improve the quality of soft images produced in Pakistan.¹² Other may argue that AI technology can replace human jobs, but other viewpoint that it can also create new opportunities and increase efficiency. This article explores what is the current state of AI in Pakistan through looking the current AI initiatives and recent government enterprises for AI in Pakistan.

Research questions

The following research questions have been responded in the first part of the study:

1. Can artificial intelligence (AI) help the country recover its soft image and promote national development?
2. What are the benefits of using AI in the soft image industry of Pakistan?
3. What are the challenges to digitalization at national level?
4. To inquiry about the challenges and potential impact of AI on Pakistan's economy and society.

The answers to above questions offers an understanding of AI systems and its impact on shaping country's global perception.

Current State of AI in Pakistan

The emerging landscape of AI in the country seems to be very progressive as different AI startups are dedicated to develop intelligent solutions that can help improve the scale of national development. For instance, in business, Brainchild¹³ is working on intelligent chatbots to operationally computerize businesses' customer service. In health sector, AI-Tech develops AI solutions for helping doctors and hospitals in improving patient recovery plans. AI Technology Center at National Center for Physics is committed to deliver AI solutions with highest

¹² Dr. Ghaniur Rehman, 'Definition of cultural heritage from the viewpoint of Archaeology and History and utility of cultural heritage studies in Pakistan', Dr. Imran Sabir, 'Definition of cultural heritage from the viewpoint of Sociology and utility of cultural heritage studies in Pakistan', and Dr. Memona Khan, 'Definition of cultural heritage from the viewpoint of architectural studies and utility of cultural heritage studies in Pakistan.' It can be found online at: aia press, 'News - IAD 2017 Recap: Save Cultural Heritage Group, Pakistan', Archaeological Institute of America, 9 April 2019, <https://www.archaeological.org/iad-2017-recap-save-cultural-heritage-group-pakistan/>.

¹³ <http://www.brainchild.net>

quality.¹⁴ Other emerging AI startups in Pakistan include Center of Excellence in Artificial Intelligence (CoE-AI) at Bahria University. IoT cloud-based services will be launched by CoE-AI at discounted prices. It will facilitate learning more quickly and help academic endeavors. CoE-AI will support IoT-based application development, enhance the capabilities of cloud-based and IoT technologies, and offer cutting-edge resources for predictive analytics and the creation of insights for a range of businesses. The initiative would invite national and international businesses to compete to offer IoT-based Cloud services.¹⁵ Xpertflow, which is working on developing AI solutions by innovating and bringing the AI techniques and offering a decision support system to improve quality of treatment in healthcare.¹⁶ The concept of robot journalism has also been introduced by another company in Pakistan that has launched 'Dante'—an AI computer programme in content writing on cultural themes and international media coverage including national stock exchange closing reports.¹⁷ With regard to reimagining the just and ethical future, Islamabad Institute of Futures Studies is another suggestion to government to invest and fund post-normal policy in the country.¹⁸ In short, such startups in the country are the drivers of AI innovation in helping to futurize AI ecosystem in Pakistan.

Believing in a just digital future, the government is committed to digitalization in order to 'end digital divide' between the urban and rural areas.

Through digital inclusion, aiming to protect and assist the most marginalized such as minors, gender (Information Communication Technology for Girls Project), and special persons (National Information

¹⁴ <http://www.aitec.org.pk>

¹⁵ <http://www.bahria.edu.pk>

¹⁶ <http://www.xpertflow.com>. Also see, Tahir Amin, Ministry Drafts, 'National Artificial Intelligence Policy', *op.cit.*, Brecorder, 15 May 2023, <https://www.brecorder.com/news/40242327>. Find the complete information about government recent developments on AI here: <https://moitt.gov.pk>

¹⁷ APP. 'Pakistani company lunches 'robot journalist'', *The News International*, 26 October 2017.

¹⁸ In this lieu, request and invitations for signing MOU have been submitted to federal and provincial universities. A cluster of scholars, university professors, IT professionals, futurists, and cultural theorists and ethicists is working on the theme of post normal policy building and thus registering it as a non-government think tank in order to conceptualize future of Pakistan in Post-Normal Times (PNT). These times are referred to 3Cs as a coming world of confusion, contraction and chaos. See, Ziaduddin Sardar's commentary on PNT.

Communication Technology Council for Persons), the Ministry of IT (MIT) and International Telecommunication Union (ITU) came into agreement in 2022. MIT's agenda to adopt technologies of future also includes to provide youth with digital skills for utilization and application of artificial intelligence, big data, cloud computing and mobile robotics etc.¹⁹

Pakistan on the importance of AI has taken a number of administrative steps to promote its development. One such initiative is the establishment of the National Centre for Artificial Intelligence and Robotics (NCAIR).²⁰ Focused on promoting AI education and innovation, the center is skillfully working on research and development on a national level. In addition, the government has launched some other initiatives to promote AI in Pakistan. For example, the Ministry of Information Technology and Telecommunications has launched an AI for All program, which is designed to provide relevant training to students and professionals on national as well as provincial level. Nevertheless, there are still a number of tests with regard to AI development in the country.²¹

Among these difficulties and challenges regarding AI transformation in Pakistan is the deficiency of funds and organizational support. As much of the operational networks are self-employed and many groups and research institutions need funding for their AI projects on capacity building that is why their ability to innovate is not much extended. Making it difficult to develop and implement AI solutions in Pakistan is another limitation of resourcefulness, including the shortage of futurists and even skilled AI professionals. One most noteworthy challenge regarding AI development is also the firm will on AI for good policies and pro-AI infrastructure and conducive AI innovation and growth environment. Understanding these limitations, policy should include tax exemption for AI setups along with regulatory frameworks and authority that boost innovation, and also resourcing in high-speed internet and cloud computing.²²

¹⁹ <https://moitt.gov.pk/NewsDetail/ODEwMTZmNzYtMDczMi00MGVmLTgzNzAtYzBmNWRIYmJlMWFJ>

²⁰ <https://moitt.gov.pk/Detail/OWIyNzRiMWMtNGRhZS00YjQxLWFLYTQtZjU3MzAwNmU3NjI3>

²¹ High Impact Skills BootCamp, Ministry of Information Technology and Telecommunication (MoITT), National Freelance Training Program All over Pakistan (PITB) are few a mentionable. For a complete PSDP projects list, visit the following web: <https://moitt.gov.pk/>

²² Tahir Amin, Ministry drafts 'National Artificial Intelligence Policy', *op.cit.*

Despite these challenges, several AI applications in Pakistan are already making a significant cross-sectorial impact. One such area is healthcare where AI-powered solutions can help doctors and hospitals improve patient outcomes by analyzing patient data and providing personalized treatment plans.²³ Next comes farming and agriculture, where AI-powered keys be able to assist local farmers in yielding super crops by evaluating weather conditions, soil settings, and other environmental dynamics.²⁴ Such AI applications have the potential to reformulate multi-sectorial strategic approach in achieving the UN's sustainable development goals (SDGs). By incorporating AI in public and private sectors development specialists can disentangle the myth of underdevelopment in the country. Pakistan as a smart nation can demonstrate its commitment to technological innovation and national progress and build high-tech character as well as positive image on the global level.²⁵

AI in Cultural Diplomacy

One vital aspect of nation's soft image lies in its amusing and captivating cultural heritage. Pakistan is the most misrepresented country in the age

²³ The Pakistani government has formed a National Task Force (NTF) to accelerate the adoption of artificial intelligence (AI) in different sectors, including business, development, governance, education, and health care, the Pakistani planning ministry said...In a first, Pakistan sets up task force for 'accelerated adoption' of AI. <https://www.arabnews.pk/node/2286746/> Pakistan

²⁴ Ibid., Minister says AI integration in governance, health care, education systems will revolutionize sectors: 'The key objective of the NTF is to develop a 10-year roadmap for accelerated adoption of AI in the business, development, governance, education, and health care sectors. The NTF force will comprise experts in artificial intelligence as well as representatives from the government and private sectors'. 'Establishing the NTF on AI is part of the government's commitment to embracing AI and its potential to transform the country's economic landscape positively', the statement quoted Ahsan Iqbal as saying. 'The integration of AI in our governance, health care, and education systems has the potential to revolutionize these sectors and bring about significant progress', also see, <https://www.pc.gov.pk/>

²⁵ In the world of realism, technology is key to sovereignty. The sooner a nation realizes the course of scientific, industrial and technological development, the better it is in the position not to be entangled in global controversies. This is an establish discourse, no need to labour it here anymore.

of propaganda and misinformation.²⁶ The use of AI in social sciences can play a substantial part in interpreting civilizational, archaeological, historical, and anthropological accounts to reproduce fair representation and attractive content. Synchronizing AI-based language algorithms with extensive research, nations' exclusive cultural artefacts in national museums can be enigmatic for global spectators. AI-driven podiums be the next curators, assisting digital art galleries or exhibitions, creating virtual excursions of rich archaeological sites, and generating educational expos that re-represent the musicology and multicultural diversity of Pakistan.

AI is rapidly transforming various sectors worldwide, and Pakistan is no exception. In addition, personalized travel plan for visitors across the globe can better be suggested now and through tell-tale tourism framework can be rebuilt. We can also take AI assistance in visually-engaging travel contents, integrating arresting images and descriptions as a part of national cultural policy. Though the county's potential as a tourist destination remains unexploited, a dearth of natural scenery is not the issue in Pakistan. The country boasts the breathtaking landscapes, the towering peaks and enigmatic valleys, mysterious rivers and hypnotic desserts. Through virtual chronicles and graphic narratives under AI-generated content, Pakistan's natural wonders can indeed be repainted. By digitalizing Pakistan's unseen charms, AI-powered content can rekindle desire to travel and inspire travel companies and tourists to discover the sensations the country has to offer. As the country struggles to augment its global standing, AI is evolving as an influential apparatus in constructing a positive image for any nation.²⁷ Not only in stimulating service sector and cultural heritage but also in fostering multidimensional economic growth and innovation, this novel field now transfiguring how we are being perceived globally.²⁸

Technologies such as AI-powered virtual reality (VR) and augmented reality (AR) are redesigning the world of tourism and travel

²⁶ Geo-political dynamics of global power-politics in the region assumes stigmatic labeling and blame game as a tool of political scoring to gain the support of popular opinion. A kind of appeal to emotion that one country uses against the other. See articles on the *image of Pakistan* after Global War on Terror.

²⁷ Giancarlo Elia Valori, 'The Artificial Intelligence Which look back to the past: The development of contemporary archaeology', *Modern Diplomacy*, <https://www.moderndiplomacy.eu>

²⁸ Vivan Walker, 'AI and The Future of Public Diplomacy', USC Center on Public Diplomacy, USC University of Southern California, 22 Aug 2023, <https://www.uscpublicdiplomacy.org>

now. These offer lasting experiences, letting travel-lovers to sightsee the picturesque sceneries, ancient places, and lived and experienced realities of cultures. AI algorithms can help in choice development, applauding the finest terminuses, lodgings, and activities created on discrete penchants.

Traversing thousands of years in history and human civilizations, Pakistan is blessed with a very rich cultural heritage. Through machine learning algorithms AI's has a central part in preserving and promoting this heritage as for as analyzing and interpreting historical artifacts, documents, and archaeological sites are concerned.²⁹ It can surely empower us in cherished visions into Pakistan's great past. To be sure, in order to fostering a deeper appreciation and fuller understanding of Pakistan's cultural legacy, AI-powered chatbots are profound enough to reorient foreign visitors on our lived, experienced realities. Cultural diplomacy is now being considered as a pillar of international relations.³⁰

AI Applications in Healthcare

The healthcare sector in Pakistan faces significant challenges, including limited access to quality healthcare, shortage of medical professionals, and inefficient systems. AI can address these issues by improving the accuracy and speed of diagnostics, enabling telemedicine services, optimizing resource allocation, and facilitating data-driven decision-making/personalized medicine.³¹ AI-powered predictive models can help identify disease patterns, track outbreaks, and guide public health interventions, leading to more effective healthcare delivery.³²

Improving Healthcare

AI is revolutionizing healthcare in Pakistan, contributing to a positive image by ensuring better healthcare outcomes. AI-powered diagnostic

²⁹ Santanu Ghatak, 'The Lessons We Learn: AI in Archaeology: Unraveling Ancient Mysteries with Artificial Intelligence', 10 August 2023. <https://www.linkedin.com/pulse/>

³⁰ 'Cultural Diplomacy: A Pillar of International Relations', Department of sports, education and culture, Republic of South Africa, <http://www.dac.gov.za>

³¹ See a recent study by a Pakistani Data Scientist Hafsa Mughal on the 'Advances in Data-Driven Personalized Medicine: Patient Attitudes and the Role of AI'

³² Benedetta Giovanola and Simona Tiribelli, 'Correction: Beyond Bias and Discrimination: Redefining the AI Ethics Principle of Fairness in Healthcare Machine-Learning Algorithms', AI & SOCIETY, 2023, <https://doi.org/10.1007/s00146-023-01722-0>.

tools enable early detection and accurate diagnosis of diseases, leading to timely and effective treatments. Additionally, AI algorithms help analyze vast amounts of medical data, aiding in medical research, drug discovery, and personalized treatment plans.³³ Recent research on pharmacology and biotechnology reveals that the AI has played an important part not only in identifying new illnesses, but also various advances in novel medications through the application of different simulated tools. These include artificial neural network, genetic algorithm fuzzy logic.³⁴ By embracing AI in healthcare, Pakistan can also showcase its commitment to providing accessible and quality healthcare services.

We consider that all practices of neural networks that substantively influence the thematic areas of the healthcare should be incorporated for greater public good,³⁵ but here in this section we will limit our concentration to the applications of such networks for health sector. Though there are various important issues for medical professionals, Pakistan Medical Association, PMDC, and pharmaceuticals etc. to contemplate, we will not discourse health sector issues per se here as our apprehensions in this research paper are actually applied to Pakistan and AI or Pakistan in digital age.

AI in Education and Research

Education is critical for the socio-economic development of any nation. AI has the potential to revolutionize the education system in Pakistan by enhancing access, personalization, and quality of education. Intelligent

³³ In the development of personalized medicines, AI is now interpreting and redefining test results produced. See, Shyam Bass, Sheetu Wadhwa, 'Artificial Intelligence and Personalized Medicines: A Joint Narrative on Advancement in Medical Healthcare,' in Cherry Bhargava and Pardeep Kumar Sharma, *Artificial Intelligence: Fundamentals and Applications* (Boca Raton: CRC Press, 2021).

³⁴ Uddipta Das, Pankaj Wadhwa, 'Applications of Artificial Intelligence in Pharmaceutical and Drug Formulation,' in Cherry Bhargava and Pardeep Kumar Sharma, *Artificial Intelligence: Fundamentals and Applications* (Boca Raton: CRC Press, 2021), also see, Saurabh Jha et al, A Hybrid Approach Using the Fuzzy Logic System and the Modified Genetic Algorithm for Prediction of Skin Cancer, *Natural Processing Letters*, 2021.

³⁵ Natalia Mesa, 'Will Advancements in AI Lead to Job Loss in Biotech?', BioSpace, 10 May 2023, <https://www.biospace.com/article/ai-advancements-could-result-in-job-loss-upskilling-in-biotech/>.

tutoring systems,³⁶ adaptive learning platforms,³⁷ and virtual classrooms can enable personalized learning experiences,³⁸ particularly in remote areas. AI can also help in automating administrative tasks, improving assessment methods,³⁹ and identifying areas where students may need additional support.

Strengthening Education: AI is transforming the education sector, making quality education more accessible and inclusive.⁴⁰ Intelligent tutoring systems and personalized learning platforms powered by AI algorithms cater to individual student needs, ensuring enhanced learning outcomes. AI also facilitates remote learning, enabling students across Pakistan to access educational resources and connect with expert educators, bridging the educational divide and positioning Pakistan as a hub of knowledge and innovation.

The Role of AI in Improving Quality of Education in Pakistan

There are numerous challenges faced by students in remote area of Pakistan. Limited resources, lack of qualified teachers, and outdated teaching methods are just a few of the obstacles that stand in their way. However, the rise of artificial intelligence in education is offering a new hope for students across the country. One successful example of AI in

³⁶ Abdul Wahab Muzaffar et al., ‘A Systematic Review of Online Exams Solutions in E-Learning: Techniques, Tools, and Global Adoption’, *IEEE Access* 9 (2021): 32689-712, <https://doi.org/10.1109/access.2021.3060192>.

³⁷ Khalid Colchester et al., ‘A Survey of Artificial Intelligence Techniques Employed for Adaptive Educational Systems within E-Learning Platforms’, *Journal of Artificial Intelligence and Soft Computing Research*, 7:1 (2016), 47-64, <https://doi.org/10.1515/jaiscr-2017-0004>.

³⁸ Hui Luan et al., ‘Challenges and Future Directions of Big Data and Artificial Intelligence in Education’, *Frontiers in Psychology* 11 (2020), <https://doi.org/10.3389/fpsyg.2020.580820>.

³⁹ R.S. Kamath and R.K. Kamat, ‘Emerging Research Directions in Educational Data Mining’, *Educational Data Mining with R and Rattle*, 2022, 21–29, <https://doi.org/10.1201/9781003338024-2>. Also see, Janice D. Gobert et al., ‘From Log Files to Assessment Metrics: Measuring Students’ Science Inquiry Skills Using Educational Data Mining’, *Journal of the Learning Sciences* 22:4 (2013), 521-63, <https://doi.org/10.1080/10508406.2013.837391>.

⁴⁰ See Perspectives on Rethinking and Reforming Education, A great reading in this regard is Jeremy Knox’s, *Artificial Intelligence and Inclusive Education: Speculating Futures and Emerging Practices* (Singapore: Springer Nature, 2019).

education is the use of chatbots to support student learning.⁴¹ In a pilot project at a university in Lahore, chatbots were used to assist students with their coursework, providing instant feedback and answering questions in real-time. This allowed students to receive personalized support outside of traditional class hours, improving their understanding of the material and ultimately leading to better grades.⁴²

Another area where AI can make a significant impact is in the development of adaptive learning programs. These programs use algorithms to assess a student's learning style and pace, adapting the curriculum to meet their individual needs. This approach can be especially helpful for students in rural areas who don't have access to a qualified teacher or who struggle to keep up with their peers.⁴³ While there is still much work to be done to fully integrate AI into Pakistan's education system, the potential benefits are clear. AI has the power to revolutionize the way we teach and learn, making education more accessible and effective for all students.⁴⁴ By investing in AI development and implementation, we can create a brighter future for the next generation of learners in Pakistan.

⁴¹ Shubham Joshi, Radha Krishna Rambola, and Prathamesh Churi, 'Evaluating Artificial Intelligence in Education for Next Generation', *Journal of Physics: Conference Series*, 1714:1 (2021), 012039, <https://doi.org/10.1088/1742-6596/1714/1/012039>.

⁴² Both HEC and HEIs of Pakistan need policy modifications with regard to their scholarly publications criteria, As new and emerging AI's NLP systems 'raises important issues for research ethics and research integrity', 'generate coherent and informative text, ranging from a few sentences or paragraphs to an entire essay in response to specific prompts from the user, such as the topic, length, or writing style', yet authors revealed the absurdity committed during academic role of virtual researchers that must be dealt by 'However, the OpenAI chatbot can also produce answers that contain erroneous, misleading, or irrelevant information'. See, Mohammad Hosseini, Lisa M. Rasmussen, and David B. Resnik, 'Using AI to Write Scholarly Publications', *Accountability in Research*, 2023, 1-9, <https://doi.org/10.1080/08989621.2023.2168535>.

⁴³ Allama Iqbal Open University (AIU) is one and only of its kind to provide services for distance learning on wide and far areas from every corner of country. Policy in order to reframe distance learning program should be reformulated and incorporation of AI in AIU's educational structure need to be a mandate for ministry of education and IT, HEC and AIU.

⁴⁴ Chong Guan, Jian Mou, and Zhiying Jiang, 'Artificial Intelligence Innovation in Education: A Twenty-Year Data-Driven Historical Analysis', *International Journal of Innovation Studies* 4:4 (2020): 134-47, <https://doi.org/10.1016/j.ijis.2020.09.001>.

Pakistan's AI landscape is still in its infancy, but there has been a visible increase of interest and investment lately. Universities, research institutions, and startups are key players and stakeholders that are working towards developing innovative AI solutions to overcome the country's most pressing challenges. Pakistan's young and tech-savvy population is one of the factors driving the growth of AI in the country. The government has also recognized the significance of AI and taken steps to promote its development. Another area is the development of AI-powered solutions for education. AI can provide personalized learning experiences that cater to each student's individual needs and learning style. AI has the potential to create new industries, improve productivity, and create jobs.⁴⁵ However, there are also potential risks associated with AI, such as job displacement and the risk of bias in AI algorithms.⁴⁶

The Role of AI in Social and Economic Development

The potential impact of AI on economy and society is immense. Pakistan's economic development is crucial for poverty reduction and overall progress. AI applications in industries such as agriculture, manufacturing, and finance can significantly enhance productivity, efficiency, and competitiveness.⁴⁷ AI-powered technologies, such as smart irrigation systems and precision farming, can improve agricultural yields.⁴⁸ In manufacturing, automation⁴⁹ and predictive maintenance can reduce costs and enhance product quality. AI algorithms can assist in

⁴⁵ Sufyan Habib, Nawaf N. Hamadneh, and Mohammed Arshad Khan, 'Influence of Electronic Word of Mouth (Ewom) and Relationship Marketing on Brand Resonance: A Mediation Analysis', *Sustainability* 13:12 (2021): 6833, <https://doi.org/10.3390/su13126833>.

⁴⁶ Andrew Guthrie Ferguson, *The Rise of Big Data Policing*, 2020, <https://doi.org/10.18574/nyu/9781479854608.001.0001>.

⁴⁷ Daron Acemoglu and Pascual Restrepo, *Artificial Intelligence, Automation and Work*, 2018, <https://doi.org/10.3386/w24196>.

⁴⁸ Mustafa Kamal Shahadat, Himadri Shekhar Mondal, and Md. Mahbub Hossain, 'Impact Study of Climatic Variability on the Productivity of Major Crops in South Western Part of Bangladesh Using Fuzzy Logic - Agricultural Research', *SpringerLink*, 4 August 2021, <https://link.springer.com/article/10.1007/s40003-021-00597-1>.

⁴⁹ On the myth of digital transformation and its positive and negative impact on society, see, Person, Astha Udit Pratap, and Mishra Singh, 'Artificial Intelligence in.', *Robotics and Automation: 5: Artificial Intelligence.*, Taylor & Francis, 28 July 2021, <https://www.taylorfrancis.com/chapters/edit/10.1201/9781003095910-5/artificial-intelligence-robotics-automation-udit-pratap-singh-astha-mishra>.

analyzing financial data, detecting fraud, and improving risk assessment models, paving the way for a robust financial sector.⁵⁰

AI is driving economic growth in Pakistan by facilitating entrepreneurship and innovation. Startups are leveraging AI technologies to develop solutions that address societal challenges and contribute to economic development. For instance, AI-powered platforms are digitally transforming banking sector,⁵¹ assisting algorithmic models for instituting portfolio optimization and anomaly detection through analyzing data science in the arena of ‘predictive analysis; optimization techniques; and anomaly detection in insurance, banking, and investment sectors’.⁵² AI is also connecting farmers with markets, impacting e-commerce,⁵³ optimizing supply chains, and improving agricultural productivity. Moreover, AI-based financial services are enhancing access to banking and credit facilities, empowering individuals and businesses to thrive.⁵⁴

Behind Pakistan's scenic beauty and cultural heritage lies a vibrant society shaped by remarkable tales of social development. AI can amplify these narratives, shedding light on initiatives aimed at poverty alleviation, education, healthcare, and gender equality. By using sentiment analysis, AI algorithms can identify positive stories, uplifting human experiences, and projects that have made a significant impact on society. Through AI-generated content, we can showcase Pakistan's commitment to progress and inspire other nations to follow suit.

⁵⁰ Jarrod West and Maumita Bhattacharya, ‘Intelligent Financial Fraud Detection: A Comprehensive Review,’ *Computers & Security* 57 (2016): 47-66, <https://doi.org/10.1016/j.cose.2015.09.005>.

⁵¹ Shaveta Chugh, ABC of Digital Era with Special Reference to Banking Sector, in Cherry Bhargava and Pardeep Kumar Sharma, *Artificial Intelligence: Fundamentals and Applications* (Boca Raton: CRC Press, 2021).

⁵² L. R. Paul, L. Sadath and A. Madana, ‘Artificial Intelligence in Predictive Analysis of Insurance and Banking’, see, Cherry Bhargava and Pardeep Kumar Sharma, *Artificial Intelligence: op.cit.*

⁵³ Prateek Kalia, ‘Artificial Intelligence in E-Commerce: A Business Process Analysis’ in Cherry Bhargava and Pardeep Kumar Sharma, *Artificial Intelligence, op.cit.*

⁵⁴ Meryem Duygun Fethi and Fotios Pasiouras, ‘Assessing Bank Efficiency and Performance with Operational Research and Artificial Intelligence Techniques: A Survey’, SSRN, 28 February 2009, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1350544.

Using AI in Transfer of Technology

The next part of this study explores the transformative impact of AI in conducting the e-public administrative⁵⁵ and digital diplomacy i-e., efficiency, effectiveness, and accessibility of technology transfer processes. For this, available AI data in general, selective case studies and topic-specific AI research journals is analyzed and finally, concluded with exploring the role of AI in ethical transformation, highlighting its potential benefits, challenges, and future implications. In traditional conditions, the technology transfer refers to the process of circulating knowledge, skills, and technological progressions from developed country to less developed one. In functional terms, AI analyzes big data, absorbs certain patterns, and make smart assessments in multitude of digital diplomacy.⁵⁶ By automating various tasks, predicting market trends, and enabling efficient collaboration, AI has become an indispensable tool in driving successful technology transfers.⁵⁷ The transfer of technology plays a vital part in dynamic innovation, e-growth, and sustainability. In recent years, AI has emerged as a leading field in enabling and accelerating the transfer of technology across various industries.⁵⁸

Expanding Accessibility, Improving Effectiveness, and Increasing Efficiency

Technology transfer is reorganized and automated by AI, expediting the process. Hugely complicated datasets serve as the foundation for wise and thorough algorithmic evaluations. These have the ability to find appropriate beneficiaries for latent technologies and identify them for transmission. Platforms driven by AI also enable effective inter-party

⁵⁵ On the role of digital governments, please find the interview of Julia Glidden, Accelerating Digital Transformation in the Public Sector. [audio] (Better Innovation: Season 5, Ep. 10, 21 May 2022). <http://www.teybip.libsyn.com>.

⁵⁶ Oloo, O.D. The Implementation of the Digital Diplomacy of the United States, the UK, and China in Kenya, *Place Brand Public Diplomacy*, (2023). <https://doi.org/10.1057/s41254-023-00316-3>. Also see, Lala Jafarova, 'Artificial Intelligence and Digital Diplomacy, E-International Relations,' 1 August, 2023, <https://www.e.ir.info>2023/08/001>.

⁵⁷ Daron Acemoglu and Pascual Restrepo, *Artificial Intelligence, Automation and Work*, NBER Working Paper No. 24196, January 2018 JEL No. J23,J24. 2018.

⁵⁸ On the use of nanotechnology see, Virinder Kumar Singla et al., 'Artificial Intelligence and Nanotechnology', *Artificial Intelligence*, 2021, 1-8, <https://doi.org/10.1201/9781003095910-1>.

communication and collaboration, facilitating seamless knowledge exchange and negotiation. Because of the increased efficiency, technology is adopted and put into use more quickly, which promotes innovation and economic progress. AI improves the efficiency of technology transfer by facilitating better risk assessment and decision-making. To evaluate the likelihood and potential effects of technology transfers, machine learning algorithms can examine historical data, market patterns, and intellectual property landscapes. Doing so helps patrons evaluate risks, classify possible challenges, and develop mitigation strategies.⁵⁹ AI also enables real-time monitoring and evaluation of technology transfer projects, allowing for timely adjustments and improvements.

By democratizing technology transfer and opening it up to a wider group of stakeholders, AI is nowadays indispensable.⁶⁰ With the help of AI-powered platforms and online marketplaces, technology buyers and sellers may collaborate globally and geographical restrictions can be removed. AI algorithms can also help translate technical information into understandable representations, making it simpler for non-specialists to comprehend and use transferred technologies. This accessibility encourages creativity and advances fair economic growth.

Challenges

Although AI has a lot to offer in terms of technology transfer, there are also issues that must be resolved. Careful thought must be given to matters like data privacy, intellectual property rights, and ethical considerations. Building confidence and preserving the integrity of technology transfers require that AI algorithms and decision-making processes be transparent, equitable, and accountable. The stability and growth of the socioeconomic system depend on effective governance. By automating administrative procedures, boosting decision-making, and reducing corruption, AI can significantly improve government.⁶¹ Analytics powered by AI can find patterns in data, spot anomalies, and forecast trends, enabling the development of evidence-based policy. Chatbot assistants can promote citizen involvement. The Pakistani

⁵⁹ Michael J Ahn, 'Artificial intelligence in government: potentials, challenges, and the future'.

⁶⁰ See Julia Glidden on a relatively rising influence of AI in fair distribution and a declining role of state-level bureaucratic hurdles and political level of nepotism in digital age.

⁶¹ Michael J Ahn, 'Artificial intelligence in government: potentials, challenges, and the future'.

government must overcome a number of obstacles in order to provide efficient public services, ensure openness, and maximize resource allocation. By automating administrative processes, strengthening decision-making, and increasing public engagement, AI can play a transformational role in addressing these difficulties.

Enhancing Efficiency in Public Service Delivery

By analyzing massive volumes of data, offering insights, and generating forecasts, AI can help decision-makers make wise choices. In order to formulate policies that are supported by facts, machine learning algorithms can examine socioeconomic indicators, public opinion, and demographic data. AI can also assist in monitoring and evaluating the results of policy decisions, allowing for quick modifications and advancements.⁶²

Improving Decision-Making and Policy Formulation

AI can assist policymakers in making informed decisions by analyzing vast amounts of data and providing insights and predictions. Machine learning algorithms can analyze socio-economic indicators, public sentiment, and demographic data to inform evidence-based policy formulation. AI can also help in monitoring and evaluating policy outcomes, enabling timely adjustments and improvements.

Improving Transparency and Accountability and Citizen Engagement and Service Delivery

Transparency and accountability in government operations have been made possible by AI. AI systems can find anomalies, spot potential fraud, and improve audit procedures by automating data analysis. The integrity and immutability of government documents can be ensured by blockchain technology and AI, allowing for safe and open transactions.⁶³

⁶² Neal Jean et al., 'Combining Satellite Imagery and Machine Learning to Predict Poverty', *Science*, 353:6301 (2016), 790-94, <https://doi.org/10.1126/science.aaf7894>

⁶³ To find how blockchain technology impacts accounting and AI-enabled auditing in improving transparency and decision-making, based on the qualities of immutability, and consensus-driven blockchain data, thus improving assurance and efficiency and mitigating information asymmetry and 'designing blockchain ecosystems that suit accounting and auditing as they transform digitally', see, Hongdan Han et al., 'Accounting and auditing with blockchain technology and artificial Intelligence: A literature review', *International Journal of Accounting Information Systems*, Volume 48,

Platforms with AI capabilities can improve public involvement by easing feedback processes and offering customized services. Virtual assistants can help citizens navigate a variety of government procedures, streamlining interactions and lowering administrative barriers. AI is also capable of analyzing citizen comments and sentiment to pinpoint problem areas and set priorities for service delivery.⁶⁴

Addressing Challenges and Considerations

The Pakistani government should address challenges like data privacy, ethical considerations, and capacity building when implementing AI. To build trust and mitigate risks, robust data protection frameworks, algorithmic transparency, and a responsible AI uses are crucial.⁶⁵ Investment in infrastructure, data governance, and capacity building initiatives, along with collaboration with academia, industry, and international partners, can help harness AI's benefits. Prioritizing privacy and security measures is also essential.⁶⁶ The government should use these fundamentals to ensure the *paralegality* of AI technologies.⁶⁷ The effectiveness and efficiency of technology transfers can be further increased by developments in robotics, machine vision, and natural language processing. AI can also make it possible to spot upcoming technologies and make it easier to transmit cutting-edge innovations.⁶⁸

(2023), 100598, ISSN 1467-0895,
<https://doi.org/10.1016/j.accinf.2022.100598>.

⁶⁴ Ingrid Nunes and Dietmar Jannach, 'A Systematic Review and Taxonomy of Explanations in Decision Support and Recommender Systems', *User Modeling and User-Adapted Interaction*, 27:3-5 (2017), 393-444, <https://doi.org/10.1007/s11257-017-9195-0>.

⁶⁵ Julia Glidden, Accelerating Digital Transformation in the Public Sector, [audio] (Better Innovation: Season 5, Ep. 10, 21 May 2022). <http://www.teybip.libsyn.com>.

⁶⁶ 'Yuval Noah Harari: The Myth of Freedom', *The Guardian*, September 14, 2018, <https://www.theguardian.com/books/2018/sep/14/yuval-noah-harari-the-new-threat-to-liberal-democracy>.

⁶⁷ The term covers overall public regulatory mechanisms, for instance to explore the role of AI in public private collaboration and agility that organizations are trying to bring to the public sector, see, Julia Glidden, Enabling Digital Transformation in Public Sector with Industry Partnerships, Nov. 2022 [video]. <https://www.Youtu.be/TOK1tF-0KHk?si=0PB1J3M51zMkhyWU>

⁶⁸ *Ibid.*

The Ethical Implications

Though the potential for AI in cultural and public sector is enormous, yet to avoid biases or unforeseen outcomes it is crucial to make sure AI is created and applied ethically, taking into account its possible societal impact.⁶⁹ Throughout this article has been reviewed the potential benefits of AI for Pakistan. However, it is worth noting that there are also a number of issues which must be addressed for AI to reach its full potential. Though not exhaustive, the following table provides representative risks along with recommendations to mitigate:

| S.No. | Issue | Description |
|-------|------------------------------------|--|
| 01. | Labor Replacement/Job Displacement | The loss of employment is one of the major threats posed by AI. Certain jobs may become obsolete as AI-powered solutions proliferate, resulting in employment losses and economic instability. ⁷⁰ This is especially problematic in Pakistan, where the labor market already faces many difficulties. For people to be able to adapt to the shifting labor market, the public and private sectors must engage in reskilling and upskilling initiatives. ⁷¹ |

| S.No. | Issue | Description |
|-------|--|--|
| 02. | Totalizing and Globalizing Tendencies of AI: Bias in Data Backup/Rampant Orientalizing | Few more identified issues are the entrenched and in-built metalanguage of oppression in western culture with regard to alternative epistemologies/social world. ⁷² In addition, as Machine Learning is supposed to depend on the Orientalist reflexivity of AI as well as on the |

⁶⁹ Nick Bostrom, 'Superintelligence: Paths, Dangers, Strategies', Google Books, accessed 10 August 2023, https://books.google.com/books/about/Superintelligence.html?id=7_H8AwAAQBAJ.

⁷⁰ For Example, in the field of biotech, ethicists are especially concerned on the issue of human replacement from biotech. See, Natalia Mesa, 'Will Advancements in AI Lead to Job Loss in Biotech?', *BioSpace*, 10 May 2023, <https://www.biospace.com/article/ai-advancements-could-result-in-job-loss-upskilling-in-biotech/>.

⁷¹ *Ibid.*

⁷² Ziauddin Sardar, 'The Smog of Ignorance: Knowledge and Wisdom in Postnormal Times', *Futures* 120 (2020): 102554, <https://doi.org/10.1016/j.futures.2020.102554>. Also see, Jordi Serra, Ziauddin Sardar, 'Intelligence in postnormal times', 2017, accessed July 14, 2023, <https://journals.sagepub.com/doi/10.1177/1946756717709277>

| | | |
|--|--|--|
| | Tendencies of AI Machines Visual/textual Data Bias | intensification of some other reductionisms related to race, color, faith, gender, etc. ⁷³ so cultural critics should come forward to give a true picture and implementing strategy on how not to write non-west out of history in Post-Normal Times. |
|--|--|--|

| S.No. | Issue | Description |
|-------|-----------------------|---|
| 03. | Bias in AI Algorithms | Bias in AI algorithms is another potential risk related to AI in Pakistan. The quality of AI algorithms depends on the data they are trained on. The AI system will reflect any bias present in the data if it contains errors or prejudices. ⁷⁴ Particularly in fields like healthcare ⁷⁵ and criminal justice, where decisions based on AI recommendations can have far-reaching effects, this can have serious undesirable consequences. ⁷⁶ Data quality and transparency in algorithms must be given top priority by Pakistani AI developers in order to reduce this risk. |

| S.No. | Issue | Description |
|-------|---|---|
| 04. | Investments in Research and Development | Given certain bureaucratic modalities and limited synergy level in public sector of Pakistan, there still remain obstacles to overcome. These include a dearth of qualified AI experts, inadequate infrastructure, data of poor quality, and ethical issues. Building a robust AI ecosystem requires a profound and extended cooperation between the government, academia, and industry to overcome these issues. |

⁷³ Lexalytics, 'Bias in AI and Machine Learning: Sources and Solutions', (2022, December 7) <https://www.lexalytics.com/blog/bias-in-ai-machine-learning/>.

⁷⁴ Ferguson and Andrew Guthrie, *The rise of Big Data Policing: Surveillance, Race, and the Future of Law Enforcement* (NYU Press, 2017).

⁷⁵ Benedetta Giovanola and Simona Tiribelli, 'Correction: Beyond Bias and Discrimination: Redefining the AI Ethics Principle of Fairness in Healthcare Machine-Learning Algorithms'.

⁷⁶ Rachel Courtland, 'Bias Detectives: The Researchers Striving to Make Algorithms Fair,' *Nature*, 558:7710 (2018), 357-60, <https://doi.org/10.1038/d41586-018-05469-3>.

| S.No. | Issue | Description |
|-------|---|--|
| 05. | Ethics in Research & Published Material | As uses of NLP systems are going to be restructuring research's originality and its integrity in the very near future, therefore a Higher Education Commission/Higher Education Institutions call for submission must be issued on the emerging disputes related to precision, prejudice, significance, and rationale of published material as well as authorship rights and responsibilities. ⁷⁷ |

| S.No. | Issue | Description |
|-------|--|---|
| 06. | Inequalities at Public and Private Sectors | Due to some unnecessary competition among applicants, Some more certification may be required for job industry. ⁷⁸ |

| S.No. | Issue | Description |
|-------|-------------------|---|
| 07. | Gender Inequality | Few applications using female voice and tone leads to the idea that only female as work assistant could be mistaken on the cognition level. ⁷⁹ |

| S.No. | Issue | Description |
|-------|-------------------------------------|--|
| 08. | Economic Disparities among Citizens | As higher educated lot may outsmart people who don't have professional degrees, so AI can produce further economic disparities among the classes of a given country. ⁸⁰ |

⁷⁷ Mohammad Hosseini et al, 'Using AI to write scholarly publications'.

⁷⁸ Given few segments of society are unable to have access to highly professional certifications, there are chances they may be excluded from the recruitment processes due to additional certification requirement, see, Aki Nagano, 'Economic Growth and Automation Risks in Developing Countries Due to the Transition toward Digital Modernity', *Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance*, 2018, <https://doi.org/10.1145/3209415.3209442>.

⁷⁹ Marie Louise Søndergaard, *Staying with the Trouble through Design: Critical-Feminist Design of Intimate Technology*, n.d., <https://doi.org/10.7146/aui.289.203>.

⁸⁰ Xiaojing Dong and Shelby H. McIntyre, 'The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies', *Quantitative Finance* 14:11 (2014): 1895-96, <https://doi.org/10.1080/14697688.2014.946440>.

| S.No. | Issue | Description |
|-------|--|--|
| 09. | Technological Disparity for Low-income Countries | By compounding already existing differences, AI-Powered Machine are based on supra-technological backgrounds favoring relatively rich and powerful countries hindering sustainable development, ⁸¹ thus leading to a new kind of digital Orientalism. ⁸² |

Future Outlook for AI in Pakistan

Looking ahead, several potential areas for growth and innovation in AI in Pakistan exist. One such area is the development of AI-powered financial solutions. AI can analyze financial data and provide personalized investment recommendations, helping Pakistanis make better financial decisions. While the potential of AI in reconstructing Pakistan is immense, yet there are challenges to overcome. As evidenced in the table above, *the government, academia, and industry need to collaborate to build a strong AI ecosystem*. Then investments in research and development, capacity building programs, data governance frameworks, and the establishment of AI innovation hubs can foster the growth of AI in Pakistan. It's imperative to draft a proposal for AI regulatory framework for enacting a straight regulation and legalizing the particular uses of AI systems and related risks. It proposes to introduce a parliamentary act instituting a technology-neutral delineation of AI systems in Pakistani law and particularizing a *mode of risk taxonomy* for AI systems with legal provisions and responsibilities.

While embracing AI's potential in shaping Pakistan's soft image, it is crucial to address the ethical considerations involved. Maintaining authenticity and accuracy is a paramount concern. Human oversight must be integrated to ensure AI-generated content aligns with the truth and upholds the country's values and identity. Moreover, privacy concerns should be addressed when employing AI-based data analysis to

⁸¹ Ricardo Vinuesa et al., 'The Role of Artificial Intelligence in Achieving the Sustainable Development Goals', *Nature Communications* 11:1 (2020), <https://doi.org/10.1038/s41467-019-14108-y>.

⁸² Suat Gezgin, Seray Yalçın, and Ozan Evren, 'Orientalism from Past to Present, Traditional to Digital', *Advances in Media, Entertainment, and the Arts*, 2021, 1–11, <https://doi.org/10.4018/978-1-7998-7180-4.ch001>.

personalize content for target audiences.⁸³ Though by using the power of AI Pakistan can harness a multitude of opportunities to shape a better future, however when evaluating the impact of technology on society it is important to carefully find the common ground between techno-optimism and techno-pessimism.

Conclusion

By altering many areas, artificial intelligence helps in fostering economic growth and innovation. Pakistan is dedicated to progress, development, and inclusivity by utilizing AI technologies. Pakistan's favorable reputation will continue to grow as AI develops. By leveraging AI-generated content, we can captivate audience worldwide, encouraging exploration, collaboration, and investment. With AI-generated content promoting cultural heritage, tourism, and social development, Pakistan can foster international collaborations, attract investment, and boost its global reputation.

AI has the ability to significantly impact Pakistan's social sector and technological advancement. Although the nation has made considerable strides in creating its AI ecosystem, there are still a number of issues that need to be resolved. Pakistan may establish itself as a leader in AI innovation and enhance its reputation on the international scene by making investments in AI education, health, and innovation, developing helpful policies and infrastructure, and pushing AI applications that address real-world issues. The efficiency, efficacy, and accessibility of the technology transfer process have all been revolutionized by artificial intelligence, which has emerged as a transformational force in the field. Artificial intelligence (AI) has the ability to expedite innovation and promote economic growth by automating processes, enabling data-driven decision-making, and facilitating international collaborations. To ensure ethical and fair technology transfers, it is essential to address ethical, legal, and societal issues. AI's involvement in technology transfer will become increasingly important as it develops, helping to shape innovation and sustainable development in the future.

Pakistan has the chance to change its reputation using AI-driven narratives, but must be cautious of the ethical ramifications. The government of Pakistan has numerous chances to improve efficiency, transparency, and service delivery thanks to artificial intelligence. The

⁸³ Julia Glidden, Accelerating Digital Transformation in the Public Sector. [audio] (Better Innovation: Season 5, Ep. 10, 21 May 2022). <http://www.teybip.libsyn.com>.

government may improve decision-making, facilitate citizen involvement, and reduce administrative procedures by utilizing AI technologies. To achieve responsible and inclusive AI implementation, however, serious considerations, including ethical and privacy concerns, must be made.