

ARTIFICIAL INTELLIGENCE ECOSYSTEM IN PAKISTAN

A REPORT BY ATOMCAMP

atomcamp

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About Us

atomcamp is a continuous learning platform that aims to intellectually and professionally uplift Pakistan's workforce.

atomcamp hosts various courses and programs centered on tech education to upskill the Pakistani workforce and to create the awareness that continuous education is critical to keep up with the fast-paced world.

Technology Bootcamps

At atomcamp, we offer a variety of multidisciplinary courses, but our main focus is Data Science, Artificial Intelligence and Cloud Computing and Infrastructure, which are relatively new and emerging fields, especially in Pakistan. Our focus is to make careers in these fields accessible to everyone in Pakistan - regardless of the educational or professional background.

atomcamp's 6-month Data Science Bootcamp enables participants to learn relevant data skills and launch their careers. The program is meant for those who are aiming to switch into a data science career as well as those who want to incorporate data science training into their current jobs/careers to remain competitive.

Our 4-month AI bootcamp is designed to train you to launch your career in AI, regardless of the educational background. This program is designed for everyone as the first two months of AI bootcamp focus on building a foundation in Python, Math, and Machine Learning.

About the Author

This report has been authored by Mahnoor Imran Sayyed, a research analyst at atomcamp.

atomcamp

Our Mission



promote a culture of continuous learning



provide skill development for youth



encourage interdisciplinary learning



build learning communities



provide contextual & accessible knowledge

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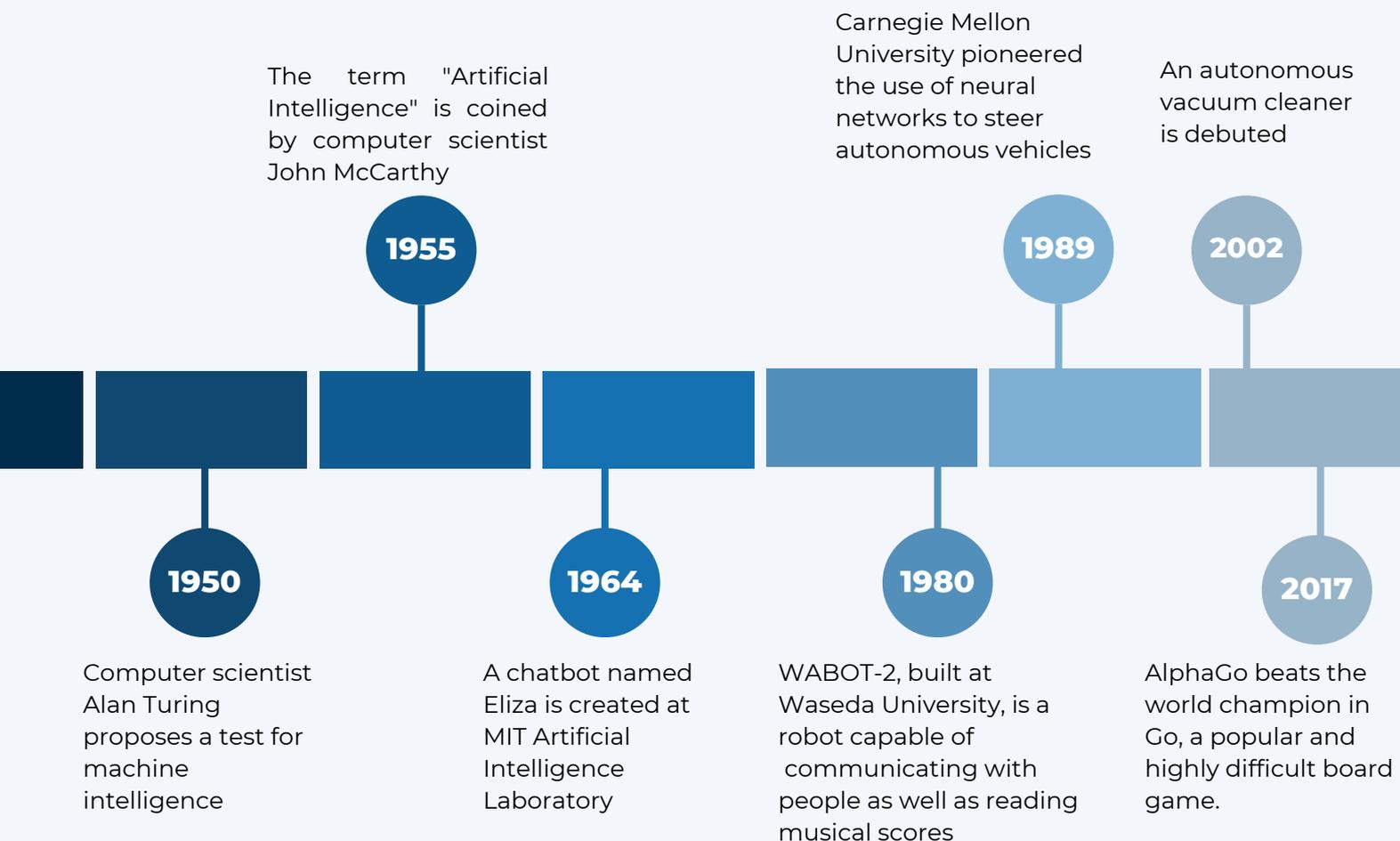
Age of Artificial Intelligence

Artificial Intelligence is a disruptive new kind of technology that has been decades in the making. This new development promises to redefine the way we interact with machines-as individuals, economies and communities. An accelerating adoption across the globe has placed artificial intelligence front and center of a global digital revolution.

Leaps Forward: Advances in AI

Artificial Intelligence has an emerging presence in our everyday lives. At an individual level, AI technologies are being leveraged to provide customized recommendations, automate routine tasks and create and curate content for millions. For organizations across the world and in Pakistan, AI represents a huge opportunity to both enhance operations and processes as well as explore new avenues and markets.

7 Decades of AI



Some Use Cases of AI

In sectors such as healthcare, artificial intelligence holds the potential to provide support in diagnosis, surgery and measurements.



In financial institutions across the world, AI can be harnessed to provide accurate forecasts of global markets, detect cybercrime and fraud transactions and make informed decisions about credit risk.



Similarly, in transport and industry, the efficient booking and deployment of resources and the automation of manual tasks such as driving via artificial intelligence is helping companies save millions.



In agriculture, AI can be harnessed to provide real time insights on areas that need irrigation, fertilizers or pesticides thereby enhancing overall productivity.



The dramatic uptake of AI by organizations both globally and in Pakistan has called for greater government oversight and involvement moving forward as AI pushes the frontier on technological development.

Artificial Intelligence: an Introduction

The undisputed buzzword of the 21st century, artificial intelligence has been hard to define, even for academics themselves. A widely agreed upon definition of artificial intelligence is one suggested by Stanford University's Nils J. Nilson and it argues that "Artificial intelligence is activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment."⁽¹⁾ However, how companies, governments and individuals define "foresight" and "intelligence" varies upon context.

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Typically, artificial intelligence can be categorized across two major markers:

The extent of human assistance

- Depending on their use, some artificial intelligence models are designed to involve humans while others function entirely independently.

The extent of adaptivity

- Artificial intelligence can also be defined based on its relative adaptivity. Certain models are capable of adjusting to and learning from their environment while others are hardwired or in other words perform their function in the specified way regardless of changes to their environment.

Categories of AI

	Human Assistance	No Human Assistance
Hardwired	<p>Assisted Intelligence These are systems that assist humans in making decisions or taking actions. Hardwired systems that do not learn from their interactions.</p>	<p>Automation This refers to the automation of routine manual tasks. This does not involve new ways of doing things – it automates existing tasks.</p>
Adaptive	<p>Augmented Intelligence AI systems that enhance human decision making and continuously learn from their interactions.</p>	<p>Autonomous Intelligence AI systems that adapt to different environments and act independently without human assistance.</p>

Source: PwC (2020)⁽²⁾

Artificial Intelligence: the Global Outlook

Globally, the artificial intelligence industry is poised to be one of the most productive and profitable industries of the 21st century. Business leaders across the world are looking to understand the potential benefits and risks of incorporating new and advanced AI technologies in their day to day operations.

Artificial Intelligence: the Global Market

\$66.8 billion

AI global funding for 2021

65

AI companies with a valuation of USD 1 Billion

\$15.7 trillion

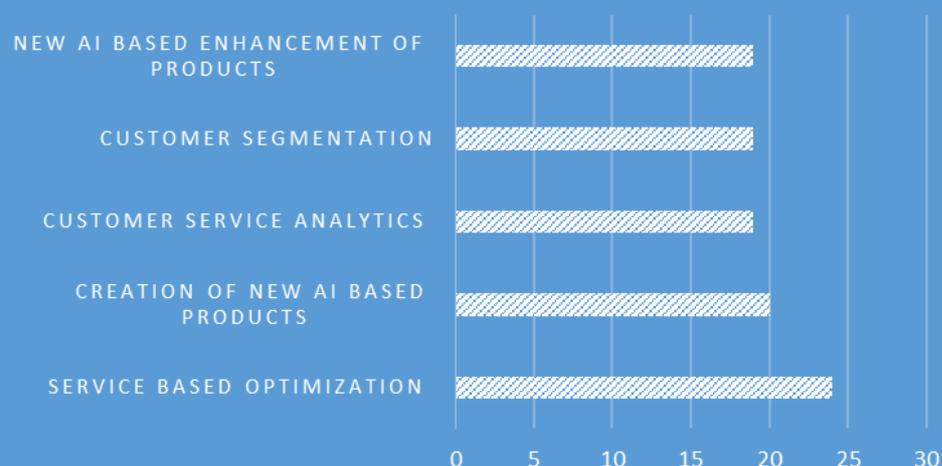
added by AI adoption to the global economy by 2030 (projected)

The AI industry is thriving across the globe. In 2021, the global market was estimated to be worth over USD 328 billion⁽²⁵⁾. Moreover, AI global funding doubled to \$66.8 billion, and a record 65 AI companies reached \$1B+ valuations⁽³⁾. Every year, an increasing number of companies adopt AI solutions. PwC predicts AI could add up to \$15.7 trillion dollars to the global GDP by 2030. Of this increase, \$6.6 trillion is likely to come from increased productivity as a result of AI solutions while \$9.1 trillion is likely to come from consumption side effects.⁽²⁾

With its development still in nascent stages, AI holds significant potential at a macroeconomic level. Currently, its applications are being explored by both developed and developing countries. While all regions are poised to benefit from the advances in AI, PwC predicts that North America and China will make up nearly 70% of the total global economic impact of the AI advances to come. Currently, these two countries also dominate in cross country collaborations for AI, according to the Stanford AI Index Report. As of 2021, the United States was the world leader in both total private investment in AI and the number of newly funded AI companies, three and two times higher, respectively, than China, the next country on the ranking⁽⁴⁾. In Europe, London is a critical hub, with AI companies employing almost 23,800 people. Singapore is also a major center for Big Tech in Asia with companies such as Google, Meta, Amazon and Microsoft having set up office. As it stands, the AI market in Singapore is valued at an estimated \$960 million with an annual CAGR of 42%⁽³⁾.

Applications of AI Across the Globe

ADOPTION (% OF RESPONDENTS)



McKinsey and Company's 2022 report on the State of AI found that adoption of AI more than doubled since 2017 from a sample of nearly 1500 companies across the globe⁽⁵⁾. Companies across a variety of sectors are recognizing the value that AI can create in different functions.

Source: McKinsey & Company (2022)⁽⁵⁾

As shown, a large proportion of companies are geared towards using AI to improve the quality of service offered as well as to enhance operations. AI gains are expected to be driven by the increases in labor productivity as well as boosted consumer side demand due to accurate and customized prediction models ⁽²⁾.

Artificial Intelligence adoption is also becoming increasingly attractive and convenient as AI becomes both cheaper and more high performing. For example, since 2018, the cost to train an image classification system has decreased by 63.6%, while training times have improved by 94.4%. The trend of lower training costs but faster training times is consistent across other categories as well such as recommendation, object detection and language processing. Furthermore, this trend holds not just for AI software but also for AI hardware with robotic arms becoming cheaper: the median price of robotic arms has decreased by 46.2% in the past five years—from \$42,000 per arm in 2017 to \$22,600 in 2021. ⁽⁴⁾

With AI becoming more accessible to organizations across the globe and its benefits apparent, companies are increasingly investing more in incorporating artificial intelligence in their functions. McKinsey and Company's report on AI found that nearly 52% of companies reported that at least 5% of their budgets went into AI solutions compared to 40% in 2018⁽⁵⁾.

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Governance & AI: the Global Landscape

As interaction with AI becomes more widespread, at both the individual and organizational level, governments have begun to take note. Artificial intelligence, its uses and its potential risks have become critical discussion points for governments across the globe.

In major hubs for AI, governments have dedicated policies and plans dedicated specifically to the AI sector and its improvement. For example, in 2019, under its AI Sector Deal, the UK government allocated £0.95 billion directly to the sector as well as £2.5 billion for an investment fund and infrastructure improvements. France also has a dedicated National AI Strategy that both dispenses funds for research and leads training programs for professionals. ⁽³⁾

Not only are governments interested in supporting the artificial intelligence industries in their respective countries, but they also actively monitor and oversee developments in the industry at large. By 2020, Canada, United Kingdom, United States, Germany, and European Union had all published reports that monitored and evaluated the implementation of their AI strategies and highlighted milestones and accomplishments ⁽⁶⁾.

The regulatory environment for artificial intelligence is also a pressing concern for governing bodies. An analysis of legislative records by Stanford University's AI Index found that in a sample of 25 countries, the number of bills containing "artificial intelligence" that were passed into law grew from just 1 in 2016 to 18 in 2021. Spain, the United Kingdom, and the United States passed the highest number of AI-related bills in 2021, with each adopting three ⁽⁴⁾. International governing organizations such as the World Bank and the UN have also actively sponsored research into how governments can create a regulatory environment for AI ⁽⁷⁾. In 2021, all member states of the United Nations Educational, Scientific and Cultural Organization (UNESCO) adopted an agreement on the ethics of AI which defined "the common values and principles needed to ensure the healthy development of AI" ⁽⁸⁾.

UNESCO's policy on the ethics of AI advocates for a more human centered AI approach and advocates for greater inclusivity in the adoption and spread of AI under the banner of "AI for all". The body shows concern not just for developments in AI but also for how the profits reaped from this technological innovation are shared amongst member states. This represents an interesting shift in thinking as it indicates that policy makers at the highest level are considering not just the adoption of AI but even the consequences of what is to come after⁽²³⁾.

UNESCO has also worked to produce guidelines on policymaking for AI with a particular focus on education and released a report titled "Artificial Intelligence & Education: Guidance for Policy Makers."⁽²³⁾



22

median age of the Pakistani population



25,000

engineering & IT professionals produced every year



600 000

individuals employed by the IT sector in Pakistan



2600

AI related publications in Pakistan from 2016-2020



4th

the position of Pakistan's freelance market in terms of growth

Artificial Intelligence: the Pakistani Context

The age of artificial intelligence represents a huge opportunity for Pakistan which houses one of the largest population in the world. Organizations of all scales across various industries are both adopting AI in their day to day operations and providing AI centric services to third parties. The Government of Pakistan has also recognized the need to regulate the current artificial intelligence landscape, taking steps to nurture the growing need and demand.

Human Capital Perspective

With a median age of 22⁽⁹⁾, the population of Pakistan is a dynamic powerhouse of labor and there is some indication in current labor market trends that this potential of AI is already being realized. According to the Government of Pakistan⁽¹⁰⁾, the country produces over 25,000 IT professionals and engineering graduates every year. 600,000 professionals are currently employed by the IT sector and are engaged with AI directly or indirectly. Trends in academia also indicate the growing importance of AI with educational institutions around the country, engaging students and conducting extensive research into artificial intelligence. Between 2016 and 2020, 2600 AI centric publications were credited to Pakistan⁽²⁴⁾. Some universities such as FAST⁽²⁹⁾, COMSATS⁽²⁸⁾, SZABIST⁽¹¹⁾ and GIKI⁽¹²⁾ even offer dedicated bachelors programs in artificial intelligence. Pakistan also hosts a huge freelancing market that operates both in domestic and international spheres. According to the Government of Pakistan, in 2019-2020, the freelancer market earned a total of USD 150 million and ranked 4th globally in terms of growth. The most popular services provided by these freelancers include web development, logo designing and programming-all IT related services that are bound to involve some interaction with AI-if not currently then in the future⁽¹⁰⁾. From a human capital perspective therefore, Pakistani professionals are already extensively involved with the wider tech ecosystem and it is a growing industry in the country.

Artificial Intelligence Market in Pakistan

In Pakistan, a majority of AI-related work is done through IT exports as use cases and products that are developed for international third party users.

According to Pakistan Vision 2025 and the Digital Policy of Pakistan 2018, the ICT industry size is targeted to reach \$20 billion by 2025 ⁽¹⁵⁾. Pakistan has a flourishing IT sector with IT exports exhibiting an 18% year on year growth. IT remittances are growing exponentially, with exports valued at USD 2.1 billion ⁽²⁷⁾. Of these exports and remittances however, a large majority is concentrated in providing low end services as opposed to high end services in AI and Machine Learning ⁽¹⁶⁾.

In 2021, Pakistani tech-based startups also received \$278 million in funding ⁽¹⁷⁾. This indicates that there is also considerable promise in upcoming start-ups that could potentially use and provide AI centric solutions to consumers.

- ➔ **USD 2.1 billion in exports**
- ➔ **18% YoY growth of IT exports**
- ➔ **4% contribution of IT sector to GDP**
- ➔ **12000+ IT companies in Pakistan**

Source: P@sha Website ⁽²⁷⁾

Players & Use Cases

Pakistan is home to a number of different organizations-businesses, research groups and so on- that are looking to work with AI, either directly or indirectly. Companies are providing AI based solutions and creating AI products to solve problems for consumers and organizations.



Serving more than 120,000 companies all over the world in several different industries including trucking and logistics, passenger transit, delivery, field service, and agriculture, Motive provides AI powered applications to its consumers for tasks such as equipment and vehicle tracking and automation of day to day operations.



Addo AI

Addo is a global AI consulting firm that serves clients to create state of the art solutions using deep learning, artificial intelligence and data engineering. With an impressive docket of clients, from Visa to IFC, Addo has worked across a variety of industries and geographies. One of their projects with a large global retailer entailed creating an AI engine that precisely forecasted demand and suggested improvements on inventory management ⁽²¹⁾.



Team Urban Tech LUMS

A research group based in LUMS, Lahore, Team Urban Tech works to provide data centric solutions to existing issues in urban communities. A recent project they undertook was a traffic analytics application that used AI models to track and extract images of specific vehicles for further checks. Similarly, the team has also worked on route optimization for rescue 1122 and greens space analysis for urban communities. Such systems can be employed at scale to create smart cities ⁽¹⁸⁾.



Computational Biology Research Lab

Based in FAST University, the Computational Biology Research Lab is a research group that works with computer algorithms and AI to solve biology related problems. Most recently, the team has won grants to explore new technologies such as an AI powered cancer diagnostic tool and digital pathology.



affiniti

A unicorn valued at USD 1.6 billion⁽²⁰⁾, Affiniti is a major player in Pakistan's budding AI market. Based in the US, Affiniti provides an AI service that uses data points on customer needs and trends to enhance the quality of their client's customer service. Using a "Pair Better" philosophy, Affiniti's AI can match customer service agents to customers and ensure that their client organization benefits from an improved brand perception.



Jazz

Though originally a telecom player, Jazz has also ventured into the field of AI centric solutions. The Jazz Business Solutions vertical of the organization provides a host of AI and IoT (Internet of Things) based solutions to organizations such as managing and tracking the attendance & engagement of employees in the corporate sector and managing and monitoring traffic vehicles. In this area, Jazz has partnered with a number of organizations such as Microsoft, Oracle, Dell & ZTE.



baseH

Valued at USD 4 million⁽¹⁹⁾, BaseH is a Pakistani startup that has developed the first of its kind AI news writer called Dante. Dante can work as a robotic news writer of sorts and generate content on a variety of topics from international news to stocks to sports. On the back end, Dante creates content by using data from all across the internet and uses Natural Learning Processing (NLP) to put together content seamlessly.

Governance & AI: the Pakistani Context

In order to bolster the growing AI market and ensure that a proper regulatory framework is put in place, the government of Pakistan and the private sector have taken some notable steps. To begin with, the government has helped set up institutions such as the Presidential Initiative for Artificial Intelligence & Computing (PIAIC), National Center of Artificial Intelligence (NCAI) and Sino-Pak Center for Artificial Intelligence (SPCAI). Similarly, the Pakistan Software Export Board has launched its Tech Destination platform which creates awareness and promotes Pakistani exports abroad. These institutions provide a range of services from organizing trainings and fellowships to mentoring AI centric startups and providing seed money.

In terms of infrastructure, the Special Technology Zone Authority (STZA) was established in 2021 with the goal of providing technology destinations for business through zone development. Incentives provided to businesses in designated zones allow for IT companies to operate smoothly and catapult their growth. Currently, 7 such zones have been established by the STZA all over Pakistan, from Haripur to Lahore. Moreover, the government is also dedicated to setting up a regulatory framework for AI companies through a comprehensive National AI Policy which is soon to be launched by the Ministry of IT & Telecom⁽¹³⁾.

However, there are some key challenges to be addressed in terms of the governance of the AI ecosystem in Pakistan. To begin with, the government needs to ensure that complementary industries such as the financial sector and academia are up to date with the needs and requirements of the AI companies in Pakistan. Secondly, it is also critical to ensure that the local industry prepares and facilitates AI adoption for Pakistani organizations and use cases as well as exporting their services. Finally, if the AI sector in Pakistan is to flourish, it is critical that the legal framework for the regulation of AI is comprehensive. For example, Pakistan's IPO office is currently not designated to file AI patents. Pakistan's government currently ranks 92 out of 172 on Oxford Insight AI Readiness Index 2022 ⁽¹⁴⁾ and in order to ensure that the country is able to capitalize on the global demand for AI, it is critical that this situation is remedied.

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While the services side of Pakistan's artificial intelligence capabilities is emerging strong, we need to bolster the AI product side as well and ensure that our exports are best positioned in the international trade market

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**Hamza Saeed Orakzai
(STZA)**

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There needs to be a greater push for trainings and public and private partnerships between the government and various stakeholders to create an attractive ecosystem and talent pipeline for companies working in AI.

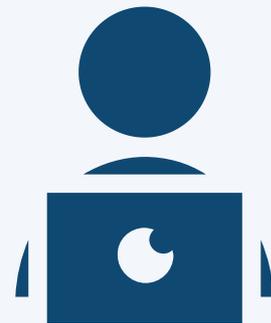
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Hussain Shahbaz (Data Science Expert)

AI Policy Considerations for Pakistan

For the People

In order to ensure that the talent of Pakistan is well positioned in the international trade market, it is critical that the government and all associated parties collaborate to ensure that a robust talent pipeline is in place. Moreover, it is important that the talent in Pakistan is appropriately trained to work in and adopt to a dynamic ecosystem. Universities need to collaborate with the private sector to ensure that proper technical training in ML & Deep learning is offered to students as a core course. The government also needs to support ed-tech platforms that are available for professionals in the industry to upskill and reskill.



For the Organizations

To bolster organizations working with AI, the government needs to promote the ease of doing business in such a field. This can be done by ensuring the availability of the internet and creating infrastructure such as co-working spaces. Moreover, the government also needs encourage AI adoption across industries to ensure that companies across various sections and industries are able to fully utilize AI. The government can also facilitate organizations by improving the processes around registering patents and receiving payments from abroad.



For the Ecosystem

The needs of the ecosystem at large must also be considered. To ensure that Pakistan is able to house a thriving AI industry, there must be greater dialogue between the private and public sector. The government must make the necessary investments through funding so that relevant opportunities are pursued. Moreover, there also needs to be a focus on research and monitoring. The impact of laws and policies put in place related to AI and IT must be mapped to so that the government has accurate information about the ecosystem. Finally, the government also needs to ensure that the needs of the fast-growing freelance market of Pakistan which is sure to be a critical player in the AI ecosystem is taken into consideration in all policies.



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