PRAXIS GLOBAL ALLIANCE

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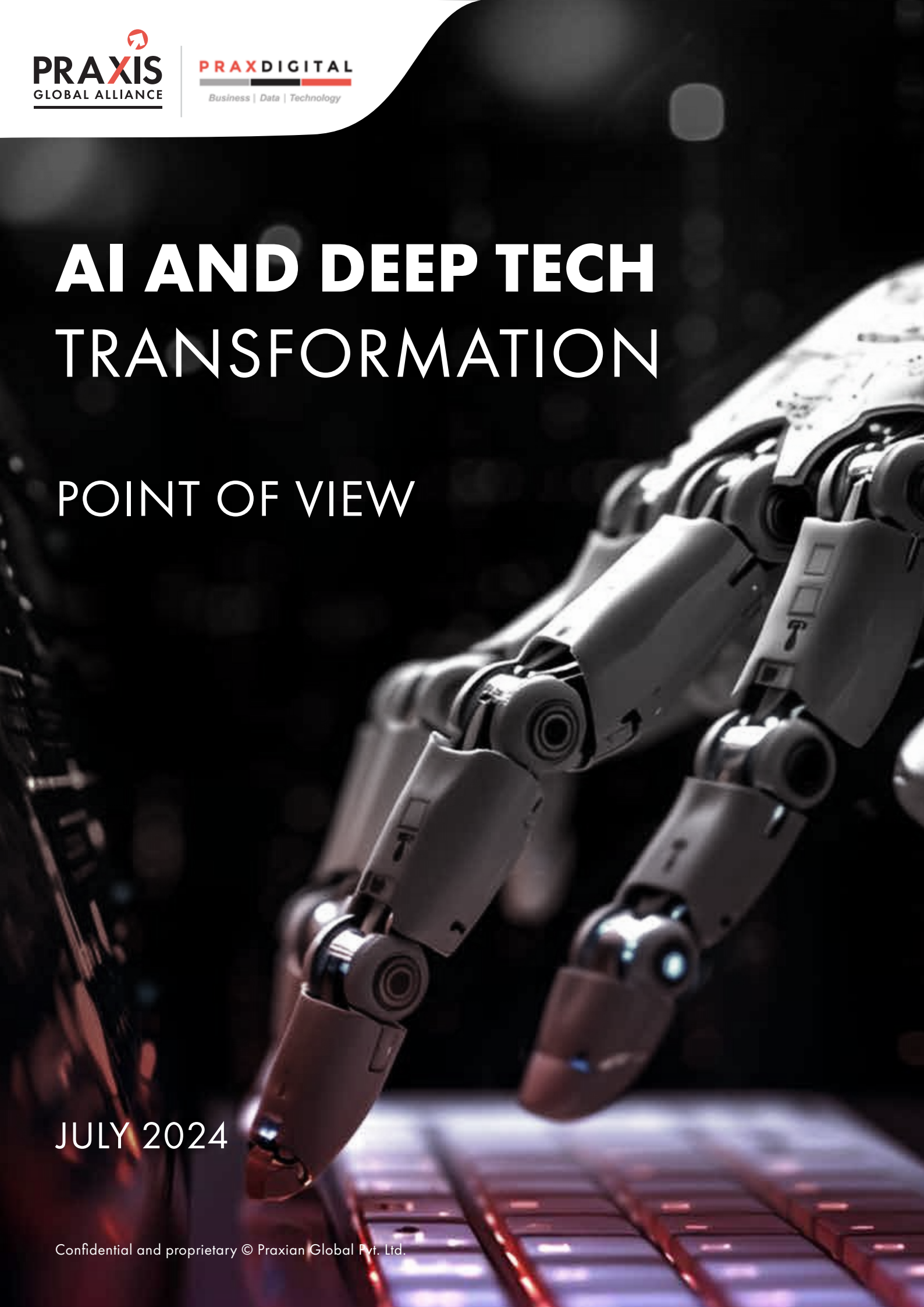
AI AND DEEP TECH TRANSFORMATION

POINT OF VIEW



JULY 2024

Foreword

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The shift towards AI and Deep Tech solutions is no longer a futuristic vision but an imperative reality. Today, AI and Deep Techs such as robotics, blockchain, and others which were considered science fiction not so long ago are being implemented in almost every phase of life. Positioned at the forefront of this technological revolution, these technologies are a force capable of engineering next-generation solutions for the problems mankind has been facing for decades and thus transforming our lives significantly.

The impact of AI and Deep Tech extends beyond just technological advancements, it is transforming industries and revolutionizing work, changing the way businesses operate. It is poised to have a major impact on companies by reducing their average lifespan with accelerated rate of innovation making older companies obsolete and is also anticipated to cause a substantial job churn of around 24% across various industries, highlighting the underlying potential which they possess.

Delving into India's AI and Deep Tech landscape, we unveil a flourishing ecosystem with several start-ups emerging in every domain. These start-ups, with their extensive research and development efforts, are reshaping the entrepreneurial landscape and outperforming conventional start-ups by unlocking exponential value. These efforts have not gone unnoticed, and in India this sector is being characterized by cutting-edge solutions and witnessing a surge in investments, emulating the boom seen in the e-commerce sector in the mid-2010s. Moreover, the report also offers insights into the forces propelling this transformative journey, like government schemes and academic institutions that are supporting these ventures and nurturing a thriving ecosystem.

This report also comprises of a comprehensive deep dive into the practical applications of these technologies across industries, from agriculture to automobile, consumer goods, and more, it becomes evident how AI and Deep Tech can potentially redefine each segment of the industry's value chain. This sets the stage for a future where technology seamlessly transforms company systems and processes to make them more efficient and unlock value.

As the world undergoes a profound transformation, it is imperative for all stakeholders to comprehend the implications and act decisively. This report aims to provide a clear roadmap, demystifying the path ahead for founders of AI and Deep Tech ventures, investors, industry leaders, and other enthusiast who are anticipating to enter the space.

Glossary of terms

Acronym	Description
3D	Three Dimension
AR	Augmented Reality
BCI	Brain Computer Interface
CAGR	Compound Annual Growth Rate
CNC	Computer Numerical Control
Cobot	Collaborative Robot
CoE	Centres of Excellence
CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
DNA	Deoxyribonucleic Acid
ESG	Environmental, Social and Governance
FY	Financial Year
GTM	Go-to-Market
IIIT	Indian Institute of Information Technology
IIT	Indian Institute of Technology
IoT	Internet of Things
ML	Machine Learning
mRNA	Messenger Ribonucleic Acid
NDTSP	National Deep Tech Start-up Policy
NFT	Non-Fungible Token
NGIS	Next Generation Incubation Scheme
PE	Private Equity
QR	Quick Response
R&D	Research and Development
SFCL	Superconducting Fault Circuit Limiters
VC	Venture Capital
VR	Virtual Reality

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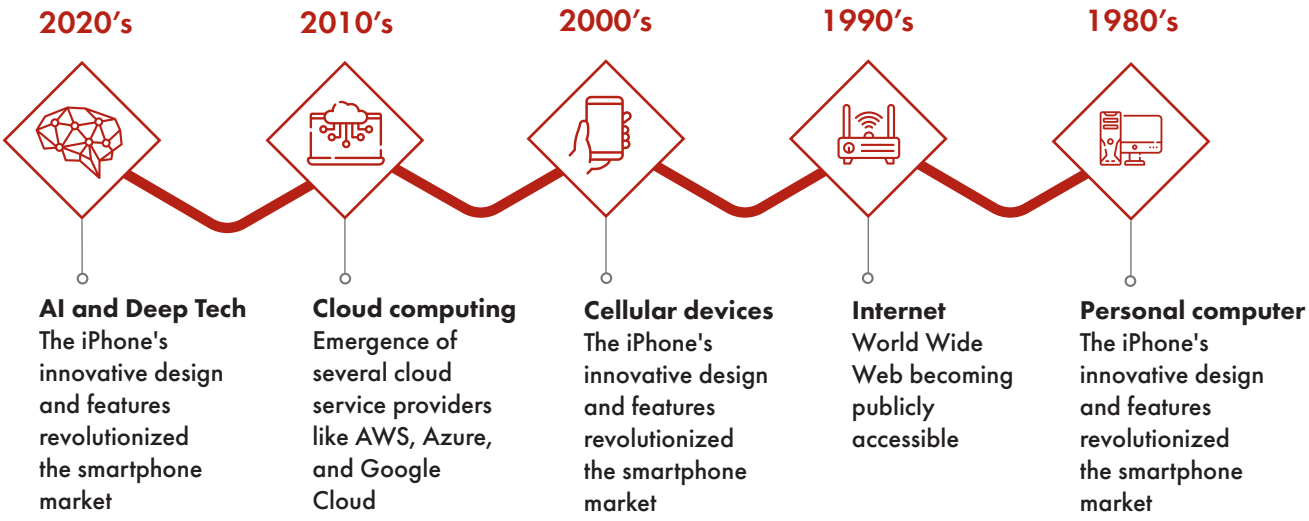
Introduction

In the current decade, we are witnessing rapid advancements in technological evolution with the advent of AI and Deep Tech. Amid recent advances, Deep Tech has risen from a term unknown to anyone in the 2010s to one of the primary solutions for complex world problems and a catalyst for transformation, along with AI.

Technological innovation is an unstoppable force that has sparked waves of disruption, transformed industries, and redefined the way businesses operate. Over the past four decades, we have witnessed the rise of personal computers in the 1980s, the reshaping of connectivity in the 1990s due to the global proliferation of the internet, the domination of ubiquitous cellular devices with unprecedented computing power in the 2000s, and the sweeping adoption of global-scale data storage and access through cloud computing in the 2010s.

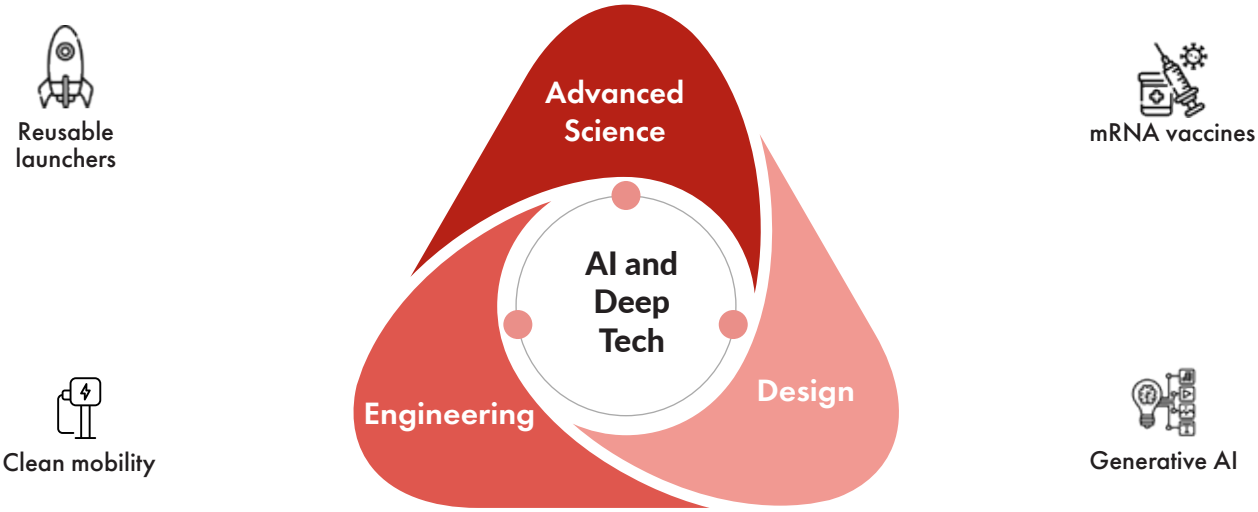
Exhibit 1.1

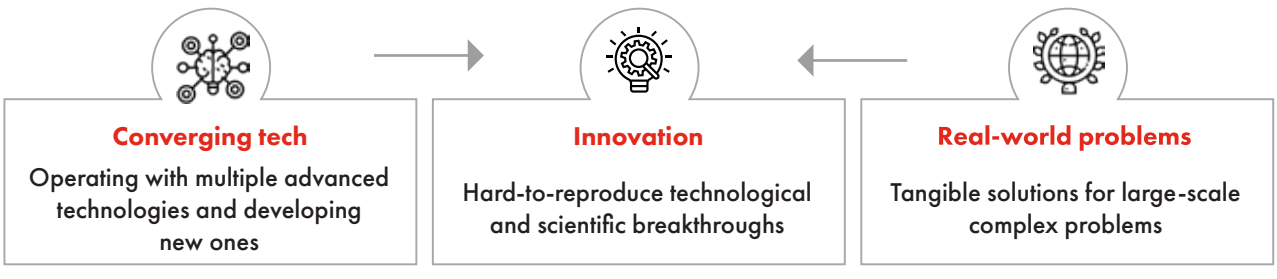
We are stepping into a new era of technology, spearheaded by AI and Deep Tech



Innovations are converging and shaping Deep Tech breakthroughs aimed at solving real-world problems

Deep Tech lies at the centre of innovation





Source(s): Praxis analysis

Now, in the current decade, AI and Deep Tech are leading the next wave of technological transformation. Unlike previous technologies, these are poised to be much more impactful as they lie at the intersection of science, engineering, and design. These technologies help companies transform their operations across the entire value chain, from production efficiency to customer fulfilment. New technologies are constantly emerging in this space, driven by investments in R&D and advancements in fundamental sciences.

Innovation is the watchword in AI and Deep Tech, serving as the cornerstone that propels advancements and new technologies. This transformation is driven by the convergence of scientific solutions developed with emerging technologies and with the objective of addressing real-world challenges. This relationship ensures purpose-driven technological advancements that address a wide range of critical issues, including but not limited to environmental sustainability and cybersecurity.

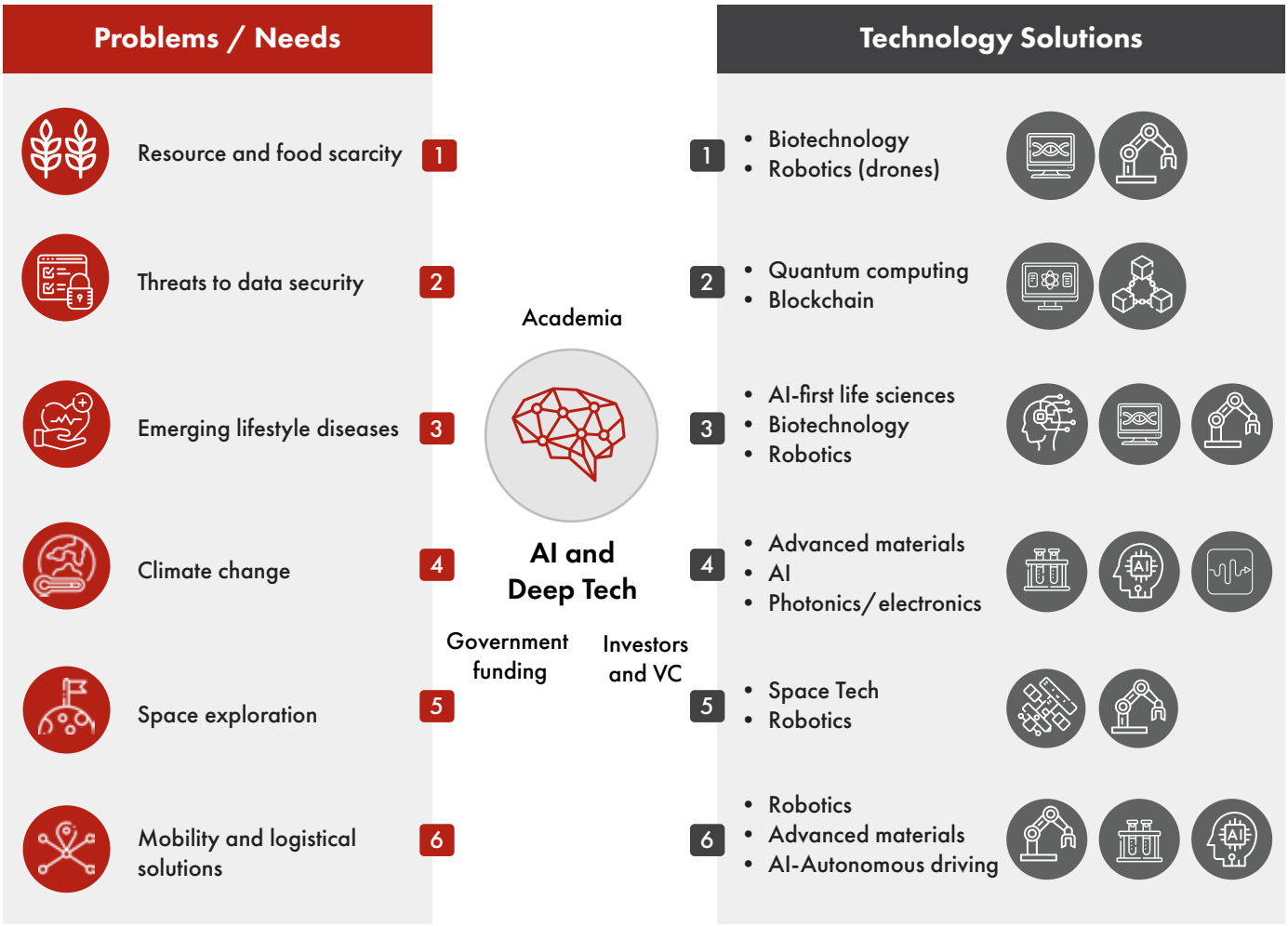
We are all at the beginning of a journey to understand AI and Deep Tech's power, reach, and capabilities. The potential is driven by the fusion of advanced scientific principles, innovative design concepts, and cutting-edge engineering. This interdisciplinary collaboration ensures that AI and Deep Tech solutions are not merely theoretical but also practical, effective, and scalable. In the process, this could unlock exponential value across sectors from banking to healthcare while addressing the world's most pressing challenges.

"A new dawn of complex challenges await humanity in the next two decades; AI and Deep Tech have the potential to engineer next generation solutions for a brighter future."

While grappling with the complex challenges of the modern world, AI and Deep Tech solutions emerge as promising avenues for transformative change, such as addressing the concern of resource and food scarcity. Conventional agricultural practices often fall short in providing sustainable solutions. However, the integration of biotechnology and robotics, particularly drones, holds the promise of revolutionizing farming practices, ensuring efficient resource utilization and bolstering food production to meet global demands.

Exhibit 1.2

AI and Deep Tech have the potential to engineer next generation solutions for a brighter future



Source(s): Secondary research and Praxis analysis

Moreover, the escalating threats to data security and sensitive information pose a significant risk to individuals and organizations alike. The rise in cyber-attacks which includes large scale Denial of Services (DoS), credential stuffing, data breaches, etc, are becoming more and more common. It is estimated that approximately 300 billion passwords are to be at risk annually, which further underscores the severity of the issue. Traditional cybersecurity methods primarily focus on perimeter defense, firewalls, and encryption, but they are reactive and struggle to keep pace with the evolving sophistication of cyber threats. Employing blockchain and quantum computing, presents an advanced defense mechanism, offering unprecedented levels of security that can withstand evolving cyber threats. The decentralized security of blockchain, coupled with the computational power of quantum computing, provides a robust defense against the escalating risks to sensitive information.

Another area of concern is the rise in lifestyle diseases, which pose a significant challenge to healthcare infrastructure. Diabetes and cardiovascular disorders have reached alarming proportions, with the latter being the cause of death for approximately 17.9 million people each year. AI and Deep Tech solutions, including AI-first life sciences, biotechnology, and robotics, emerge as alternative or enabling tools to traditional healthcare systems, which often adopt a one-size-fits-all approach, lacking the personalized and data-driven insights required for prevention or treatment. AI and Deep Techs enable personalized healthcare solutions, leveraging data analytics for intervention and precise treatment, thereby addressing health issues before they become critical.

AI and Deep Tech also have the potential to help us tackle the challenges posed by climate change. Earth's average temperature has increased by approximately 1.2°C over the past century, and we need urgent solutions to halt this increment. Methods adopted for combating climate change are often time-consuming and face challenges in delivering swift, impactful solutions. The urgency to address climate-related issues necessitates the implementation of innovative AI and Deep Tech solutions that offer rapid and transformative responses to mitigate the adverse effects on our planet. Advanced materials, AI, and photonics/electronics can collectively contribute to a multifaceted response. AI aids in climate modelling and prediction, advanced materials support sustainable practices, and photonics/electronics play a crucial role in monitoring environmental changes.

Space, the vast unknown, remains a key area of fascination. To explore this final frontier, 77 countries have developed space programs, with 16 having launch capabilities and three having sent humans into space. However, space travel remains highly expensive and controlled by a few giants, with no active travel plans currently. This presents an opportunity for private innovation to offer cost-effective solutions. Another major challenge hindering space exploration is space debris, with 35,150 tracked objects and an estimated 130 million smaller, untraceable pieces. Traveling at over 25,000 kilometers per hour, this debris can cause catastrophic collisions. This problem not only hampers exploration but also poses serious risks to Earth's atmosphere, necessitating advanced solutions like satellite debris removal services and collision-avoidance software to address these threats and protect the environment.

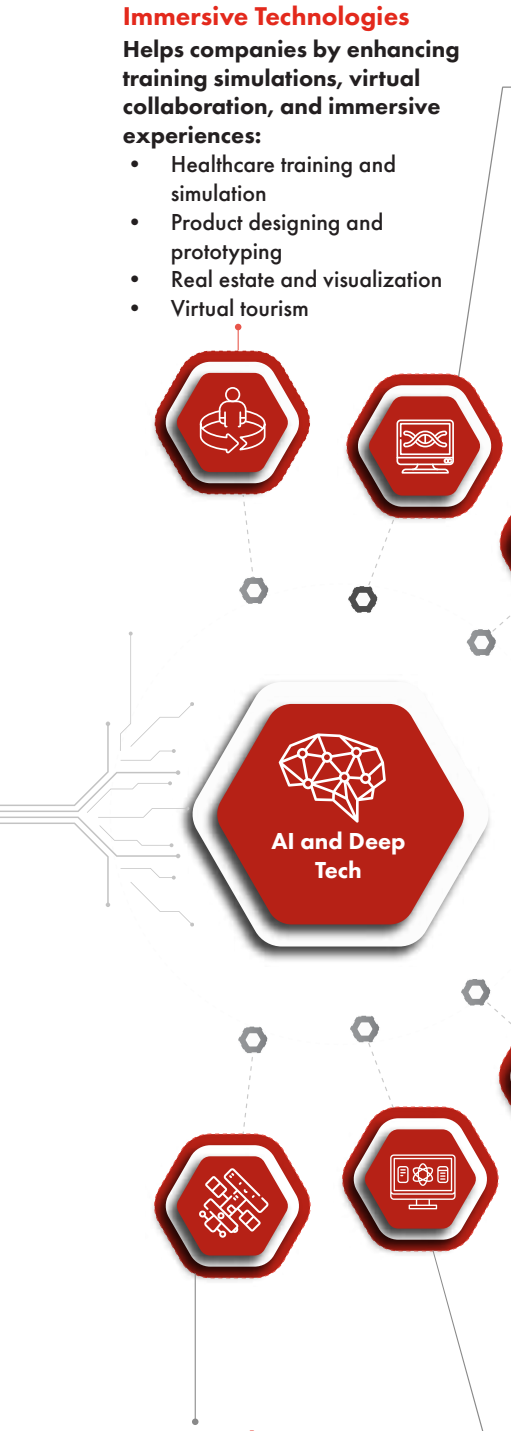
Furthermore, mobility and logistical challenges present a complex web of issues, with conventional solutions not being able to root out inefficiencies. Robotics, advanced materials, and AI-driven autonomous driving solutions promise to redefine how we navigate and transport goods. This vision aims for a future where our transportation is efficient, safe, and sustainable, solving today's problems with innovative solutions.

1.1

Key themes enabling AI and Deep Tech ecosystem

Exhibit 1.1.1

9 pioneering themes at the forefront of AI and Deep Tech Transformation



Immersive Technologies

Helps companies by enhancing training simulations, virtual collaboration, and immersive experiences:

- Healthcare training and simulation
- Product designing and prototyping
- Real estate and visualization
- Virtual tourism

Biotech

Combining biology and technology to create products, medicines, and solutions

- Cultivated meat
- Modified crops
- Bio-fuels and bio-chemicals
- DNA synthesis
- Tissue printing

AI / ML

Simulating human intelligence to automate tasks, personalize experiences, innovate

- Generative AI
- Privacy-preserving AI
- Explainable AI
- Autonomous driving
- General purpose AI

Robotics

Design, construction, and use of machines to automate tedious tasks

- Collaborative robotics
- Humanoids
- AI Robots/Cobots
- Drone exploration
- Surveillance and transportation

Photonics/electronics

- **Photonics entails the use of lasers,** optics, fiber optics, and electro-optical devices
- **Electronics, make use of electrons' power**
- These are used to develop technologies like **light-based communication, advanced semiconductors, IoT,** etc.

Blockchain

A distributed ledger that stores a history of transactions in a secure and transparent way

- Infrastructure (scaling solutions & cryptography)
- Decentralized finance and smart contracts
- NFTs

Advanced Materials

Specifically engineered materials that exhibit enhanced properties & confer superior performance

- CO_2 negative materials
- Bio-plastics
- Synthetic diamonds
- Nanostructure and Graphene

Space Tech

Space Technology is application of science and engineering to conduct operations beyond Earth's atmosphere

- Reusable and next-gen rockets
- In-space transportation
- In-space manufacturing
- Debris removal

Quantum Computing

Harnessing quantum mechanics for exponentially faster data processing:

- Quantum computing
- Quantum cryptography
- Quantum communications
- Micro and nanoelectronics
- Brain computer interface

Source(s): Secondary research and Praxis analysis

1.1.1 AI/ML

Artificial intelligence (AI) and machine learning (ML) have become transformative forces, deploying algorithms and systems that emulate tasks once exclusive to human capabilities. The evolution of Generative AI, which empowers machines to autonomously create new content, is showcasing ingenuity in fields like art and textual generation. Its capabilities include generating realistic and coherent text, producing high-quality images and art, and creating human-like conversational responses. Privacy-preserving AI is another dimension, emphasizing the importance of safeguarding sensitive information while harnessing the potential of AI. Many AI technologies, such as Enterprise AI, Explainable AI, and Generative AI, have matured and are ripe for disruption. This maturity is characterized by their advanced capabilities, increased reliability, and widespread applicability. The ascent of AI-augmented workflows and automated content creation is disrupting industries and unlocking hyperproductivity. LLM-based Generative AI holds the potential to enhance business operations by automating customer service interactions, generating insightful data analytics reports, and facilitating content creation. ChatGPT by OpenAI, Gemini by Google, and Llama 3 by Meta are among the most popular LLMs that have brought AI capabilities to the masses.

1.1.2 Robotics

The fusion of design, construction, and automation has given rise to diverse applications of robotics. Collaborative robotics, exemplified by cobots, demonstrates the synergy between humans and machines across workspaces. Humanoids, with human-like features, have expanded the boundaries of robotics, while AI Robots and Cobots embody the fusion of AI with physical automation. Drone exploration further extends the capabilities of robotics, offering unprecedented perspectives and functionalities. Most robotics technologies currently find themselves in the ripe-for-disruption phase along the innovation S-curve, poised to automate tasks with increasing use cases across sectors such as surveillance, agriculture, surgeries, and prosthetics, industrial tasks, etc.

1.1.3 Photonics/electronics

Photonics, which involves generating, controlling, and detecting light through lasers, optics, fiber optics, and electro-optical devices, contrasts with electronics that harness electrons. Both fields work in coherence for developing technologies like light-based communication, advanced semiconductors, and the Internet of Things (IoT). Photonics contributes to innovations in telecommunications, medical imaging, and quantum computing, enabling faster data transmission, high-resolution imaging, and quantum technologies.

1.1.4 Blockchain

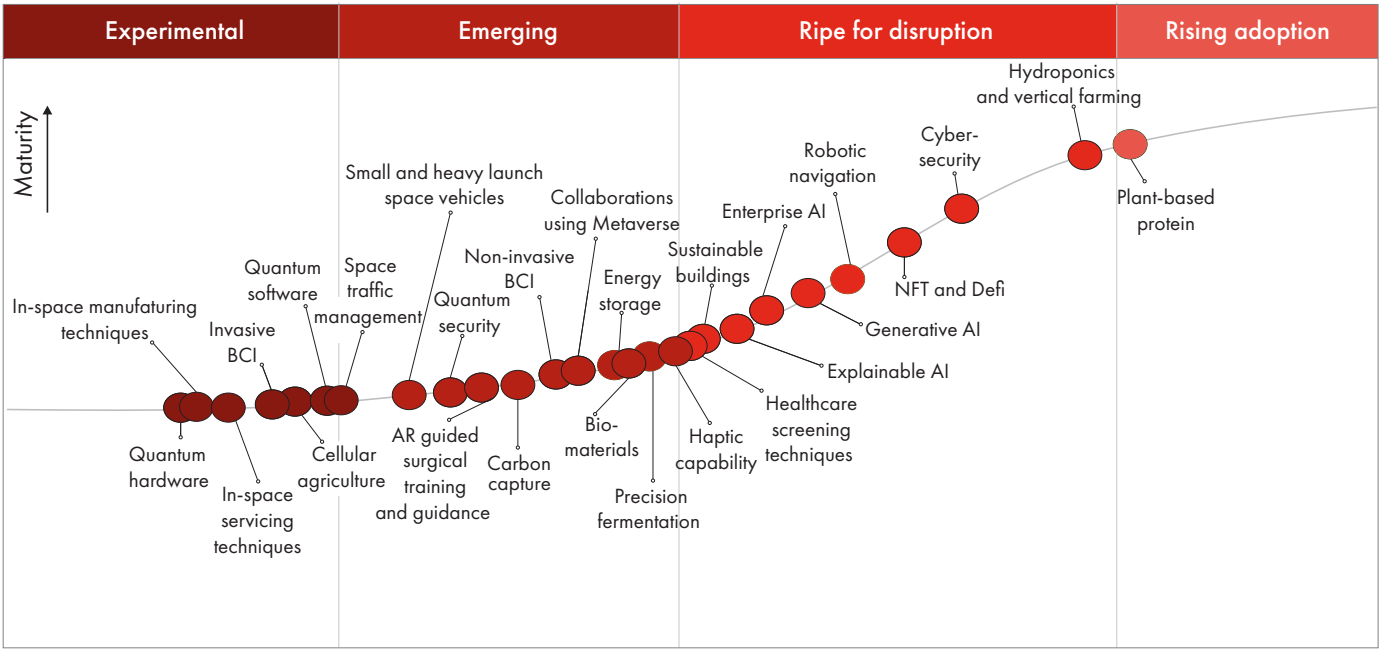
Blockchain is a decentralized ledger technology that securely and transparently records transaction histories, rendering them immutable. Its applications span various domains, including infrastructure, offering solutions for scaling and cryptography. In decentralized finance, blockchain enables innovative financial solutions, while smart contracts automate and secure contractual agreements. Another offshoot of blockchain, non-fungible tokens (NFTs), has gained prominence in the digital art and collectibles space, facilitating unique digital assets with verifiable ownership.

1.1.5 Advanced materials

Advanced materials represent a frontier in materials science, involving the engineering of substances and materials to exhibit enhanced properties and confer superior performance. CO_2 negative materials, a subset of advanced materials, contribute to sustainable solutions by actively capturing and reducing carbon dioxide emissions. Bioplastics introduces environmentally friendly alternatives to traditional plastics, while synthetic diamonds exhibit exceptional hardness and conductivity. Nanostructures like graphene, with remarkable strength and conductivity properties, hold promise for applications in electronics, energy storage, and materials science, showcasing the breadth of possibilities within advanced materials.

Exhibit 1.1.2

Technologies along the innovation s-curve



- **BCI is evolving** from analysis of brain signals to modulating brain activity for medical and commercial applications
- **Advancements in quantum hardware** and software are decreasing error rates and increasing computing
- **Space tech is witnessing reduction in cost of launches** and rising need of in space servicing & manufacturing

- **Gene editing technologies** are forging cures to diseases that have plagued humanity for centuries
- **Rising competitiveness of carbon negative materials** to regular ones
- Market is preparing itself to **quantum cryptic** standards
- **Supercapacitors & Li batteries** leading to high performance energy storage

- **AI augmented workflows and automated content creation** are disrupting industries while unlocking hyperproducitivity
- **Vertical farming** and cultivating crops **in internally controlled environments**
- **Tokenization of assets** and streamlining trades through **smart contracts**
- Robotics **automating tasks** with increasing use cases across sectors specifically in **surgeries and prosthetics**

- **Plant based proteins** and dairy products are seeing **wide scale adoption**

1.1.6 Quantum computing

Quantum computing represents a paradigm shift in computational capabilities, harnessing quantum-mechanical phenomena to perform complex computations. Researchers and companies are exploring applications ranging from solving intricate mathematical problems to simulating quantum systems. Quantum cryptography secures communication, offering encryption methods resistant to classical cryptographic attacks. Quantum communications further extend the possibilities for secure and efficient transmission of information.

1.1.7 Space tech

Space tech encompasses technologies applied to operations beyond Earth's atmosphere. Reusable rockets, a hallmark of space tech, aim to reduce launch costs and increase accessibility to space. In-space transportation systems facilitate the movement of payloads and personnel within space environments. In-space manufacturing explores the possibility of constructing structures and producing materials directly in space, minimizing the need for Earth-based resources. Space tech is revolutionizing weather forecasting and rainfall prediction, enabling more accurate and timely agricultural planning. Additionally, satellite-based internet services like Starlink offer high-speed connectivity in remote areas, facilitating access to crucial information across the globe.

1.1.8 Immersive technologies

Immersive technologies hold potential to transform people's perception of and interaction with various sectors. In healthcare, advanced simulations and training modules allows practitioners to hone their skills in lifelike scenarios without real-world risks. Product designing and prototyping can become more efficient and creative, as virtual models can be manipulated and tested in real-time, reducing the need for physical prototypes. Real estate can see a shift in visualization techniques, enabling potential buyers to explore properties through immersive virtual tours, making the decision-making process more informed and engaging. Similarly, virtual tourism allows individuals to experience distant locations intimately, enhancing their understanding and appreciation without physical travel.

1.1.9 Biotech

Biotech or biotechnology involves the application of biological processes for industrial and scientific purposes. Cultivated meat represents a sustainable alternative to traditional animal agriculture, providing a resource-efficient and ethical approach to meat production. Modified crops showcase genetic engineering to enhance traits such as yield, resilience, and nutritional content. Bio-fuels and bio-chemicals harness biological processes to produce sustainable alternatives to conventional fuels and chemicals. DNA synthesis and gene editing involves the manipulation of DNA sequences, enabling advancements in fields like synthetic biology and genomics. Tissue printing utilizes bioprinting technologies to create functional biological tissues for medical and research purposes, ushering in new possibilities for regenerative medicine.

1.2 Impact of AI

The rise of AI and Deep Tech transformation signifies a crucial and major change, reshaping the business landscape and challenging the conventional norms that have defined industries for decades. This wave of technological advancement is projected to shorten the average company lifespan to approximately 14 years, reflecting the accelerated pace at which businesses must adapt and evolve to remain competitive in this dynamic environment. Simultaneously, the impact of this transformation is anticipated to cause a substantial job churn of around 24% across various industries.

Moreover, these frontier technologies stand out as the leading macrotrend driving disruption, impacting a staggering 86% of companies across sectors and disrupting approximately 83 million jobs by 2027, as reported by the World Economic Forum. A comprehensive analysis suggests that automation will touch upon 2,000 work activities spanning 800 professions, emphasizing the breadth of occupations affected by these shifts.

As industries undergo a profound transformation, the human workforce faces a paradigm shift, with around 40% of workers estimated to require reskilling to adapt to the evolving demands of the job market. This necessitates a strategic approach to workforce development and skill acquisition to align with the requirements of an increasingly technology-driven economy.

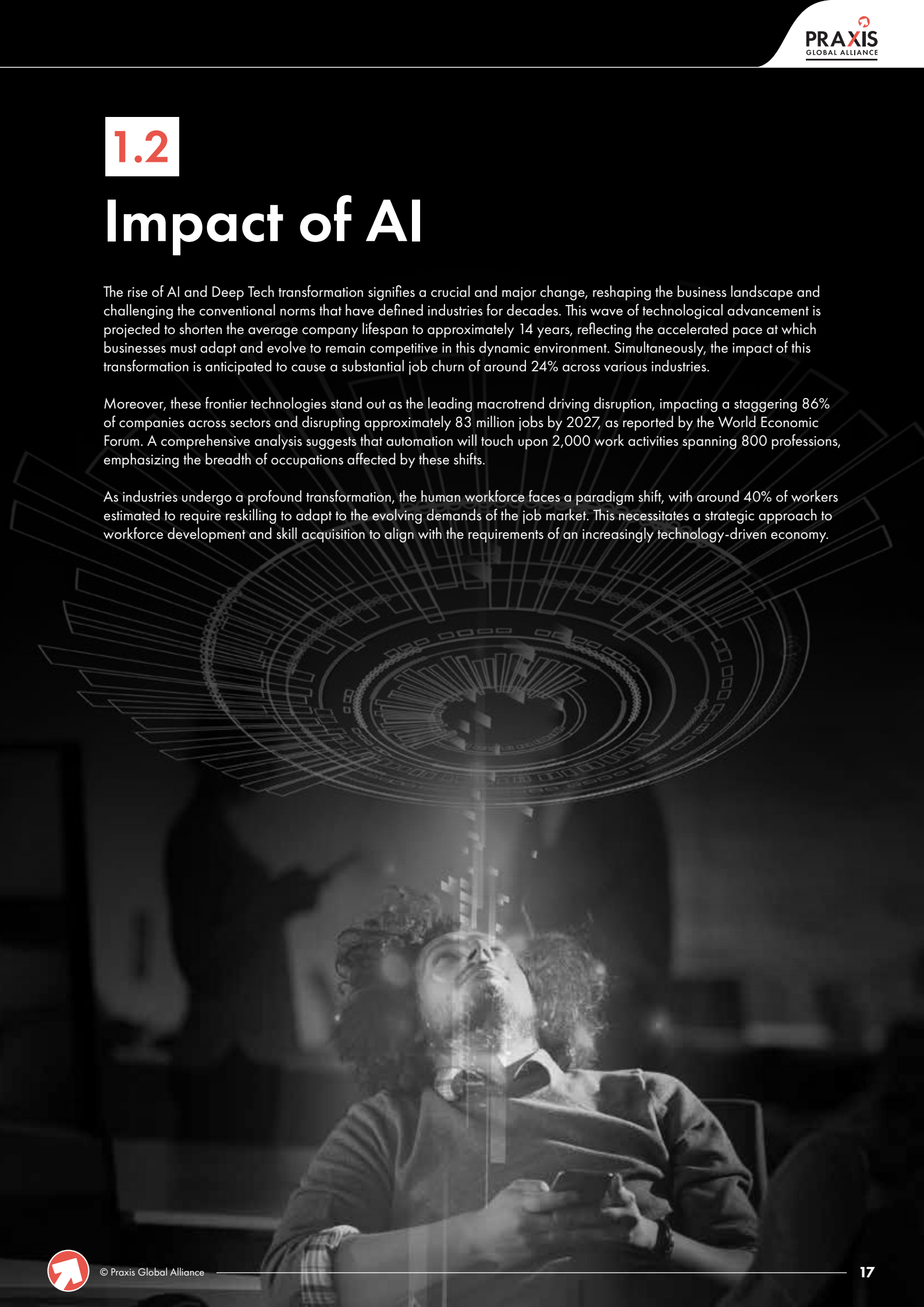
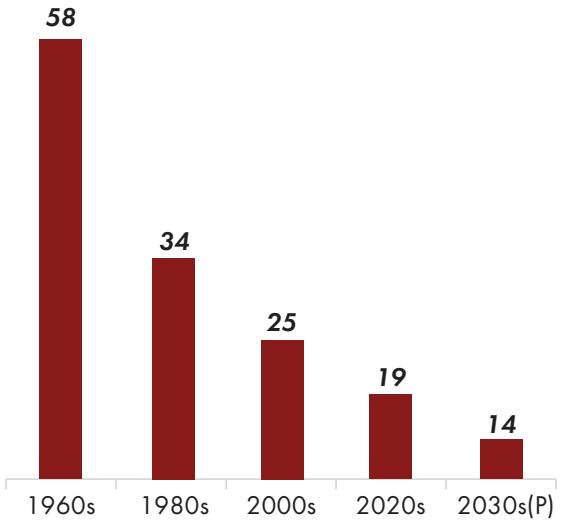


Exhibit 1.2.1

Average company lifespan on S&P 500 index (LHS) and five-year job churn by industry (RHS)

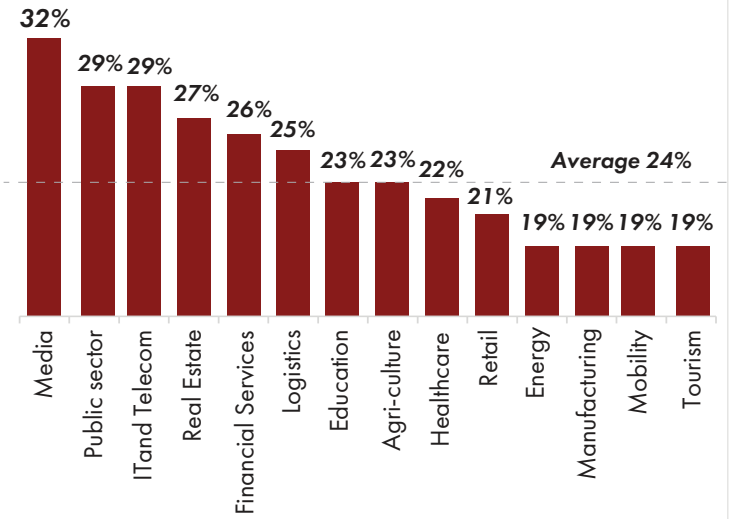
The average age of companies is projected to drop below ~15 years by 2030

Average company lifespan on S&P 500 Index
(#, 1960s-2030s(P)



~24% of all jobs will be disrupted across major industries in the next 5 years

Five-year job churn by industry
(%, 2023-27)



Impact of adoption of new and frontier technologies

- Leading macrotrend for disruption among 86% companies
- 83 million jobs are projected to be disrupted by 2027
- 2000 work activities to be automated across 800 professions
- 40% of the workers are estimated to require reskilling

Source(s): Praxis analysis

1.3

Digital to AI

This decade has witnessed a significant shift in technology, moving from mainstream digital platforms and other tools like the internet, towards more intricate domains of AI and Deep Tech. Digital transformation, characterized by the integration of digital technologies into various aspects of business, operations, and society, played a pivotal role in setting the stage for the subsequent AI and Deep Tech transformation.

In its initial stages, digital transformation helped achieve efficiency, connectivity, and data-driven decision-making. It laid the groundwork for a more interconnected world, where information flowed seamlessly, and businesses embraced digital tools to streamline operations. We are now witnessing a transition from basic digital applications to the integration of supercharged technologies such as Artificial Intelligence (AI), Virtual Reality (VR), blockchain, and more into the existing digital infrastructure. This shift signifies a move towards more sophisticated and specialized tools that have the capacity to solve complex problems, facilitate faster innovation cycles, and propel industries to new heights.

Exhibit 1.3.1

Digital to AI and Deep Tech transformation

Digital transformation

- **Digital platforms** and technologies played a **crucial role in the past decade**
- But their potential has **shifted from radical innovations to broader dissemination**

Digital transformation has paved the way for AI and Deep Tech transformation

AI and Deep Tech transformation

- Now, we are **upgrading from basic digital apps to supercharged tech** like AI, VR, blockchain, etc.
- Enabling a future where we can solve complex problems, innovate faster, and reach new heights

AI and Deep tech ventures

AI and Deep Tech ventures are **leveraging the digital infrastructure and startup ecosystem** created during the digital revolution

AI and Deep Tech ventures are now **solving the needs and gaps** that have surfaced during digital revolution by **pioneering cutting-edge** solutions

Organizations at the forefront of AI and Deep Tech transformation

Developments in generative AI, quantum computing, etc., are enabling businesses **to optimize processes, improve efficiency, and reduce costs**

Agile companies that are adapting to these technologies **gain a competitive edge as they innovate faster and outpace their competitors** in evolving demands

Investors

Investors are actively seeking **'the next big thing,'** directing their attention towards AI and Deep Tech ventures offers **substantial growth potential due to their disruptive nature**

Several AI and Deep Tech solutions **contribute positively to ESG,** such investments align with **responsible investment strategies and meet sustainable goals**

Opportunities created due to shift from digital to Deep Tech transformation

1.3.1 Emergence of AI and Deep Tech ventures

The emergence of AI and Deep Tech ventures signifies a strategic utilization of the digital infrastructure and startup ecosystem established during the digital revolution. These ventures are now crucial in addressing emerging needs and gaps, pioneering innovative solutions to complex challenges.

In the aerospace sector, Deep Tech companies like Dhruva Space, which develops application-agnostic small satellite platforms, and Digantara, which offers space debris tracking and monitoring solutions, have boosted India's aerospace sector to new heights, as companies and governments, globally utilize their solutions. Similarly, Unmanned Aerial Vehicle (UAV) Deep Tech ventures such as Garuda Aerospace, known for its cloud-based multi-utility drones for industrial applications, and BotLab Dynamics, a provider of light-show drones and service solutions, are making significant impact across industries like e-commerce, logistics, defense, etc.

In robotics, companies like I Hub Robotics, which provides robotics solutions, and Accio Robotics, specializing in warehouse automation and robotic systems for enterprises, are driving breakthroughs in logistics and manufacturing through advanced technologies.

AI and Deep Tech ventures in the above-mentioned sectors and numerous others are not only leveraging existing digital infrastructure but are also pushing the boundaries of innovation across various industries.

1.3.2 Existing businesses leveraging AI and Deep Tech

Existing businesses are capitalizing on advancements in generative AI, quantum computing, and other Deep Tech domains to develop new solutions by leveraging their existing capabilities, optimizing processes, enhancing efficiency, and reducing operational costs. Agile companies embracing these technologies gain a competitive edge, as they exhibit the ability to innovate faster and outpace competitors in adapting to evolving market demands.

Exhibit 1.3.2

AI and Deep Tech impact across various businesses

NETFLIX

Personalizing recommendations for users, improving the overall user experience and engagement using generative AI

Google

Generative AI helps in **language translation, image recognition,** and **natural language processing**

amazon

Amazon's Prime Air drones have made **around 100 deliveries.** Prime Air drones fly up to 50 mph, up to an altitude of 400ft

SPACEX

Leveraging Space Tech to further enhance the **space exploration and transportation**

BBVA

BBVA has explored the potential of blockchain technology as a major catalyst to create value in finance by **delivering loans using blockchain**

Helix

Enabling healthcare organizations to accelerate the integration of genomic data into **patient care and public health decision-making**

VICARIOUS SURGICAL

A robotic system, controlled by a **VR headset,** is designed to allow freedom of movement and precision in minimally invasive surgeries

TESLA

Deep Tech in Tesla vehicles leverages deep learning for **real-time decision-making** for autonomous driving

sensat

Uses digital twin software to **combine and visualize various data sources** from construction sites to eliminate data silos

Adopting AI and Deep Tech has led to diverse solutions that have helped us improve customer experience. We are also helping businesses out there not directly relevant to Cargill, like supporting farmers in terms of giving them the support.

Regional Director, Commercial Excellence, Cargill

Cargill

AI and Deep Tech can contribute to both supply and price stability of raw materials, which are key for a manufacturer. We are looking to implement it to enable innovation on processes to deliver step-changes in energy efficiency.

CEO, Syzygy Plasmonics Inc

SYZYGY

We are leveraging AI and Deep Tech at the intersection of several emerging technologies, such as synthetic biology and 3D printing. It addresses complex issues that cross different scientific fields.

CEO, LanzaTech

LanzaTech

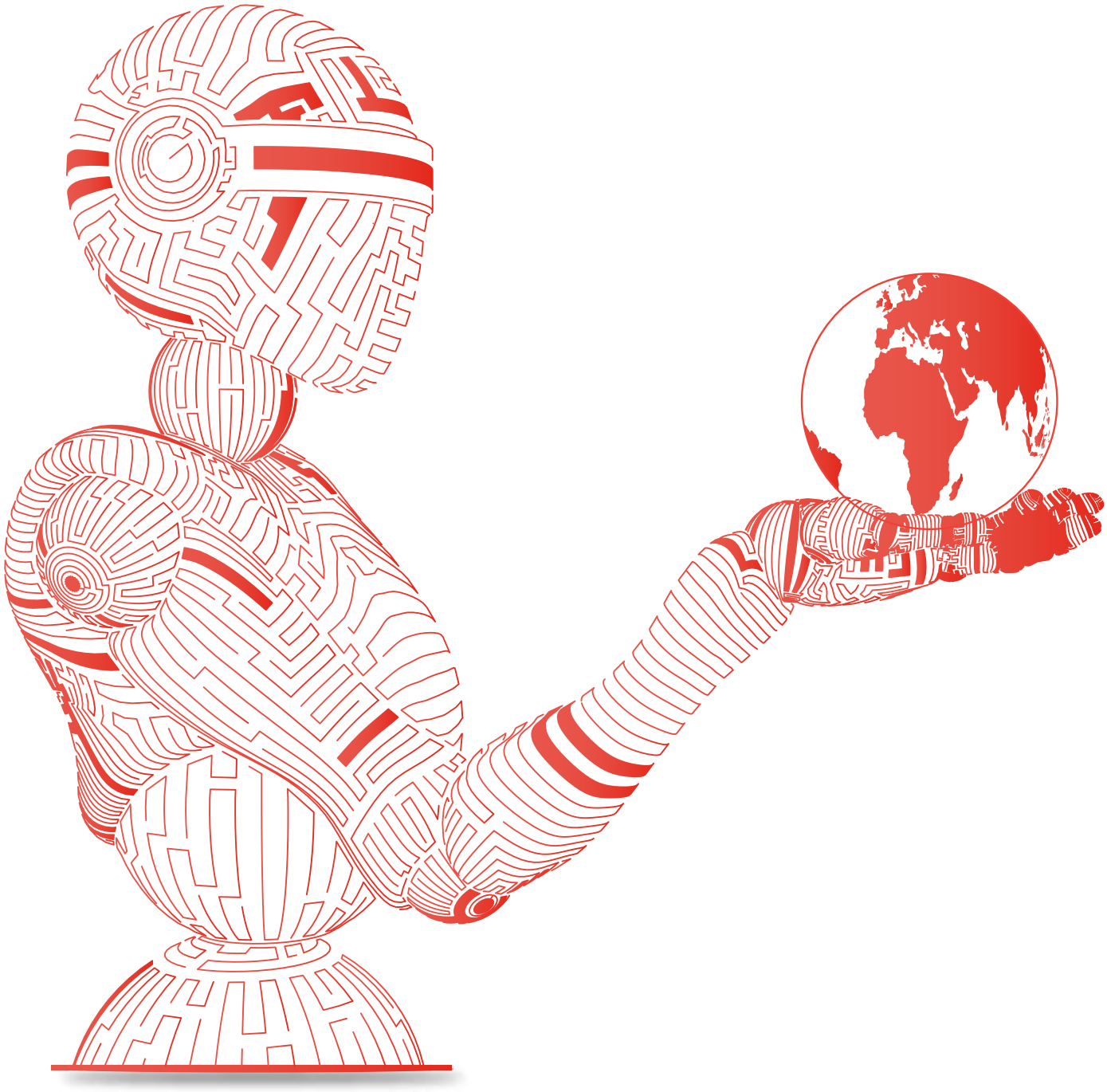
In the dynamic world of technological breakthroughs, AI and Deep Tech is helping us surge forward as a harbinger of the future. As Deep Tech will gain momentum, almost every aspect of smart manufacturing will appear ripe for disruption.

Senior Vice President, Strategy and Solutions, Innover

innover

1.3.2 Investing within AI and Deep Tech space

The investment landscape is witnessing a pronounced focus on AI and Deep Tech space. Investors are actively seeking 'the next big thing,' directing their attention towards AI and Deep Tech ventures that offer substantial growth potential due to their disruptive nature. Notably, many AI and Deep Tech solutions contribute positively to Environmental, Social, and Governance (ESG) criteria, aligning with responsible investment strategies and supporting sustainable goals. This triad of value waves underscores the transformative impact of AI and Deep Tech across ventures, businesses, and the investment landscape.



1.4

AI and Deep Tech ventures vs regular start-ups

AI and Deep Tech ventures, in contrast to conventional startups, embark on a distinctive journey characterized by a prolonged Research and Development (R&D) phase. This deliberate investment of time and resources into cutting-edge research allows these ventures to explore uncharted technological territories.

A notable advantage of this extended R&D journey is the reduced threat of immediate competition. The intricate and often specialized nature of AI and Deep Tech solutions necessitates a level of expertise and investment that acts as a barrier to entry for potential competitors. This insulation provides AI and Deep Tech ventures with a strategic advantage, allowing them to focus on refining and perfecting their innovations without having to address the constant threat of competition.

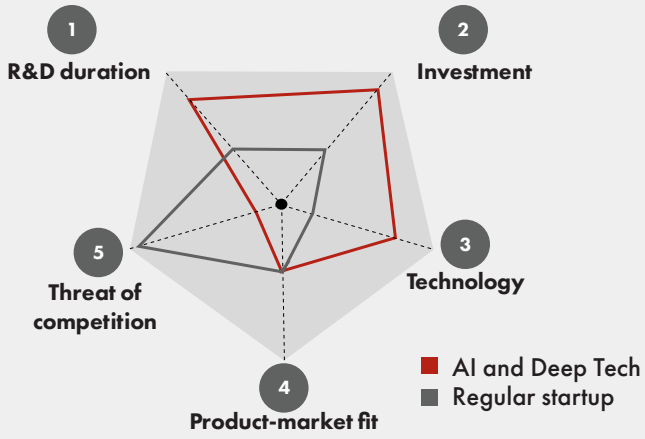
When it comes to value creation, only 1 in 3 regular start-ups make it out of the seed stage. They begin value creation in the GTM phase, followed by slow growth. In contrast, AI and Deep Tech start-ups undergo a prolonged R&D phase, delaying value creation and facing the constant threat of a commercially unviable product or an uncertain time of realizing returns. However, once a product with a unique value proposition emerges from R&D, it often experiences exponential growth, surpassing the value of regular startups in a much shorter time.

Exhibit 1.4.1

AI and Deep Tech ventures have an extensive and extended R&D phase and create more value than regular start-ups

AI and Deep Tech ventures have an extensive and extended R&D phase as they research for revolutionary breakthroughs

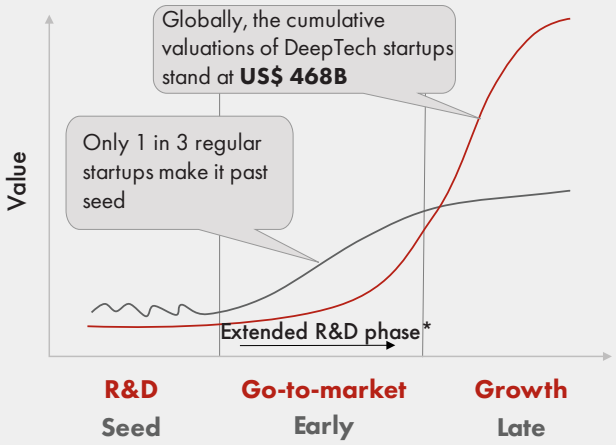
AI and Deep Tech vs regular startups characteristics



- **From founding to exit,** AI and Deep Tech startups take an average of **11 years while 4-5 years** for other startups
- The global AI and Deep Tech unicorn exits from 2018 to 2022 have increased by 550%

The value created by AI and Deep Tech startups is more than regular startups as its roots are grounded in innovation

Value curve



***R&D duration for Deep Tech startup is likely to reduce with development in talent pool and further technological advancements**

In essence, the deliberate and extended R&D phase, coupled with a reduced early competition landscape and a steadfast commitment to innovation, places these ventures at the forefront of transformative growth. This distinctive approach enables them to carve out a niche in the entrepreneurial landscape, contributing to the evolution of industries and the advancement of technology.

1.5

Role of academic institutions in fostering AI and Deep Tech ventures

Collaborations between academic institutions, particularly esteemed entities such as the Indian Institutes of Technology (IITs), Indian Institutes of Information Technology (IIITs), and Indian Institutes of Management (IIMs), are playing a pivotal role in propelling these ventures to become commercially viable. These partnerships establish crucial connections between academia and entrepreneurship, where the research infrastructure of these institutions enables AI and Deep Tech ventures to research is seamlessly translated into real-world applications.

The collaborative efforts extend beyond theoretical contributions. Incubation centres and mentorship programs create tangible support structures for these ventures. Academic institutions, recognizing the potential of startups, provide the necessary resources and guidance for transforming ideas into market-ready solutions.

Exhibit 1.5.1

Academic institutions catapult Indian AI and Deep Tech start-ups toward growth

Startup name	Founded year	Academic Institution	Industry (Theme)	Funding raised (US$)	Key Investors
ideaForge	2007	IIT Bombay	Robotics (Drones)	Publicly Listed	NOMURA
UNBOX	2019	CIIE-IIM Ahmedabad	Robotics	9.1M	arali, SIXTH sense
5ire	2021	IIT Delhi	Blockchain	221M	ClimateAngels
LOG9	2015	IIT Roorkee	Advanced Materials	90M	KANGAROO
CLEAN ELECTRIC	2016	IIT BHU	Advanced Materials	2.35M	PETRONAS, AMARA RAJA, SiriusOne
gupshup	2004	IIT Bombay	AI/ML	486M	TIGER GLOBAL, think
uniphore	2008	IIT Madras	AI/ML	658M	KDDI, ALPHA WAVE
SEA6 ENERGY	2010	IIT Madras	Biotech	39.4M	TATA CAPITAL
GREENJOULES	2018	Savitribai Phule Pune	Biotech	5.37M	BLUE ASHVA CAPITAL
LIGHT METRICS	2015	IIT Delhi	Photonics/Electronic	10.4M	SEQUOIA
Q→NU	2016	IIT Madras	Quantum Computing	13.5M	
AGNIKUL	2017	IIT Madras	Space Tech	67M	rocketship.vc, pi Ventures
pixxel	2019	BITS Pilani	Space Tech	71.7M	RADICAL
Lattice	2020	IIM/IIT	AI / ML	-	-

02

India’s AI and Deep Tech landscape

India’s AI and Deep Tech landscape is thriving with the emergence of numerous ventures across various industry domains. The biotech sector is particularly prominent, with products ranging from on-demand green hydrogen to enzymatic cocktail developers. AI/ML ventures are leveraging Generative AI to address issues like talent pooling and training and education, while robotics are advancing in areas from warehouse automation to medical surgeries. Additionally, Deep Tech sectors such as advanced materials, blockchain, and quantum computing are experiencing rapid growth and developing cutting-edge solutions such as graphene electronics, DeFi, blockchain-based supply chain transparency, quantum cryptography, and advanced material simulations.

Exhibit 2.1

India's AI and Deep Tech landscape is burgeoning, as ventures sprout across the 8 key themes of innovation

Source(s): Press reviews and Praxis analysis

2.1

India's AI and Deep Tech landscape resonates e-commerce boom of 2013

AI and Deep Tech is likely to experience a surge, far exceeding the e-commerce boom of the mid-2010s. Investments in Indian AI and Deep Tech ventures have witnessed a remarkable 5x increase, growing at a CAGR of 31%, over the last 6 years (FY18-24). In FY22, these ventures raised funding worth US$ 1.6B over 85 funding rounds with Uniphore, Fractal Analytics and Gupshup contributing approximately 70% of the deal value. The sector, however, is still in its nascent stages as approximately 95% of the deals are centered around early-stage ventures, that have potential to become scalable solutions in the future. The investment decline from the high of CY22 in subsequent years can be attributed to a broader funding winter, as PE and VC firms continue to reassess their investment strategy and are sitting with huge dry powder. This capital is likely to be deployed in the coming years, potentially leading to a resurgence in the growth of funding activity.

But what sets AI and Deep Tech apart is not just its rapid growth, but the size of the bets it attracts. Unlike their e-commerce counterparts of FY14, these ventures are securing significantly larger funding rounds, a testament to the immense confidence investors have in their disruptive capabilities. This disparity in deal size reveals that, e-commerce startups, while innovative, often relied on proven technologies and existing infrastructure, however these ventures are focused into uncharted territory, tackling complex challenges with cutting-edge technologies. This can lead to exponentially higher potential payoffs, but it also makes the path to success rife with uncertainty and requires significant upfront investment in R&D for these innovative breakthroughs.

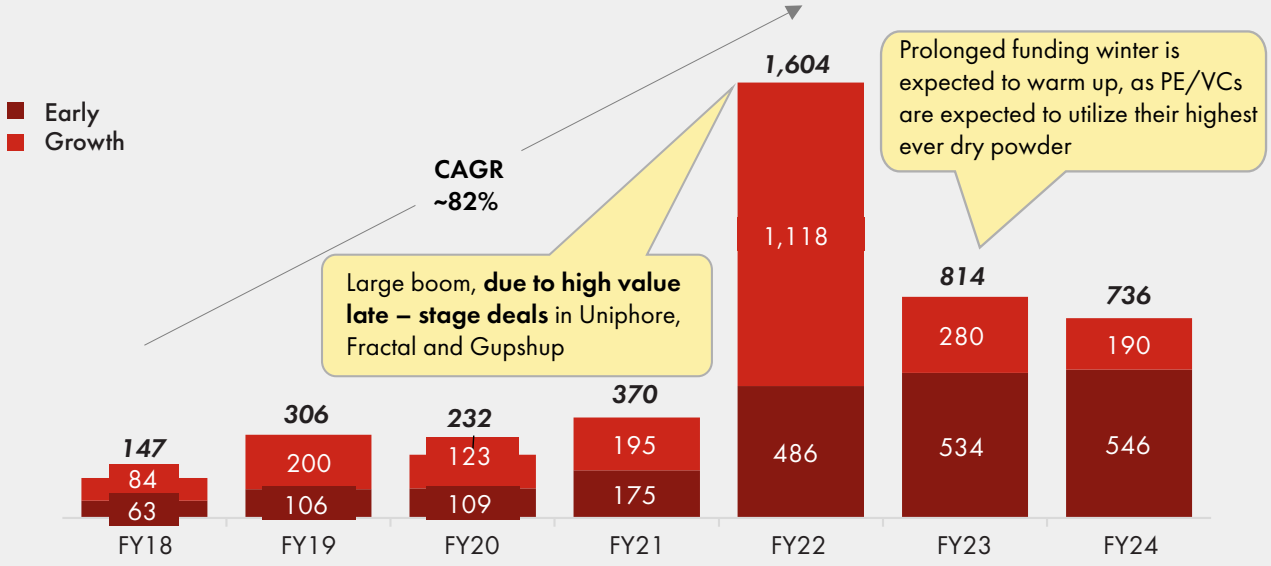
Exhibit 2.1.1

The surge in investments for Indian AI and Deep Tech ventures echoes past e-commerce boom

The funding for Indian Deep Tech startups experienced a massive boom in FY22 and grew ~10 times over FY18

Funding landscape of Indian Deep Tech ventures

(US$ M, FY18-24)



# deals	22	28	37	44	85	86	63

~93% of deals for Indian Deep Techs are early-stage emulating e-commerce (FY14), poising it for exponential growth

Highlights of Indian Deep Tech FY22 vs e-commerce FY14

Parameters	Deep Tech	E-commerce
Total funding (US$ M)	1,604	1,465
Average deal size (US$ M)	19	8
% Early-stage (# Total deals)	93% (78)	92% (183)
# Unicorns	5	3

Key Insights

- PE/VCs are willing **to bet larger on Deep Tech ventures** to support their extensive R&D, in pursuit of innovative breakthroughs
- With **~93% of early-stage deals,** the landscape is still **nascent and is expected to grow rapidly as funding** picks up again

For venture capitalists and private equity firms, the opportunity is ripe with immense potential. Investing in promising AI and Deep Tech companies offers the unique opportunity to be at the forefront of transformative revolutions across various industries.

2.2

Challenges and drivers of AI and Deep Tech ecosystem in India

Navigating the landscape of Indian AI and Deep Tech startups involves encountering both challenges and opportunities that influence their path forward. On the positive front, India stands as the third-largest startup hub globally, boasting over 26,000 tech startups that leverage affordable tech talent. The availability of capital, incubation/acceleration support, and substantial VC funding empower entrepreneurs to explore and innovate. India has seen a remarkable fivefold increase in patents related to hard science, whose growth has been largely driven by government initiatives such as the National Blockchain Framework and AIRAWAT. Collaboration with esteemed academic institutions like IITs and IISc plays a pivotal role as well. These institutions produce cutting-edge research and advancements, provide enabling infrastructure for development and testing, and facilitate knowledge transfer, ultimately leading to the commercialization of research outcomes. This synergy between AI and Deep Tech startups and academia strengthens the foundations of innovation in India.

Exhibit 2.2.1

India's startup ecosystem aids Deep Tech's potential to flourish, however it must navigate biases to reach full fruition

Drivers and challenges faced by Indian AI and Deep Tech startups

Tailwinds

Start-up ecosystem

- India is the **third largest startup hub,** with **26,000+ tech startups** creating and leveraging affordable tech talent
- **Availability of capital,** incubation/acceleration support, and ample VC funding in India has empowered entrepreneurs

Government aid to innovation ecosystem

- Hard science innovations in India soared **with a 5X growth in patents,** backed by government initiatives like the **National Blockchain Framework and AIRAWAT**
- **Grants, design linked initiatives, challenges, incubators,** and policies further foster innovation

Collaboration with academia

- Prestigious academic institutions like **IITs and IISC,** produce cutting-edge research and advancements. Collaborating with them facilitates knowledge

Headwinds

Inertia in transformation

- India is **viewed as an outsourcing hub for cutting costs** globally, it would be a **challenge to overcome this inertia to transform** into a hub for innovation and Deep Tech

Economic viability

- Producing economical products to cater to a **price-sensitive and diverse market**
- Startups have a **long gestation period** before generating revenue
- Satisfying price-sensitive customers and **innovating thus, becomes a delicate balancing act**

Investment bias

- Many investors have **limited exposure to Deep Tech, preferring familiar sectors** due to their comfort with traditional businesses
- Lack of understanding about Deep Tech innovations may result in **missed investment opportunities**

When it comes to challenges, overcoming the prevailing perception of India as a cost-cutting outsourcing hub and transforming it into a center for innovation, presents a significant obstacle. This requires a fundamental shift from a service-oriented mindset to one focused on pioneering new technologies. Balancing scale with creating economically viable products for a diverse and price-sensitive market is another challenge. Satisfying cost-conscious consumers after significant investment in R&D demands a delicate and innovative approach to pricing and market strategies. Additionally, these ventures often face an investment bias, as many investors have limited exposure to these technologies. This bias can result in missed opportunities for AI and Deep Tech startups, emphasizing the importance of bridging the understanding gap.

Source(s): Praxis analysis

2.3

Unlocking AI and Deep Tech potential with government initiatives

The Indian government has recognized the significant potential of AI and Deep Tech and is actively shaping a regulatory framework to support its growth. Central to this strategy is the National Deep Tech Startup Policy (NDTSP), aimed at supporting and nurturing the unique needs of Deep Tech startups in India. Alongside NDTSP, the SAMRIDH Scheme, launched in August 2021, underscores the government's commitment to accelerating software product-based startups, including those which are working in the AI and Deep Tech space, by providing essential support for scaling and navigating developmental challenges. Furthermore, the establishment of 26 Domain-specific Centers of Excellence (CoEs) drives self-sufficiency and builds capabilities to capture new and emerging technology areas, further enriching the ecosystem.

Moreover, initiatives like GENESIS aim to democratize innovation by supporting startups in tier 2 and tier 3 cities, fostering collaborative engagement among startups, government entities, and corporates to promote Deep Tech innovation. Additionally, the Next Generation Incubation Scheme (NGIS) focuses on the software product ecosystem, aiming to support 300 tech startups in tier 2/3 cities over three years, thereby enhancing and diversifying India's AI and Deep Tech landscape.

Exhibit 2.3.1

Government initiatives in AI and Deep Tech space

1. **National Deep Tech Startup Policy (NDTSP):** To support and nurture the unique requirements of Deep Tech startups in India.
2. **SAMRIDH Scheme:** Launched in August 2021, with an aim to support and accelerate potential software product-based startups (including AI and Deep Tech) to scale.
3. **Technology Incubation and Development of Entrepreneurs (TIDE 2.0) Scheme:** To foster tech entrepreneurship by providing financial and technical support to incubators backing ICT startups utilizing emerging tech like IoT, AI, blockchain, and robotics.
4. **Domain specific Centres of Excellence:** 26 Centres of Excellence (CoEs) were operationalized in diverse areas of national interest for driving self-sufficiency and creating capabilities to capture new and emerging technology areas.
5. **Support for International Patent Protection in E&IT (SIP-EIT) Scheme:** Encourages international patent filing by Indian MSMEs and start-ups to encourage innovation and recognize the value and capabilities of global IP.
6. **GENESIS (Gen-Next Support for Innovative Startups):** To discover, support, grow and make successful startups in tier 2/3 cities with emphasis on collaborative engagement among startups, government and corporates.
7. **Next Generation Incubation Scheme (NGIS):** To support the software product ecosystem and has solution-oriented architecture and aims to handhold 300 Tech startups in tier 2/3 cities over the period of 3 years.

03

Investment thesis

AI and Deep Tech ventures have the potential to revolutionize industries and address critical global challenges, offering substantial value creation opportunities for all stakeholders. Their significant potential and competitive advantages over incumbents make AI and Deep Tech an attractive investment avenue for private equity and venture capital firms.

Expansive market opportunity: the cumulative global valuations of AI and Deep Tech ventures currently stand at US$ 468 Billion, highlighting the value which these ventures hold. The commercialization of groundbreaking solutions has led to a remarkable ~6x increase in the number of exits by investors from AI and Deep Tech unicorns from 2018 to 2022. This trend indicates robust market traction and the potential for substantial returns on investment as more AI and Deep Tech innovations reach the market.

Diversification & innovation potential: Deep Tech encompasses a wide range of sectors, allowing investors to diversify their portfolios. Key technologies like biotechnology, artificial intelligence (AI), and advanced materials are leading the charge due to their transformative impacts on industries such as healthcare, manufacturing, and energy. For instance, AI's ability to enhance decision-making processes and biotechnology's potential to cure diseases represent significant advancements. Moreover, emerging fields like quantum computing are set to revolutionize IT and cybersecurity, offering entirely new investment horizons. This breadth of opportunities not only spreads risk but also positions investors to benefit from breakthroughs across multiple high growth domains.

Strong competitive advantage: The complex and capital-intensive nature of their research and development (R&D) efforts means that only a select few can compete effectively, creating strong barriers to entry. Furthermore, extensive IP protection, including patents and proprietary technologies, ensures that these companies can safeguard their innovations against competitors. This high degree of IP protection not only secures their market position but also enhances the long-term value of the company, making it a stable investment choice. This strategic moat helps AI and Deep Tech firms sustain their competitive advantage and achieve market dominance.

Promising investment landscape in India: The Indian AI and Deep Tech ecosystem is burgeoning, reminiscent of the early stages of the e-commerce boom. Government initiatives such as the National Deep Tech Startup Policy (NDTSP) and the SAMRIDH Scheme are pivotal in nurturing this sector. These policies provide critical support for innovation, scale-up, and overcoming developmental challenges. Additionally, India's vast and affordable talent pool, coupled with collaborations with prestigious academic institutions, creates a robust environment for AI and Deep Tech growth. This supportive ecosystem enhances the potential for high returns on investment in Indian AI and Deep Tech ventures, mirroring the success seen in the earlier e-commerce wave

Exhibit 3.1

Investment thesis for Deep Tech space

What we like about investing in AI and Deep Tech

- **AI and Deep Tech ventures have the potential to revolutionize industries and provide solutions to pressing global challenges such as healthcare, climate change, energy efficiency, and cybersecurity, creating substantial market growth opportunities in the process**

- **Market opportunity:**
  - Several, AI, and Deep Tech ventures have the potential to cater to a large segment of market
  - Globally, the cumulative valuations of Deep Tech startups stand at **US$ 468B**
  - Many groundbreaking Deep Tech solutions are being commercialized, and **successful exits continue to increase**
  - The global Deep Tech **unicorn exits from 2018 to 2022 have increased by 550%**

- **Diversifying investment is a good option for investors as many segments are major investment opportunities**
  - Biotech, AI, and advanced materials are prime investment areas because of the huge market potential in key industries but other areas are growing rapidly like quantum computing which can create a new age of IT

- **Competition:**
  - AI and Deep Tech companies generally face low competition in the market as the technology solutions involved are difficult to replicate as it requires considerable time and investment
  - AI and Deep Tech companies often have a high degree of IP protection because of extensive R&D resulting in patents on their core technologies and offerings
  - The high degree of IP protection and hard to replicate offerings enable them to achieve a significant competitive advantage in their markets

- **The current investment landscape (funding, % early-stage deals, # unicorns, etc.), for Indian AI and Deep Tech ventures is like the nascent stages of the e-commerce boom of FY14, yet the growth potential remains far from tamed and could easily surpass the value created by e-commerce**

- **Tailwinds for the sector include, government aid in innovation systems, leveraging the huge startup ecosystem that offers affordable talent, sufficient funding opportunities and collaboration with prestigious academic institutions for R&D**

Key considerations

- **AI and Deep Tech companies typically require substantial R&D investments, leading to extended periods without revenue**
  - Uncertainty in government regulations especially in areas like biotechnology and AI pose compliance and market access risks

- AI and Deep Tech startups generally have **longer gestation for the development of 5-8 years** when compared to 1-3 years of normal startups to reach revenue

- The pace of technological change **can create market volatility and not all innovations might have a market fit by the time of maturity**

However, there are a few challenges that require a strategic approach for mitigating the risks associated with AI and Deep Tech investing.

High R&D investment and longer gestation Period: AI and Deep Tech ventures demand significant R&D investments, which can lead to prolonged periods without revenue. The typical development cycle for Deep Tech products ranges from 5 to 8 years, far longer than the 1 to 3 years seen in other startups. This extended gestation period necessitates a patient capital approach and a long-term investment horizon. Investors must be prepared for delayed returns and must be willing to commit the required ongoing capital to support these ventures through their developmental stages. However, the potential for groundbreaking innovations and substantial market impact justifies this extended investment period.

Regulatory and compliance risks: The regulatory landscape for AI and Deep Tech, especially in biotech and AI technologies, is still evolving. This creates uncertainty and potential compliance challenges since government regulations can change rapidly, affecting market access. Investors must navigate these regulatory risks carefully, recognizing that compliance requirements may vary significantly across different jurisdictions. Investing in companies with robust regulatory strategies and compliance frameworks is crucial for effectively managing these uncertainties.

Market volatility and technological uncertainty: The rapid pace of technological advancement in AI and Deep Tech can lead to market volatility. Not all innovations will achieve market fit or commercial success by the time they mature. This inherent uncertainty requires investors to be vigilant and adaptable, continually assessing the market potential and viability of emerging technologies. Diversifying investments within AI and Deep Tech can mitigate some of this volatility, ensuring that not all bets are placed on a single technology or market trend.

Despite these challenges, the transformative potential and substantial competitive advantages of AI and Deep Tech ventures present a compelling investment opportunity. With a strategic approach to navigating the associated risks and maintaining a long-term perspective, investors can tap into the significant growth and innovation that AI and Deep Tech offers, positioning themselves at the forefront of the next industrial revolution.

Key applications of AI and Deep Tech across industries

Deep Tech, with its revolutionary technologies, is poised to fundamentally transform industries across the board. The convergence of disciplines such as biotechnology, AI, robotics, blockchain, quantum computing, advanced materials, and electronics/photonics is driving innovation that will reshape the way businesses operate.

Industries will benefit from enhanced automation, data-driven decision-making, and the ability to solve complex problems with precision. AI and Deep Tech enable predictive analytics, autonomous systems, and secure decentralized networks, fostering a more resilient and adaptive business landscape. From optimizing supply chains and improving operational efficiency to enabling personalized services and revolutionizing energy practices, the impact of AI and Deep Tech is far-reaching.

Embarking on a comprehensive exploration, we delve into the transformative impact of AI and Deep Tech across diverse industries such as agriculture, automotives, e-commerce, energy, finance, healthcare, manufacturing, retail, and beyond. As businesses leverage these transformative technologies and position themselves at the forefront of a new era, ready to navigate the challenges and seize the possibilities that AI and Deep Tech brings to the table.

04

Chemical and Agriculture

AI and Deep Tech are fundamentally transforming the entire value chain of the agriculture industry, impacting critical phases such as farming, processing, storage and warehousing, distribution, and fulfilment.

This transformation is driven by a sophisticated array of technologies like biotech, AI, IoT, AR/VR, etc. which are innovating farming techniques like precision agriculture, virtual farm panning, autonomous harvesting, etc. The industry is already witnessing the increased adoption of genetically modified crops offering increased yield in shorter production times while reducing the need for chemical pesticides due to inherited pest resistance. These crops also boast higher nutritional content and longer shelf lives, making them instrumental in addressing global hunger issues. Furthermore, virtual farm planning optimizes layouts using satellite imagery for weather monitoring and hyperspectral imaging to assess soil health. In processing, robotics play a crucial role in harvesting and processing crops, employing automated grading using computer vision. This not only reduces human effort and capital but also ensures processing occurs in shorter durations with minimal errors.

4.1

Agriculture

Exhibit 4.1.1

The AI and Deep Tech revolution is poised to transform the agriculture industry by unlocking value throughout the supply chain from farming to distribution

Select disruptive themes

Farming

AI, IoT, and AR/VR

Implementing innovative best practices for precision monitoring and automation

- **AI-based precision agriculture**
- **Hyperspectral imaging** to assess crop health and soil nutrients
- **Virtual farm panning** to plan and optimize farm layout

Robotics and space tech

Automation and real-time monitoring

- **Autonomous harvesting** and monitoring with the use of farming robots and drones
- **Satellite imagery** for real-time crop assessment and weather monitoring

Biotech

Leveraging farming techniques and products pioneered using biotech

- **Genetic modification** to make crops pest resistant and enhance nutritional value

Processing

AI and robotics

Real-time monitoring and control of processing equipment

- **Automated grading and ripeness assessment** using computer vision
- **Predictive maintenance** for food processing and packaging equipment
- **Robotics for complex food processing tasks** and **handling delicate procedures**
- **In-field harvesting and processing** using compact robotic processing units

Advanced materials and biotech

Use of special materials to preserve the quality of the product

- **Nanoencapsulation for nutrient reservation** to preserve the nutritional value and extend shelf life
- **Enzyme technology** to enhance food processing efficiency by reducing processing time

Storage and warehousing

AI, robotics, and IoT

Real-time monitoring and control of warehousing and distribution processes

- **Predictive analytics for pest management** and early outbreak detection
- **Precision monitoring and control systems** to create optimal storage conditions
- **Robotic sorting** to efficiently categorize produce based on size, ripeness, and quality
- **Microbial biocontrol** storage techniques to ensure longer preservation
- **Energy-efficient cold storage** by implementing AI algorithms to optimize energy consumption

Advanced Materials

Use of special materials to preserve the quality of crops and maintain the quality

- **Climate-responsive packaging** by using materials that adapt to temperature and humidity

Distribution & fulfilment

AI, robotics, and IoT

AI helps in order scheduling and route planning, moreover robotics mitigate fulfilment inefficiencies by automation

- **Order tracking and route optimization** for real-time order visibility and reduce ETA of products
- **Predictive maintenance of vehicles** to monitor engine performance, tire pressure, and other parameters
- **Autonomous delivery vehicles** that navigate predefined routes, load-unload products, etc.
- **IoT Sensors for quality monitoring** of agricultural products during transit

Blockchain

Maintain transparent record of end-to-end product journey and ensure standardization

- **Provenance tracking** to help in taking corrective measures in case of material recall or quality issues
- **Smart contracts for automated payments** like crop insurance payouts

Expected adoption Short-term → Long-term

Source(s): Secondary Research, Praxis analysis

Post-processing techniques employ advanced materials such as liposomes, hydrogels, and pH-sensitive polymers to preserve nutritional value and extend shelf life, which is crucial during storage and distribution. Storage and warehousing rely on climate-responsive packaging materials made from starch to protect agricultural produce from temperature and humidity fluctuations. Apart from this, precision monitoring and control systems, leveraging AI and IoT, ensure optimal storage space utilization, while robotics assist in inventory management.

Storage and warehousing benefit significantly from robotic sorting and energy-efficient cold storage technologies. Robotic sorting systems use advanced sensors and machine learning algorithms to efficiently categorize produce based on size, ripeness, and quality, ensuring only the best products are distributed and reducing waste. This technology enhances the speed and accuracy of sorting, leading to improved inventory management and fresher produce for consumers. Furthermore, energy-efficient cold storage employs AI algorithms to optimize energy consumption, maintaining ideal storage temperatures while minimizing costs and environmental impact. This smart approach to cold storage not only preserves the freshness and nutritional value of the produce but also contributes to sustainability efforts. Other advancements include predictive analytics for pest management, precision monitoring and control systems, and microbial biocontrol, all of which collectively enhance the efficiency and effectiveness of storage and warehousing operations.

In the final stage of the agricultural value chain, distribution, and fulfilment are leveraging blockchain technology for transparent, automated payments and insurance payouts. AI, IoT, and robotics play extensive roles in this phase, handling order tracking and route optimization to ensure real-time order visibility with minimal delays. Automated delivery vehicles, using IoT and AI for predictive maintenance, further enhance efficiency and reliability in the distribution process.

The impact of these disruptions can be witnessed in real life industry examples as industry leaders are actively embracing these transformative technologies to redefine their operational paradigms. Companies such as PhosAgro, BCS, Cargill, and ITC are at the forefront of leveraging AI and Deep Tech for revolutionary advancements. ITC, for instance, employs AI solutions not only for monitoring crop and soil health but also for the early detection of diseases and identification of nutrient deficiencies. Furthermore, the deployment of autonomous robots for weed removal in challenging field conditions showcases the tangible and practical applications of Deep Tech in agriculture. Early adoption of Deep Tech in agriculture, mentioned in the examples above showcase how it is paving the way for a sustainable, efficient, and technologically enriched future of the industry.

Exhibit 4.1.2

Industry leaders' opinion on AI and Deep Tech transformation in agriculture

FUTURE OF AGRICULTURE

PHOSAGRO

"We have built a system that uses innovative technologies – elements of artificial intelligence – that allow you to automatically distribute documents to financial reporting centers. Such measures made it possible to significantly reduce the time for processing documents and labor costs when working with contractors."

Sergey Didenko,
CIO, PhosAgro Group

Bayer CropScience

"Bayer Crop Science AG (BCS), is leading the way in deploying a combination of big data, machine learning, the internet of things, and drones to create and distribute value through integrated digital farming. BCS uses data science to accelerate R&D processes and creates efficiencies in production and supply chain while improving customer experience."

Nalini Polavarapu,
Enterprise Data Science Strategy Lead at BCS

Cargill

"Big data and advanced analytics continue to have a major impact. To be more specific, I'd point to computer vision from low-Earth orbit satellites and very sophisticated up-close imagery in dairy, swine, and row crop farming, along with artificial intelligence to drive predictions and decisions on the farm."

Justin Kershaw,
CIO, Cargill

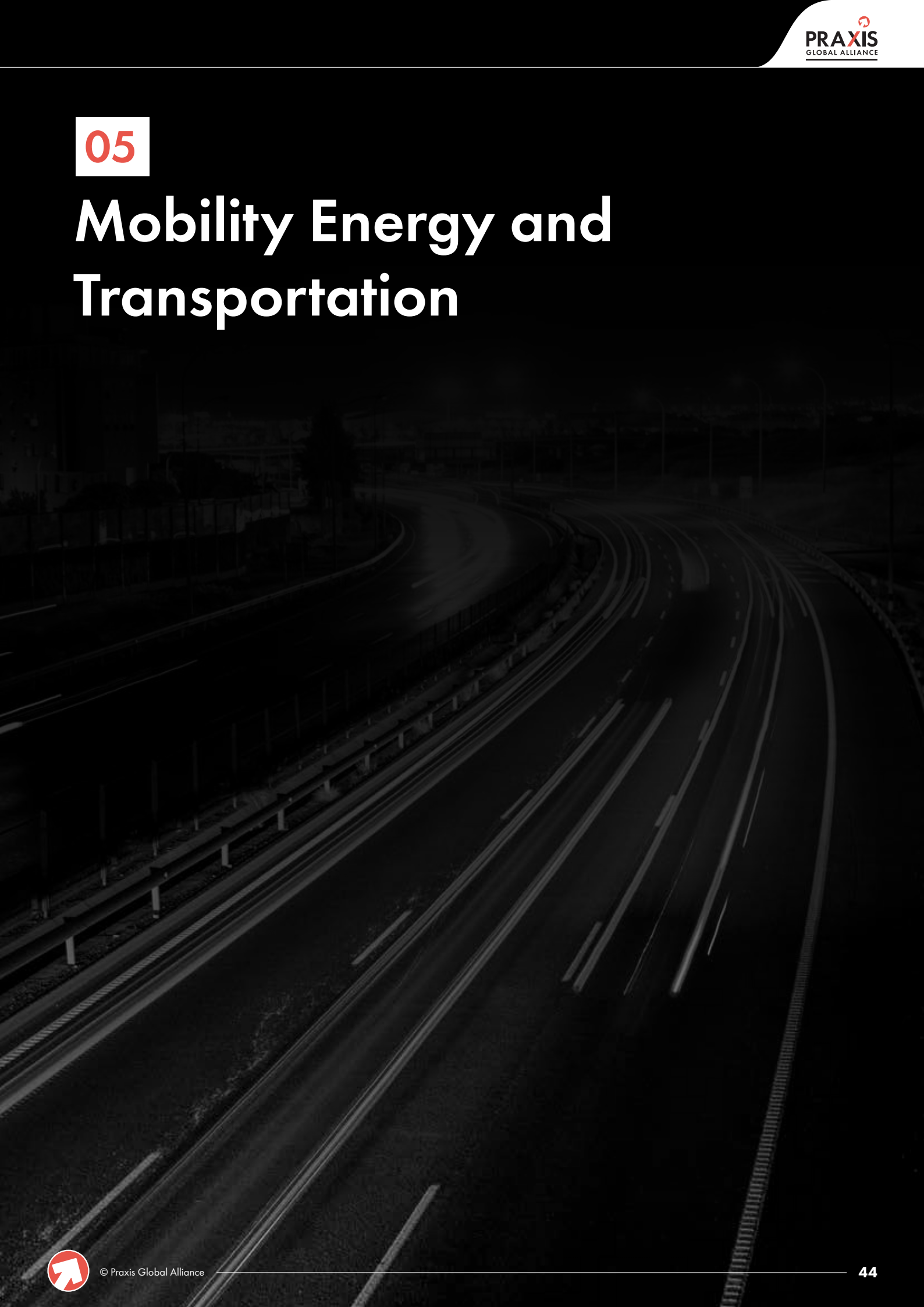
ITC Limited

"AI is optimizing agriculture by improving input precision and output prediction in scientifically managed operations We are also evaluating AI solutions to monitor crop and soil health to detect diseases and nutrient deficiencies. Autonomous robots to remove weeds when the field conditions are risky is another application being examined."

S. Sivakumar,
Group Head Agri and IT Businesses, ITC

05

Mobility Energy and Transportation



5.1

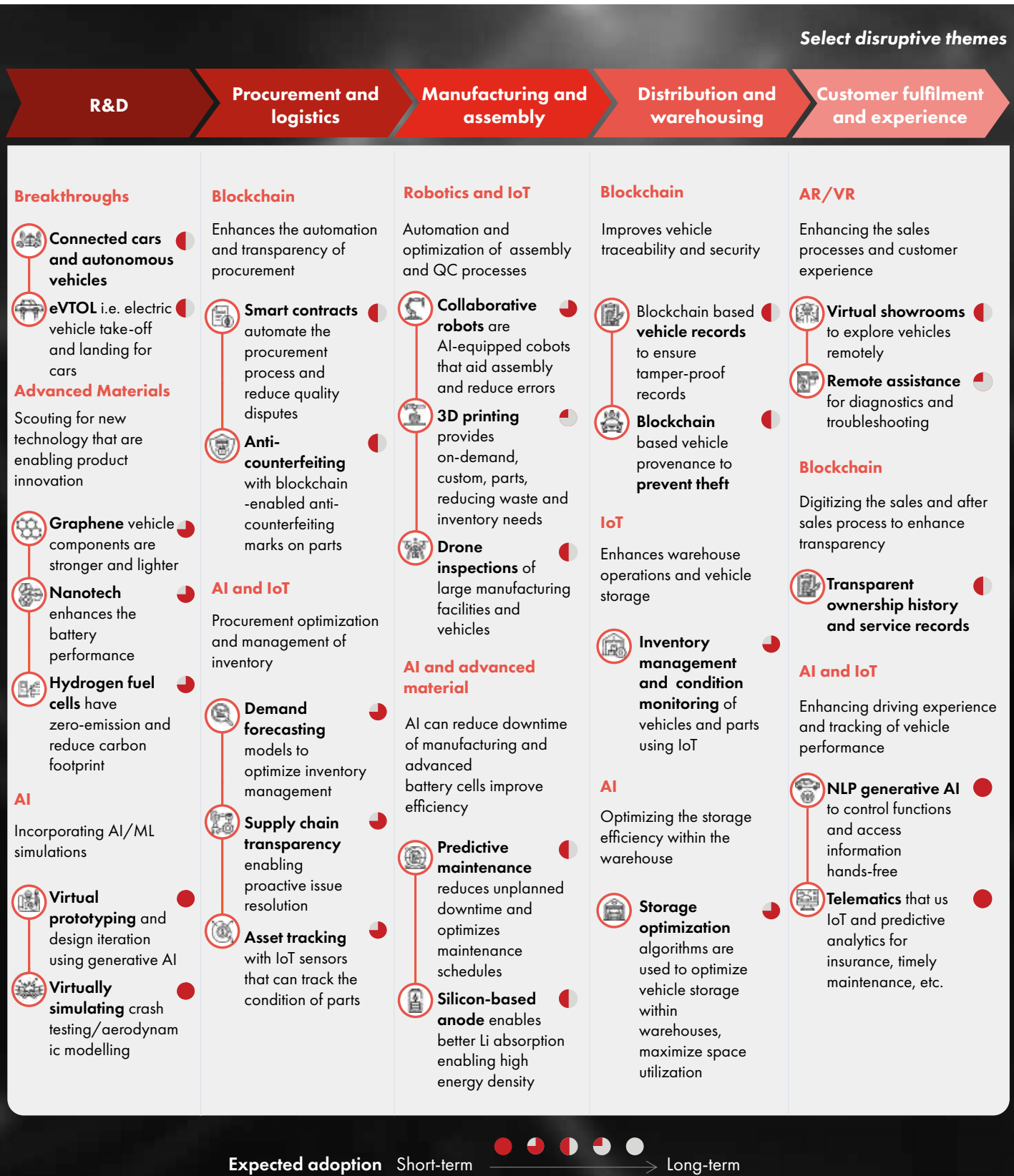
Automotive

The integration of AI and Deep Tech is revolutionizing the automobile industry's value chain, spanning critical phases from R&D and procurement to manufacturing, distribution, and customer fulfilment.

This transformation begins with the deployment of cutting-edge technologies across the entire R&D process such as breakthroughs, advanced materials and AI. Virtual prototyping and crash testing, facilitated by gen AI, streamline automobile manufacturing by offering time and cost-effective solutions. By visualizing and interacting with prospective products, manufacturers can rectify issues at the development stage itself, minimizing the need for physical prototypes and ensuring a smoother production process. Advanced materials like graphene are also reshaping the industry, from structural components to batteries, tires, and lubricants, graphene contributes to the production of lighter and stronger vehicles. Additionally, nanotech materials-based batteries are enhancing performance by increasing electrode surface areas and reducing ion diffusion pathways. Connected cars and autonomous vehicles also exemplify the prospects AI and Deep Tech hold within space.

Exhibit 5.1.1

The AI and Deep Tech revolution is poised to transform the automobile industry as it unlocks value by revolutionizing processes across the value chain



Source(s): Secondary Research, Praxis analysis

Going further in the automotive value chain, procurement, manufacturing, and assembly represent crucial phases where IoT, AI, and robotics are making significant strides. Collaborative robots, known as cobots, lead the assembly process with impeccable accuracy, automating routine tasks while also being adaptable to harsh conditions and capable of handling hazardous materials. Cobots offer affordability, low energy consumption, and simple maintenance, thereby reducing operating costs. Furthermore, AI models enable predictive maintenance of assembly lines, optimizing asset and inventory management through demand forecasting. This ensures streamlined operations and minimizes downtime, contributing to increased efficiency in manufacturing.

In distribution and warehousing, as well as customer fulfilment and experience, blockchain technology ensures transparent ownership, vehicle authenticity, and service histories, enhancing trust and reliability. For manufacturers, blockchain helps protect against duplicate products and counterfeit components. It is also extensively used in fleet leasing, where tamper-proof smart contracts provide secure access to contracts and financial transactions, reducing theft risk. AR/VR technologies offer immersive virtual showrooms where customers can interact with and customize products to find the best fit for themselves. AI virtual assistants can provide round-the-clock remote troubleshooting and assistance, offering service advisory if vehicles break down anywhere in the world. These assistants can promptly flag issues to the nearest service centers, ensuring timely and efficient support. AI virtual assistants can schedule maintenance, monitor vehicle health in real time and predict potential issues before they occur. Moreover, AI and IoT play integral roles in providing hands-free information, telematics, and predictive analytics for insurance and maintenance.

Leading industry players like Mahindra, Mercedes Benz, Toyota, and Honda are spearheading the adoption of transformative technologies, setting new benchmarks in the automotive sector. For instance, Mahindra is implementing generative AI-driven solutions for collision avoidance systems, lane assist, and cruise control in their SUVs set to launch by 2025. Additionally, Mahindra is utilizing AI in design engineering to optimize aerodynamics, significantly improving vehicle performance and efficiency. While Mercedes Benz is enhancing customer experience with their MBUX Virtual Assistant powered by generative AI, which provides more personalized interactions and natural communication. This includes AI-linked navigation and gesture control, as well as smart sales assistance and website experience enhancement. These innovations not only elevate customer experiences but also drive industry-wide advancements in manufacturing practices.

Exhibit 5.1.2

Industry leaders' opinion on AI and Deep Tech transformation in autotech

FUTURE OF AUTOMOTIVE

Mahindra

"The rise of Generative AI is likely to be a major inflexion point which could fundamentally transform life and business as we know it. AI could literally become a co-pilot in almost everything that we do."

Anand Mahindra,
Chairman, Mahindra and Mahindra

Mercedes-Benz

"Deep Tech is revolutionizing the automotive industry, making cars advanced AI-powered devices with cutting-edge electronics. Software-driven innovations, like gesture controls, and data analytics are enhancing predictive capabilities, propelling the industry forward."

Manu Saale,
MD and CEO, Mercedes Benz Research and Development India

TOYOTA

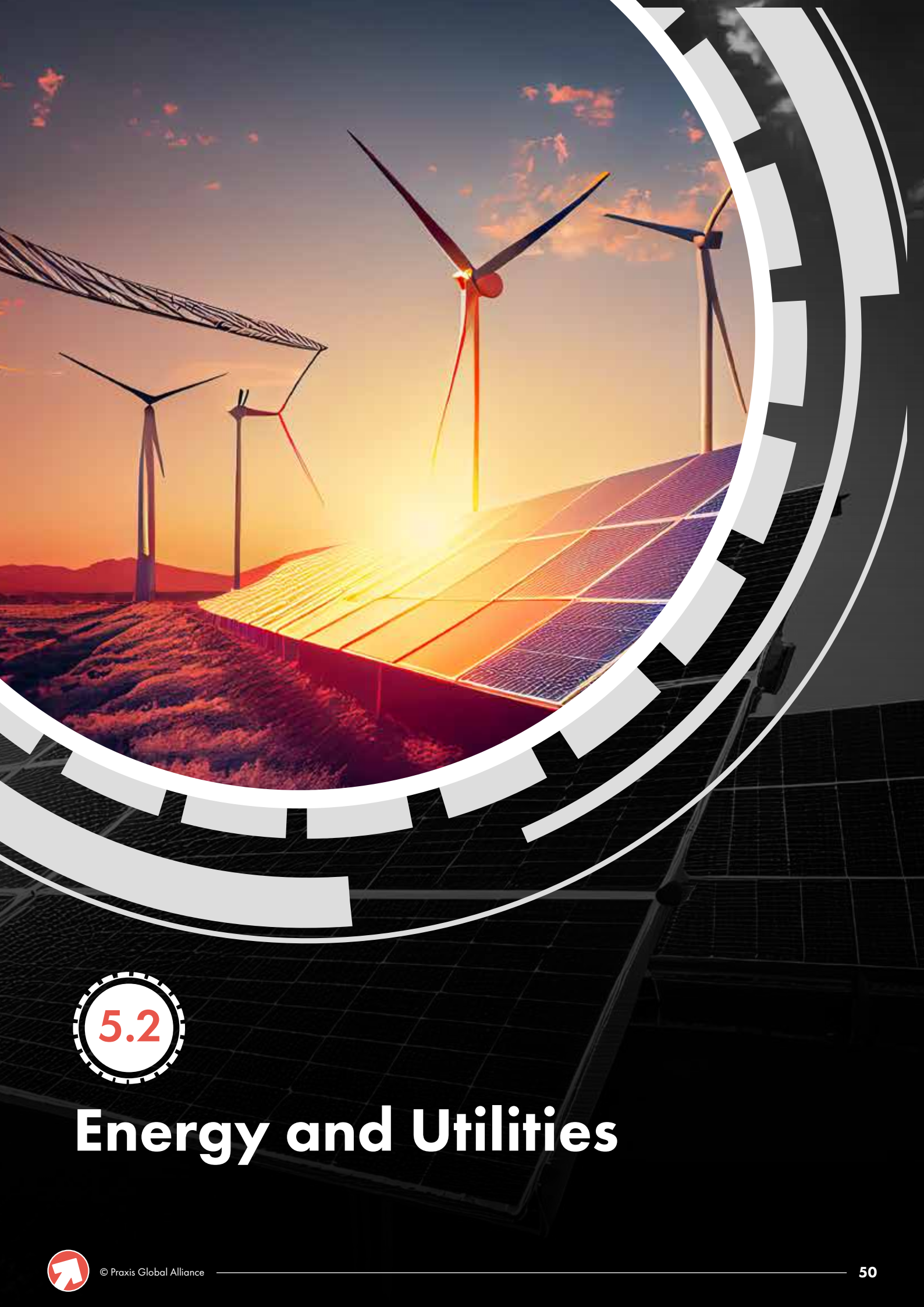
"The auto industry is in a state of revolution rather than evolution, AI is helping accelerate what we offer our customers, transforming Toyota into the mobility company we need to be to compete in this changing landscape."

Ted Ogawa,
President, Toyota Motor North America

HONDA INNOVATIONS

"The idea for these advanced AI technologies and the reason why we like them so much is that they augment and help our workers in these environments to create better products. It's not about replacing a human being; it's about supplementing and augmenting their activities, and that's really where we see, as a company, the value of AI. It almost gives us superpowers."

Dennis Clark
Managing Director, Honda Innovations



5.2

Energy and Utilities

The energy and utilities industry, a vital part of global infrastructure, is experiencing a significant transformation owing to AI and Deep Tech. As societies aim for more sustainable and efficient energy practices, AI and Deep Tech impact every step of the energy process, from generating power to storing, transforming, distributing, and finally, consumption.

Energy generation is being revolutionized by various Deep Tech innovations, with algae biofuels as a prime example. Energy-rich oils extracted from algae, such as seaweed, offer a renewable energy source that is environmentally friendly. When burned, these biofuels release only the carbon dioxide that the algae absorbed while growing, making them carbon neutral. Thermoelectric and transparent solar materials, such as AZO (Al:ZnO), ITO (In:SnO_2), $CuAlO_2$, and CuI, have the potential to convert UV and infrared light into electricity. These materials, which have no moving parts, can serve as portable and environmentally friendly energy sources. Nanocomposites are also playing a crucial role in energy generation. These strong yet lightweight materials are finding diverse applications, like being used in wind turbine blades, increasing their durability and performance. Furthermore, technologies such as space tech including satellite imagery, and AI/IoT based energy forecasting, and drone inspections are also poised to reform energy generation in the coming years.

The integration of IoT for energy forecasting allows for precise demand predictions, significantly improving energy efficiency and grid management. This technology ensures that energy production aligns closely with consumption patterns, reducing waste and enhancing grid stability.

When it comes to energy storage, IoT and robotics are transforming the domain with condition monitoring and robotic maintenance. Advanced materials such as nanostructured supercapacitors are ground-breaking innovations in space as well. These electrochemical energy storage devices offer high power density, fast charge and discharge times, and long cycle life. They are used in applications ranging from Li-ion batteries to thermoelectric and photovoltaic systems. Another development is metal-air batteries, which have approximately 30 times the energy density of traditional lithium-ion batteries. These batteries are cost-effective, depending on the metal anode used, and are intrinsically safer.

Industry leaders like Aramco, AVEVA, Shell, and ExxonMobil are at the forefront, utilizing and innovating AI and Deep Tech solutions. Shell's commitment to sustainable energy production is demonstrated through its use of AI and ML, particularly via programs like the Shell Residency Program, where research is conducted across the business to optimize operations and integrate AI and Deep Tech. Shell employs robotics, high-performance computing, and blockchain as part of a comprehensive strategy for operational enhancement and emissions reduction. Additionally, Shell's flagship start-up incubation program, the Shell E4 program, has expanded to include investments in Deep Tech companies working in the energy and mobility sectors. Similarly, ExxonMobil utilizes AI to integrate data silos, expediting the development of oil wells. The company's application of big data and machine learning for safe drilling pads using seismic imagery highlights its dedication to leveraging advanced technologies for safer and more efficient energy exploration.

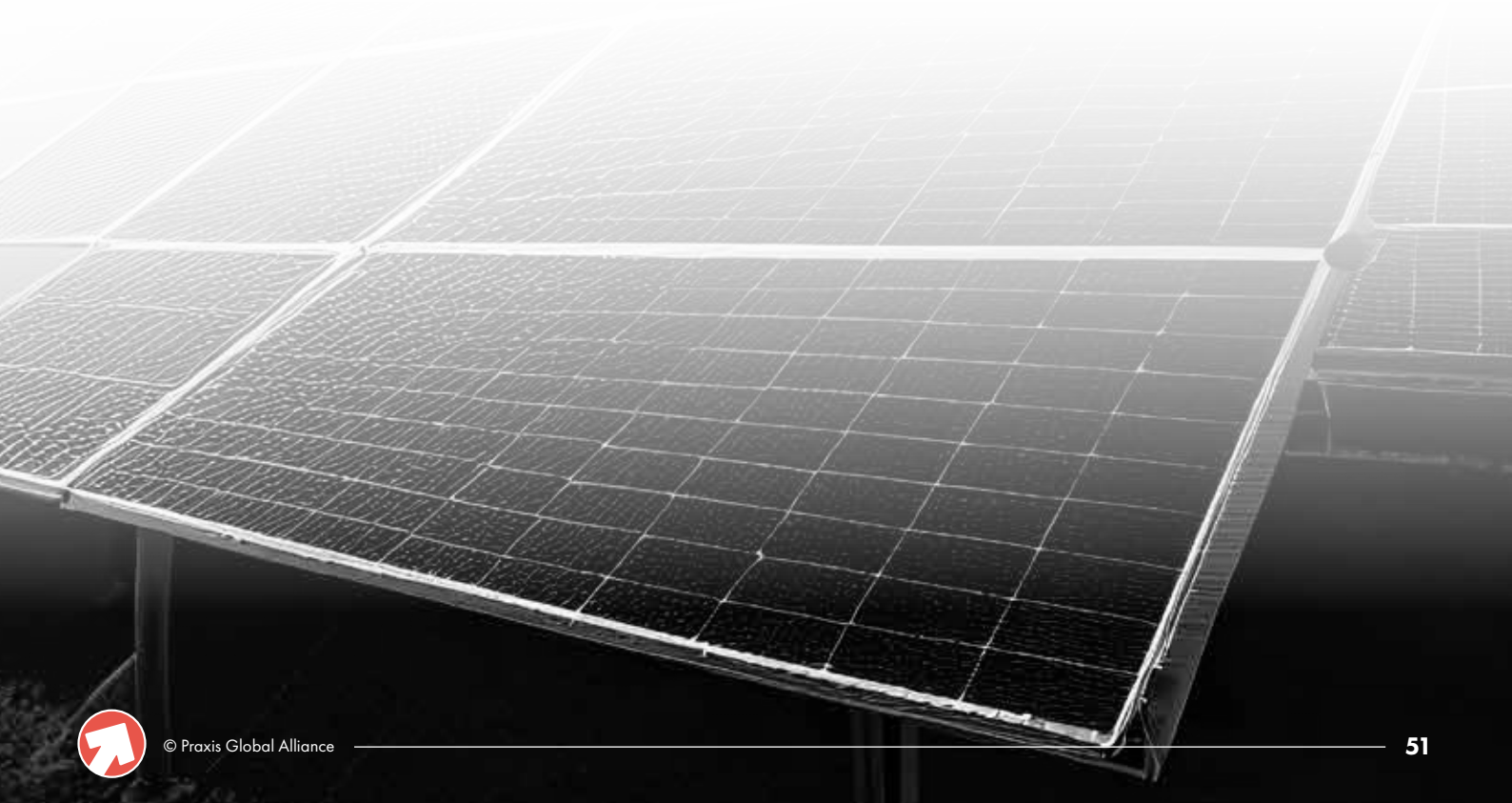


Exhibit 5.2.1

The AI and Deep Tech revolution will transform the energy and utilities industry by enhancing the efficiency of operations throughout the value chain

Select disruptive themes

Generation	Storage	Transformation, transmission, and distribution	Consumption

Generation

Advanced materials and photonics

Facilitate the adoption of advanced materials in energy infrastructure

- **Thermoelectric and transparent solar materials**
- **Nanocomposites** are strong and lightweight materials for wind blades
- **Algae biofuels** improve the cultivation of algae for biofuel prod.
- **Photonic solar cells** that enhance the efficiency of solar panels

AI, robotics, and IoT

Implement AI and robotics for predictive maintenance to reduce downtime

- **Predictive maintenance** to analyze sensor data for predicting failures
- **Energy forecasting** to improve efficiency by predicting demand
- **Drone inspections** of pipelines and wind turbines reduce human risk

Space tech

- **Satellite imagery** to identify potential drilling sites

Storage

IoT and robotics

Deploy IoT sensors and drones for real-time monitoring and maintenance of storage system

- **Condition Monitoring** for predicting maintenance needs and optimizing performance
- **Robotic maintenance** for reducing labor costs, improving safety, and extending the lifespan of storage assets

Advanced materials and Quantum computing

Evaluate advanced materials that can add to the performance of energy storage systems

- **Solid-state batteries** to improve storage density, safety, and lifespan, replacing liquid electrolytes
- **Nanostructured supercapacitors** to increase power density for rapid energy release and recharge
- **Metal-air batteries** to enhance storage capacity and efficiency
- **Battery material design** by utilizing quantum computing for simulations to discover new materials for storage

Transformation, transmission, and distribution

Advanced materials

Scout for new materials that can enhance the efficiency of transformers and grid-components

- **High-temp. superconducting wires** that have minimal resistance, reduce energy losses and enhance efficiency
- **Superconducting fault current limiters (SFCLs)** to stop short circuits and fault currents

Robotics

Establish a drone inspection program for long transmission lines to cut maintenance costs

- **Fault assessment** using drones with specialized sensors to inspect transmission line towers

AI and IoT

Set up smart grid operations using IoT sensors network combined with AI

- **Distributed grid sensors** to help enable faster fault detection
- **Dynamic load balancing** to reduce overloads and minimize energy losses
- **Predictive maintenance** for transformers based on usage patterns

Consumption

Blockchain

Blockchain-based platforms for secure energy trading and billing, peer-to-peer energy sharing

- **Energy tokenization** incentivizing renewable energy generation and trading among consumers
- **Blockchain-based energy trading** between consumers and prosumers for real-time billing and settlements

AI and IoT

Develop energy management systems for industrial, commercial and residential users

- **Energy-efficient building** controls, monitor and optimize electricity in commercial buildings, reducing waste
- **Smart home automation** of systems based on occupancy and usage patterns

Advanced materials

Facilitate discovery and adoption of innovative materials that enhance sustainability

- **Advanced insulation materials** that lead to lower energy consumption
- **Phase change materials** can reduce the need for traditional HVAC

Expected adoption Short-term → Long-term

Exhibit 5.2.2

Industry leaders' opinion on AI and Deep Tech transformation in e-commerce

FUTURE OF ENERGY AND UTILITIES

Shell

"The emergence of advanced digital technologies such as remote sensing, AI, robotics, high-performance computing and blockchain are vastly improving our ability to monitor, optimize and automate operations, and pull the right levers to reduce GHG emissions. These systems have started to transform the energy sector, and that transformation is gathering pace."

Jay Crotts,
Executive Vice President and Chief Information Officer, Shell

Aramco

"As the enormous impact of COVID-19 was felt throughout the global economy, we intensified our strong emphasis on accelerated deployment of digital technologies in areas such as AI, robotics and automation across the company significantly enhanced our performance and continued to make progress on breakthrough low-carbon solutions."

Amin H. Nasser,
President and CEO of Aramco

AVEVA

"AI helps connect simulation data with the real data, feeds it to an optimization engine. A human being can then find the gaps, put in the prescriptive analytics and make processes better and less carbon intensive - what's not to like?"

Rashesh Mody,
EVP Business Strategy at AVEVA

ExxonMobil

"Big data and machine learning could help us identify the safest locations to position drilling pads, by analyzing seismic imagery to identify hazards, or fracture zones far beneath the surface. We could then use that information to determine the best surface site for drilling, a location away from challenging rock conditions far below."

Xiaojun Huang,
Optimization and Data Science Chief at ExxonMobil

5.3

Logistics

The integration of AI and Deep Tech in the logistics industry isn't just a technological upgrade; it's reshaping the very core operations across inbound, loading/unloading, storage and packaging, and outbound processes.

For inbound logistics, the use of self-healing materials like epoxy polymers is revolutionizing packaging materials, repairing micro- and nano-level cracks without compromising mechanical properties. This not only reduces costs but also enhances durability and sustainability by minimizing discarded materials and prolonging service life. Electric vehicles (EVs) are also transforming inbound logistics, leveraging AI and IoT for real-time supplier monitoring, leading to improved supplier selection and collaboration. AI-driven demand forecasting models optimize raw material inventory, while smart contracts ensure compliance and minimize quality-related disputes, streamlining the entire inbound logistics process.

The loading/unloading phase is undergoing a paradigm shift with the integration of autonomous robotic handling. This significantly enhances production efficiency, with smart pallets and containers further streamlining transit operations, minimizing downtimes, and reducing delays. Cognitive robotic process automation (RPA) addresses paperwork challenges, reducing manual intervention and potential errors. Through advanced machine learning algorithms and natural language processing, cognitive RPA systems streamline documentation tasks, significantly reducing manual intervention and mitigating potential errors in logistics operations. Additionally, advanced materials such as graphene are leveraged for protective equipment, providing lighter and more durable gear for personnel involved in loading/unloading operations. Other unique applications include 3D printing custom cargo which enables safe movement of unique cargo, while real-time asset tracking reduces wastage due to stock expiry.

Exhibit 5.3.1

The AI and Deep Tech revolution is expected to transform the current logistics landscape due to several disruptive applications throughout the value chain

Select disruptive themes

Inbound

AI, blockchain, and IoT

Converging technologies can optimize procurement and inventory management, cutting costs and reducing time to market

- **Demand forecasting models** to optimize raw material inventory
- **Smart contracts** to help in automating payments upon delivery of cargo
- **Real-time monitoring** of inbound logistics to improve tracking of cargo

Advanced materials

Preserve and extend product life using advanced materials

- **Advanced battery material** can be used in EV trucks enabling sustainability
- **Self-healing materials** like epoxy polymers can be used in pallets, containers, or loading equipment
- **Advanced composite materials** are light and durable, resilient in harsh climates and rough handling

Loading and unloading

Robotics and IoT

Creating efficiencies by automating processes that result in quality control and cost savings

- **Cognitive robotic process** that automates paperwork
- **3D printing custom cargo packaging** to enable safe movement of unique cargo
- **Autonomous robotic handling**
- **Smart pallets and containers** for easy movement and communication

Blockchain

Creating an immutable ledger for all stock items for easy tracking

- **Real-time asset tracking** to reduce wastage due to stock expiry

Advanced Materials

Innovation of raw materials that can enhance efficiency and process

- **Protective equipment** made from graphene, that is lighter and more durable

Storage and packaging

Robotics and AR/VR

Integrate photonics and electronics to improve monitoring and control

- **Cognitive computing for dynamic packaging**
- **AR for warehouse operations** to assist warehouse workers in identifying and locating goods
- **Inventory management** via robots with IoT sensors to reduce stockouts and excess inventory
- **Condition monitoring** with real-time data on the condition of goods and materials stored in a warehouse

AI and IoT

AI and ML models used to improve the storage process and enhance maintenance via IoT sensors

- **Predictive maintenance** to help with handling and storage
- **Advanced warehouse system** to help maximize space utilization and minimize travel time

Outbound

Robotics and IoT

Real-time monitoring and control of outbound logistics processes

- **Drone deliveries** to remote or difficult-to-reach locations to help improve last mile logistics
- **Vehicle condition monitoring** with IoT sensors to monitor the vehicle condition

AI and Quantum Computing

Both technologies combined can improve route planning and distribution

- **Risk management** through optimization of delivery routes in real-time by detecting disruptions
- **Generative AI-powered assistants** that provide real-time updates to customers regarding shipments and other queries
- **Last mile improvements route planning with quantum capabilities** to reduce door-to-door freight costs by supporting global routing optimization

Expected adoption Short -term → Long-term

Source(s): Secondary Research, Praxis analysis

Storage and packaging operations are undergoing crucial transformations through the extensive deployment of AI, IoT, robotics, and AR/VR technologies in the domain. With AR technology, for instance, companies can create digital twins of their facilities, essentially virtual replicas that offer real-time insights into inventory placement and movement. This innovation revolutionizes inventory management by providing easy access to the entire storage facility, enabling workers to visualize stock levels and locations instantly. Moreover, the integration of AR facilitates better decision-making by providing contextual information on stock availability and storage conditions. IoT, AI, and ML enable real-time asset tracking, minimizing wastage from stock expiry and optimizing resource use. These technologies enhance inventory management through IoT sensors, ensuring better maintenance and monitoring and preserving the integrity of stored goods throughout the logistics journey.

In the outbound logistics segment, a transformative shift is occurring with the adoption of technologies like quantum computing. Quantum computing optimizes last-mile deliveries and reduces freight costs by enabling companies to optimize door-to-door freight costs through global routing optimization. This leads to more efficient and cost-effective logistics operations. Real-time risk management tools detect disruptions, enabling the dynamic optimization of delivery routes. Drone deliveries to remote or challenging locations are another key technology reshaping outbound logistics. Startups like Aereo, Aero360, Drone Tech Lab, and Garuda Aerospace are making significant strides in utilizing UAVs and VTOLs for B2G and B2B applications. Equipped with advanced technologies such as aerial intelligence and Light Detection and Ranging (LiDAR), these drones provide real-time situational awareness and unprecedented efficiency. They excel in areas where traditional delivery methods are impractical or inefficient, offering a transformative solution to enhance reach and reliability in logistics.

Leading the charge in this transformative journey are major industry players like UPX, FedEx, DHL, and XPO Express. DHL's strategic use of AI not only expedites last-mile deliveries but also enhances predictive forecasting and customer service, increasing the adaptability of their operations. By employing collaborative robots (cobots) for sorting, DHL has boosted its sorting capacity by 40%, achieving a rate of 1,000 parcels per hour with 99% accuracy. Similarly, XPO Logistics leverages AI and ML to analyze consumer demand, predict inventory needs, and optimize end-to-end shipment visibility. Additionally, XPO is integrating Andrea, a new HR chatbot, to streamline its human resources processes, demonstrating a comprehensive approach to incorporating advanced technologies across its operations.

Exhibit 5.3.2

Industry leaders' opinion on AI and Deep Tech transformation in logistics

FUTURE OF LOGISTICS

UPS

"AI and emerging technologies are key to understanding our complex network. We need a vast amount of data collected at every stage of the process—and can use those data and AI models to track packages throughout the facilities, increase vehicle utilization and optimize our last mile routing."

Laura Patel,
Principal Data Scientist at UPS

FedEx

"FedEx is on a mission to help its customers absorb supply chain and market shocks with the help of data-driven insights gained from analytics, AI and Machine learning. We are creating more and more data across the entire lifecycle and more granular insights and use that data to create new customer-facing solutions that deliver immediate value."

Clayton Clouse,
Director at Data Science at FedEx

DHL

"As a logistics leader, our remit has always been to enable faster and smoother last-mile deliveries for our customers – something which AI is certainly helping with. But it's also having a transformative effect further up the supply chain – on predictive forecasting, parcel sorting, customer service, the overall ability of a business to adapt to challenges."

Oliver Facey,
SVP of Global Network Operations Programs at DHL Express

XPO

"The company is using artificial intelligence and machine-learning capabilities to analyze consumer demand and predict inventory for its retail customers. Other applications include providing end-to-end shipment visibility and optimizing sequencing, so drivers have the best route possible."

Mario Harik,
CIO, XPO Logistics

06

Healthcare and Lifesciences

6.1

Healthcare

In healthcare, the profound influence of AI and Deep Tech is reshaping every segment of the industry from identification and prevention of diseases to post-treatment care. This transformative shift is driven by the seamless integration of cutting-edge technologies, promising precision, accessibility, and significantly improved outcomes for patients.

Disease identification and prevention is employing blockchain to ensure security and privacy of medical records with unique digital identities along with IoT being utilized for real-time remote patient monitoring. AI and genomics driven personalized wellness plans enhance patient care and contribute to significant reductions in healthcare costs. By proactively addressing potential health issues based on genetic insights, these plans can prevent the onset of serious conditions, thereby reducing the need for expensive treatments and interventions down the line.

Similarly, consultation services are set to undergo a substantial overhaul with AI-based innovations such as virtual assistants and optimized resource allocation, thus reducing waiting times. The integration of augmented reality (AR) and virtual reality (VR) technologies. With AR/VR, doctors can create highly accurate 3D models of a patient's body, allowing for a more thorough understanding of complex medical conditions. For example, a patient's specific symptoms, such as localized pain or visible swelling, can be replicated within a virtual environment. Medical professionals can then interact with this virtual representation, exploring different angles and perspectives to gain deeper insights. Blockchain-based Electronic Health Records (EHR) are also helping minimize duplicate tests and consultations, ensuring data consistency across the healthcare network.

Exhibit 6.1.1

The AI and Deep Tech revolution will transform the current healthcare system by enhancing the quality and accessibility as the healthcare services become more personalized

Select disruptive themes

Disease identification and prevention	Consultation	Diagnosis and testing	Treatment and post treatment
AI and biotech For predicting at-risk individuals and develop personalized wellness plans **Genomic profiling** to identify genetic markers associated with risk **Personalized wellness plans** to improve patient outcomes and reduce healthcare costs **Predictive analytics** to optimize resource allocation and mitigate epidemic impact	**AI** Implement generative AI-powered chatbots and virtual assistants for patient consultation **Virtual assistants** for consulting and appointment scheduling **AI-driven telemedicine** for real-time wellness consultancy **Optimized resource allocation** for physician schedules to reduce wait time	**Blockchain** AI-driven analysis alongside robotic help can speed up the diagnostic process **AI integration in medical imaging** to improve the accuracy of diagnosis in radiology and pathology **AI-based pathology slide analysis** to analyze tissue samples and identify cancerous cells quickly **Robotic lab assistants** to automate tasks reducing errors and manual labor	**AI and biotech** Implementing gen AI for personalization and pioneering transplant through cloning **Precision medicine and personalized treatment** **Organ cloning for therapeutic cloning in transplants**
Blockchain Implement blockchain to ensure the security, privacy, and accessibility of medical records **Digital identity** preserves data integrity and privacy for proactive healthcare decisions	**AR/VR** AR/VR consultancy for effective remote healthcare prognosis **Body visualization** to replicate the patients' symptoms for prognosis **Remote collaboration** with doctors to provide accurate consultancy	**Biotech and advanced chemicals** Scouting for new technologies emerging in diagnostic assays and testing kits enabling more accurate and rapid detection of diseases **Aptamer-based assays** for detection of biomarkers and pathogens in samples **Nanomaterial based assays** for detecting diseases, pathogens, or biomarkers at lower concentrations **Quantum dots** for high specificity, reducing the risk of false-negative results in diagnostic tests	**Robotics and AR/VR** Deep technologies can transform surgical procedures, transplants and redefine health care **Robotic surgery** for precise and minimally invasive procedures **Augmented surgery** to provide surgeons access to procedure details, required equipment, etc. **Personalized 3D printed prosthetic design** that precisely match the patient's limb
IoT Utilize IoT devices to collect real-time patient data **Remote patient monitoring** to reduce hospital admissions of at-risk patients	**Blockchain** Ensures data consistency across healthcare network and streamlining consultation **Decentralized Electronic Health Records (EHR)** where healthcare providers can add immutable records to patient's blockchain		**Blockchain and IoT** Transforming insurance claim processes and post-care services using deep technologies **Trust architecture** to automate insurance claims through smart contracts **Wearable devices and remote monitoring** for disease management

Expected adoption Short-term → Long-term

Source(s): Secondary Research, Praxis analysis

AI-driven analysis of medical imaging is revolutionizing the field of diagnosis and testing. AI algorithms, trained on vast datasets of medical images, can detect, and quantify abnormalities with exceptional accuracy. X-rays and CT scan systems are being augmented with AI that can identify signs of conditions such as pneumonia, tuberculosis, and even COVID-19 by recognizing patterns and anomalies that may be imperceptible to human radiologists. This not only enhances diagnostic accuracy but also significantly reduces the time required to analyze images, allowing for quicker clinical decisions. Innovations in biotech and advanced materials are helping to curate Aptamer and Nanomaterial-based assays which are now instrumental in detecting biomarkers and pathogens at lower concentrations as well.

Treatment and post-treatment care are witnessing breakthroughs as well, particularly in medicines and surgeries. Recent advancements in pharmacogenomics are immensely helping labs to create precision medicine, giving personalized treatment for each individual. Augmented surgery, facilitated by Deep Tech, provides surgeons with detailed procedural insights and required equipment, improving precision during complex surgical procedures. Robotic surgery causes smaller incisions, reducing pain and scarring. It also shortens hospital stays and speeds up recovery times for patients. Wearable health monitoring devices help people manage chronic diseases by continuously tracking their health. They collect real-time data, which helps detect issues early, create personalized treatment plans, and improve patient engagement and preventative care. Additionally, interoperability and seamless data exchange enable a comprehensive view of patients' conditions, promoting informed decision-making by healthcare professionals.

Several prominent companies, including Medanta, Cigna, Cardinal Health, and UHG, are leveraging advanced technologies like AI and ML to drive innovation and improve their services. Cigna's application of machine learning to forecast chronic diagnoses exemplifies a proactive healthcare approach, empowering both patients and providers with informed decision-making capabilities. Meanwhile, Medanta's incorporation of AI enables doctors to gain an understanding of meaningful patterns from data collection and eventually save a lot of time, effort, and costs through easy access to consistent diagnosis and treatment. Despite the increasing adoption of digital health, there is still significant potential for Deep Tech to further revolutionize the healthcare market in the future.

Exhibit 6.1.2

Industry leaders' opinion on AI and Deep Tech transformation in healthcare

FUTURE OF HEALTHCARE

UHG

"The responsible use of AI continues to provide important opportunities for health care leaders to streamline administrative processes and provide more effective patient care with enhanced experiences for both patients and providers."

Steve Griffiths,
Chief Data and Analytics Officer, Optum Labs arm of UHG

"There is a huge assistance from AI in the delivery of healthcare today. Now the physician has a complete picture of what could be the different diagnosis and you try to compute it from there. The power of AI can also be leveraged to help newer physicians, who don't have much of experience to derive the right conclusions."

Dr. Naresh Trehan,
Chairman and Managing Director, Medanta

cigna

"Using machine learning to predict a chronic diagnosis before it occurs – and providing patients and providers with intelligence to inform their decisions and lower costs. Also, when we do outreach driven by new machine learning models, we found ~60% patients take advantage of recommended clinical programs and specialized advice."

Gina Papush,
Ex - Global Chief Data and Analytics Officer, Cigna

CardinalHealth

"Using AI-driven insights alerts the oncologist to patient risks outside of traditional clinical profiles, thereby decreasing negative outcomes that increase cost and diminish quality of life."

Bruce Feinberg,
VP and Chief Medical Officer at Cardinal Health

6.2

Lifesciences and Pharma

The infusion of advanced technologies is penetrating the core of pharmaceutical operations and revolutionizing drug discovery, clinical trials, manufacturing, distribution, and marketing.

Ground-breaking technologies like gen AI and Quantum computing are taking center stage as they expedite the drug discovery and development trajectory by predicting drug interactions with specific protein targets and optimizing molecules for chemical reactions like protein folding. Gene editing technologies such as CRISPR help edit genes by precisely cutting DNA and harnessing natural DNA to modify the gene in the desired manner. Soon, CRISPR might make it possible to correct mutations at precise locations in the human genome to treat genetic causes of disease. On the other hand, nanotechnology is also being employed to enhance drug delivery precision for effective targeted therapies, while high-throughput screening of large compound libraries aids in the identification of molecules for personalized treatments.

The trials and approvals process integrates in-silico experiments, which involve computer-based simulations and modeling, revolutionizing the pharmaceutical sector by accelerating drug discovery and development processes. These experiments enable virtual screening of drug candidates, predicting their efficacy and toxicity, thus reducing the need for extensive in vitro and in vivo trials. This approach helps in identifying potential issues early, optimizing clinical trial designs, and expediting regulatory approvals by providing robust data on drug interactions and safety profiles. Additionally, blockchain technology enhances the credibility of trial results and expedites the regulatory approval process by facilitating transparent sharing of trial data. Whereas IoT plays a crucial role by collecting real-time health data, reducing frequent site visits, and enabling remote patient monitoring through the deployment of IoT devices.

Deep Tech is revolutionizing the manufacturing and packaging sectors by introducing innovative materials and advanced technologies. In manufacturing, smart technologies like IoT sensors for quality control are being utilized to provide real-time data, optimizing pharmaceutical production processes. These sensors monitor various parameters such as temperature, humidity, and machinery performance, ensuring consistent product quality and reducing waste. Additionally, the data collected facilitates predictive maintenance, minimizing downtime and improving overall operational efficiency. In packaging, new advanced materials are being introduced such as Nano silver coatings that possess antimicrobial properties, which help to effectively reduce the risk of contamination. Additionally, they enhance the barrier properties of packaging, prolonging shelf life by preventing oxidation and microbial growth whilst also reducing package weight and improving durability. Furthermore, AI and ML models can optimize the production process by optimizing resource allocation, enhancing efficiency, and reducing costs.

Exhibit 6.2.1

The AI and Deep Tech revolution is poised to transform the pharmaceutical industry as several disruptive applications emerge for drug discovery, trials and distribution

Select disruptive themes

Drug discovery	Trials and approvals	Manufacturing and packaging	Warehousing and distribution	Marketing and fulfilment
AI and Quantum Computing Gen AI and quantum simulations for accelerating drug discovery and development **Simulates drug-target interaction** to identify specific protein targets **Molecule optimization** to discover and design structures that are optimal for drug development	**AI** AI/ML simulations can enhance resource optimization **Drug candidate screening** to predict potential drug candidates **In silico experiments** to predict outcomes of preclinical experiments	**Robotics and IoT** Real-time monitoring and control of production processes **Smart manufacturing** using IoT sensors which offer real-time data **Quality control sensors** help reduce defects **Autonomous robotic-handling**	**IoT** Real-time monitoring of warehousing and distribution **Warehouse automation** to enhance inventory and order picking **Climate control** IoT sensors that ensure the integrity of climate sensitive drugs	**AR/VR** AR/VR enhances the sales pitch and visualization experience **Virtual demonstrations** to aid sales reps while pitching
Biotech Scouting new technologies for precise, effective, and innovative personalized treatments **Gene editing and CRISPR** to edit genes by precisely cutting DNA and harnessing natural DNA repair processes **Nanotechnology** enhances drug delivery precision for effective targeted therapies **High-through put screening** of large compound libraries to identify molecules	**Blockchain** Enhancing the credibility of trial results and expedites regulatory approval process **Clinical trial data verification** by regulators on a transparent and immutable ledger	**Advanced materials** Identifying new materials for packing that prolong shelf life **Nano silver coating** reduces weight, prolongs shelf life and prevents contamination	**AI** AI can optimize distribution for efficiency across channel sales **Predictive analytics** of market trends, disease outbreaks & product demand **Optimizes storage** of drugs and equipment	**Blockchain** Enhance customer trust by reducing risk of counterfeit drugs **Drug verification by** scanning QR codes or utilizing blockchain-based apps
	IoT Collecting real-time health data reducing frequent site visits **Remote candidate monitoring** by deploying smart wearable devices	**AI** AI and ML models can optimize the production process **Drug production line optimization** for resource allocation	**Blockchain** Creating an immutable ledger for all stock items for easy tracking **Asset tracking** reduces wastage due to stock expiry	**AI** Enhancing allocation of sales representative sources **Optimized resource allocation** based on diseases and prescribing patterns **Robotics** **Drones** for delivery of medical equipment in emergencies

Expected adoption Short-term → Long-term

Source(s): Secondary Research, Praxis analysis

Within warehousing and distribution, IoT sensors play a crucial role in ensuring the integrity of climate-sensitive drugs through precise climate control. These sensors continuously monitor and regulate environmental conditions such as temperature, humidity, and light exposure, preventing degradation of drugs. Furthermore, storage optimization is achieved through AI-based automated systems that manage inventory with high efficiency, reducing human error and ensuring quick, accurate retrieval of drugs and equipment. Additionally, through blockchain we can create an immutable ledger for all stock items that enables easy tracking, reducing wastage due to stock expiry.

Deep Tech's influence extends to marketing as AI/ML models can be used to predict demand accurately by identifying key market trends and thus optimize distribution strategies for companies. Advanced verification methods, including QR code scanning and blockchain-based applications, ensure secure and reliable drug authentication, enhancing trust and transparency in the pharmaceutical supply chain. Furthermore, drones can play a crucial role in the delivery of medical equipment, especially during emergencies, ensuring timely and efficient fulfilment. Equipped with advanced GPS and real-time tracking systems, drones enhance the reliability and precision of pharmaceutical logistics, ensuring critical medical supplies reach patients quickly and safely.

Industry leaders, including Johnson & Johnson, AmerisourceBergen, Pfizer, Cipla, and others stand as torchbearers in embracing these transformative technologies. For instance, Johnson & Johnson is leveraging Deep Tech to transform healthcare by using AI for early disease detection, drug discovery, and surgical efficiency. AI algorithms are helping them diagnose diseases like pulmonary hypertension and cardiac amyloidosis earlier and more accurately. Furthermore, the company is using AI in drug discovery to accelerate the development of targeted treatments by analyzing vast datasets to identify genetic mutations. This collective adoption underscores Deep Tech's pivotal role in propelling the pharmaceutical industry toward heightened efficiency, innovation, and ultimately, enhanced patient care.

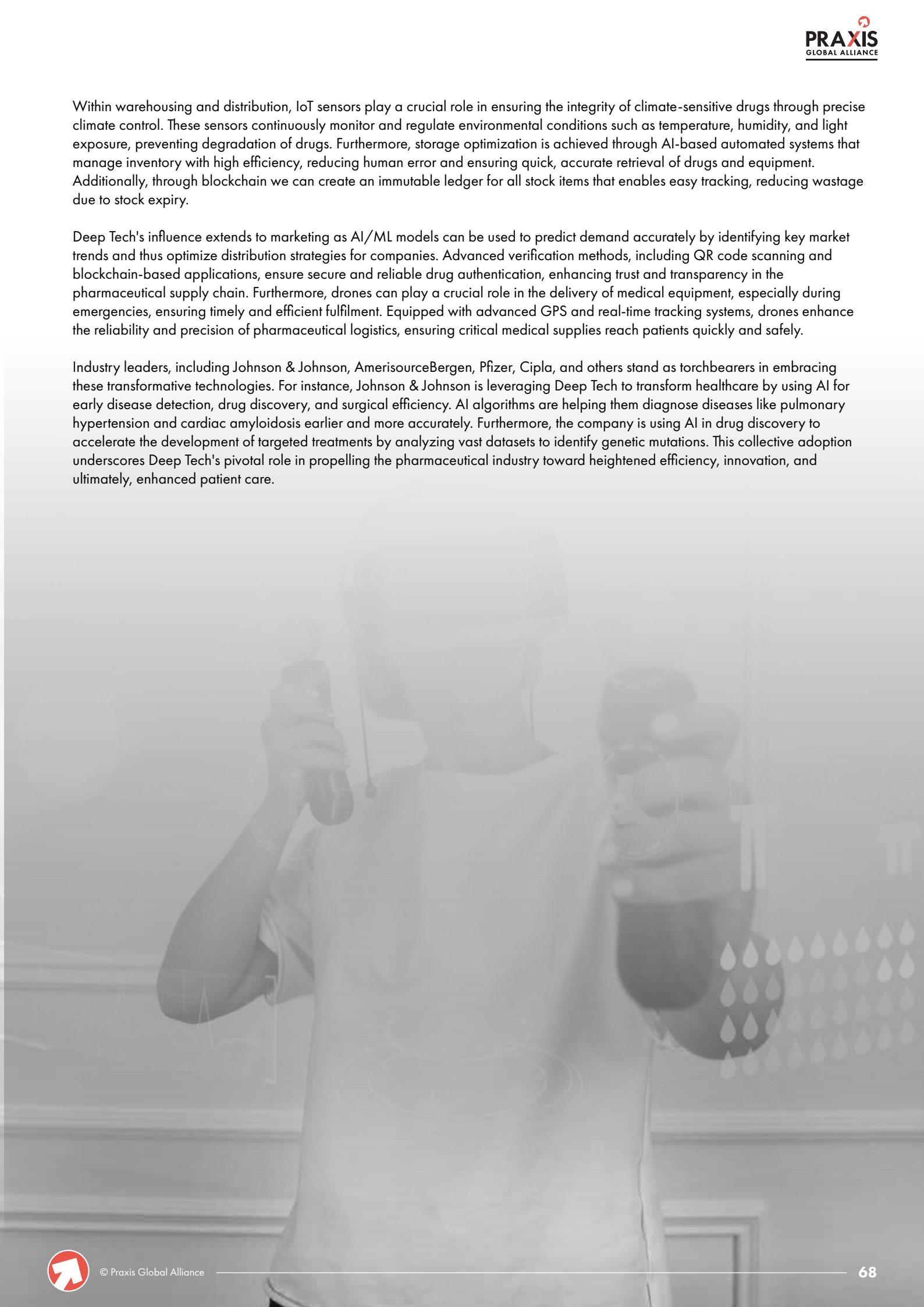


Exhibit 6.2.2

Industry leaders' opinion on AI and Deep Tech transformation in pharmaceuticals

FUTURE OF LIFESCIENCES AND PHARMA

AmerisourceBergen

"By applying advanced technologies to the healthcare space and pairing them with expert human intervention when required, we can drive faster speed to therapy and provide a more seamless experience for patients and providers."

Tommy Bramley,
Senior Vice President, AmerisourceBergen

Pfizer

"In the future, AI software trained and monitored by human experts will produce highly accurate labeling content for a new drug, and update it as the known information changes, in the blink of an eye, rather than requiring humans to do all the typing and confirming of each other's work. AI may help us predict what queries regulators are likely to come back with."

Boris Braylyan,
Vice President, Information Management at Pfizer

Johnson & Johnson

"Using the latest innovations in AI and machine learning (ML), we are able to quickly analyze these vast datasets (including electronic medical records, lab results or even medical imaging like X-rays, MRIs and CT scans), uncover new insights and then drive actions with real potential to improve patient outcomes."

Jeff Headd,
Vice President, Commercial Data Science, Johnson and Johnson

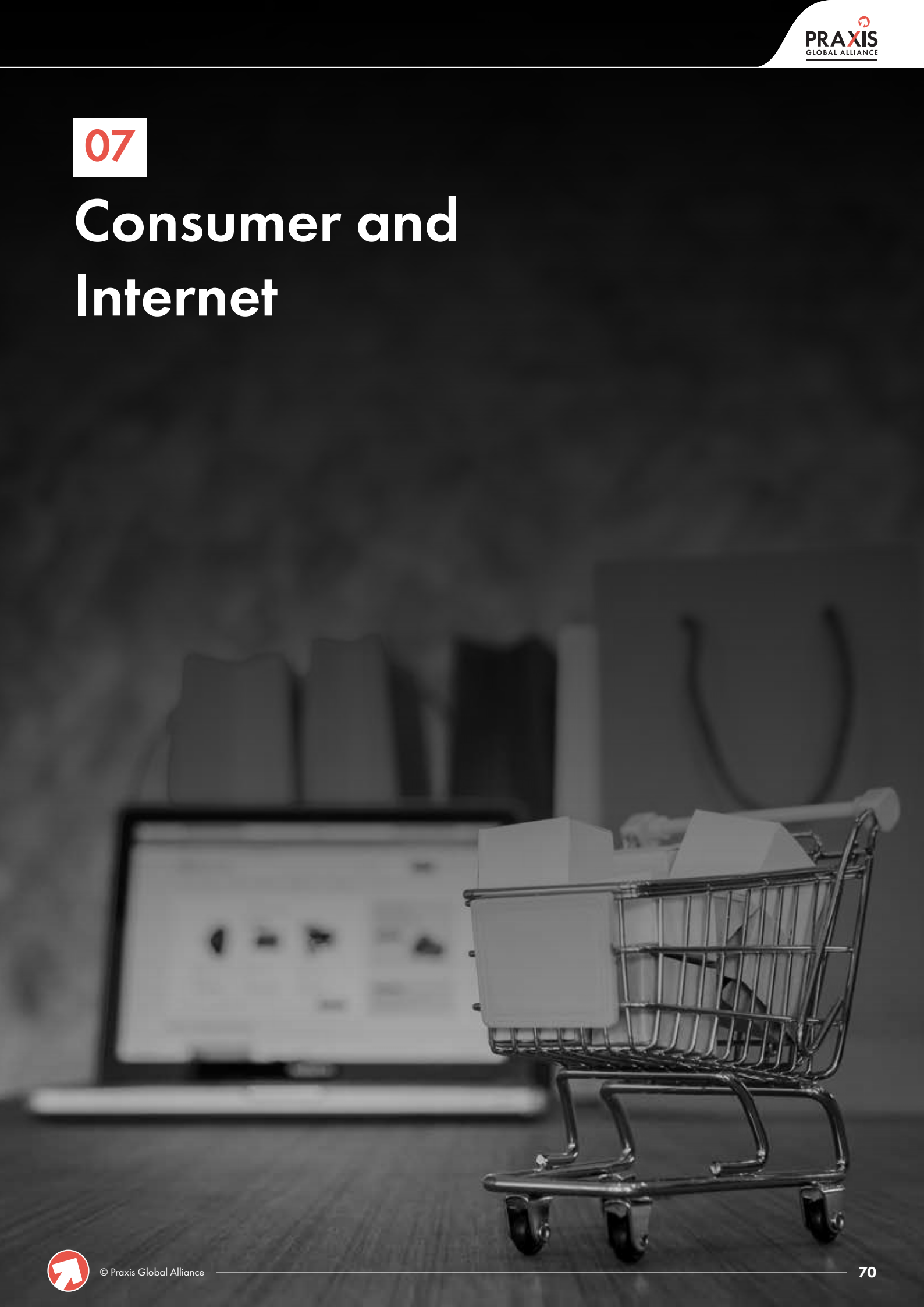
Cipla

"The pharmaceutical industry too is seeing changes with new technological intervention such as Artificial Intelligence (AI) that can accelerate drug discovery, improve clinical trials, offer personalized medicine, improve manufacturing, reduce optimize supply chain thereby immensely benefiting patients."

Nickil Baswan,
Senior Vice President and Group Head, Corporate Affairs, Cipla

07

Consumer and Internet



7.1

Consumer Goods and Retail

In this digital age, AI and Deep Tech are revolutionizing the consumer goods and retail industry by focusing on enhancing efficiency, prioritizing sustainability, and elevating the overall consumer experience. From sourcing raw materials, production, and distribution to customer fulfilment, Deep Tech is reshaping every aspect of the industry's operations.

Key Deep Tech innovations are disrupting how raw materials are procured in the consumer goods and retail industries. Plant-based proteins are a key area of innovation, with lupin, brassica, and amaranth emerging as high-protein, fiber-rich, and antioxidant-packed alternatives. These plants have the potential to substitute animal-based meat protein or complement lab-grown meat, thereby reducing the demand for livestock. Plant-based fabrics, such as plant leather, have a significantly lower environmental impact compared to traditional and synthetic leathers. They produce 40 times less carbon than traditional leather and 17 times less than synthetic vegan leather, making them highly eco-friendly. Innovative sources of plant-based leather include Mycelium leather, made from mushrooms; Piñatex, derived from pineapple leaf fibers; and apple leather, crafted from apple waste and polymers. Other upcoming technologies transforming the landscape include,

AI-powered demand forecasting models play a crucial role in managing raw material procurement and inventory management. By predicting demand accurately, these models help optimize supply chain operations and minimize waste. Robotics is enhancing efficiency through automated sampling, sorting for quality control, and 3D printing for rapid prototyping. Additionally, advanced materials such as Air carbon—a biodegradable plastic made from methane—and biochar—a carbon-rich substance produced by burning biomass without oxygen—offer CO2-negative packaging solutions. These materials not only enhance product protection but also contribute to a more sustainable production lifecycle. Other emerging disruptions in production and packaging include, AI models optimizing production, while IoT and robotics systems that enable real-time monitoring and control. These technologies support smart manufacturing for predictive maintenance, use quality control sensors to reduce defects and employ autonomous robotic handling to boost production speed and consistency.

Exhibit 7.1.1

The AI and Deep Tech revolution is poised to transform the consumer goods and retail industry with groundbreaking applications across its value chain

Select disruptive themes

Raw material and procurement	Production and packaging	Distribution and warehousing	Fulfilment
Biotech Scouting for innovation in raw materials that can enhance sustainability and yield **Modified crops** for disease-resistant and higher-yield crops **Lab-grown meat** as an alternate protein source to reduce livestock reliance **Plant-based proteins and fabrics**	**AI** AI algorithms and ML models can optimize the production process **Product line AI** models that optimize production	**IoT** Real-time monitoring and control of warehousing and distribution processes **Warehouse automation** to enhance inventory and order picking **Climate control** to ensure integrity of sensitive products during transit and storage	**AR/VR** Enhancing customer experiences and decision-making **Virtual shopping** provides immersive online shopping, especially for the apparel industry **Product visualization** in real-world environment reducing return rate
AI, blockchain, and IoT Converging technologies can optimise procurement and inventory management **Demand forecasting** models to optimize raw material inventory **Provenance tracking** using blockchain, validates product history **IoT based inventory monitoring** & increasing connectivity	**IoT and robotics** Real-time monitoring and control of production processes **Smart manufacturing** through predictive maintenance that minimizes downtime **Quality control sensors** to reduce defects and ensure consistency **Autonomous robotic handling** to enhance production speed and consistency	**AI** AI can optimize distribution operations for efficiency and save time on channel **Identify demand patterns** to improve forecasting accuracy, minimize over and understock **Storage optimization** algorithms to optimize storage maximizing utilization **Sales beat optimization and optimized channel strategies**	**AI and blockchain** Improving lead conversion by enhancing authenticity and process automation **Data-driven AI insights** for personalized campaigns and recommendations **Generative AI powered virtual assistants** **Product authentication** using blockchain to verify product authenticity
Robotics Creating efficiencies by automating processes resulting in QC and cost savings **Sampling and sorting** of raw materials for stringent QC **3D printing for rapid prototyping** and concept testing	**Advanced materials** Enhancing sustainability, product protection, and consumer experience **CO_2 negative materials** which are biodegradable polymers **Lightweight and high barrier films** to reduce packaging weight and prolong shelf life	**Blockchain** Creating an immutable ledger for all stock items for easy tracking **Asset tracking** to reduce wastage due to expiry and load on reverse supply chain for returns / exchanges	**Robotics** **Drone deliveries** which are cost-effective last-mile deliveries with the ability to service remote locations **Robotic assistants** to assist in-store customers with information and product location

Expected adoption Short-term → Long-term

Source(s): Secondary Research, Praxis analysis

Distribution and warehousing are undergoing a significant transformation with the adoption of IoT and robotics. Warehouse automation through robots streamlines order picking, reduces errors in article selection, and decreases reliance on human resources. This automation also optimizes demand fulfilment and storage utilization by constantly collecting and analyzing data. When coupled with AI, IoT enhances inventory management and order fulfilment, enabling companies to streamline supply chain operations and effectively meet the demands of a dynamic market.

Consumer fulfilment experiences are being elevated through the development of virtual shopping spaces using VR. These VR shopping environments allow consumers to interact with and control offerings in a more immersive way. The experience is further enhanced by generative AI-powered virtual assistants available around the clock for on-demand service. These assistants improve customer interactions and contribute to personalized, seamless consumer journeys

Major industry players such as Unilever, Walmart, L'Oréal, and Dabur are at the forefront of embracing these transformative technologies. L'Oréal, for instance, recently acquired augmented reality and AI company ModiFace and launched a digital skin diagnostic tool for consumers. This tool is based on 15 years of scientific research on skin aging and leverages powerful AI and data analytics to cater to consumer preferences and needs. Meanwhile, Dabur has become a cloud-only enterprise, utilizing AI and big data to automate data analysis for manufacturing optimization and supply chain management. Dabur also employs AI and ML firewalls to detect cybersecurity threats and runs hyper-personalized campaigns to target ideal customers, minimizing spending on mass marketing. These examples demonstrate the industry's proactive approach in adopting innovative solutions to enhance efficiency and customer satisfaction.

Exhibit 7.1.2

Industry leaders' opinion on AI and Deep Tech transformation in consumer goods and retail

FUTURE OF CONSUMER GOODS AND RETAIL

Unilever

"The combination of digital and leading-edge science is empowering our teams to progress their fields not by years, but by decades. The tools we use today strengthen our insights and capabilities to power next-level innovation, product reformulations, scientific discovery and portfolio simplification and we have just scratched the surface of what's possible."

Alberto Prado
Global Head of R&D Digital and Partnerships, Unilever

Walmart

"We have got incredible computing power in the palm of our hands. We have computers through deep learning that can recognize objects and understand natural language. As all these things are coming together and are fueling the next round of disruption that we are already witnessing in the way in which customers are discovering and getting inspired for new products."

Suresh Kumar,
Global CTO, Walmart

L'ORÉAL

"Our entire RNI organization is being augmented with powerful AI and data including strategic partnership, where we will combine our very large-scale consumer data with our own to better understand skin and aging. Data and AI will allow us to develop next level diagnosis services for personalized recommendation to drive loyalty and satisfaction."

Nicolas Hieronimus,
CEO, L'Oréal

Dabur

"We are using AI to automate tedious, repetitive tasks in manufacturing, supply chain, and finance services; to analyse huge sets of data from different entities, whether structured or unstructured or spatial; in cybersecurity for detecting threats and anomalies; and in improving consumer experience to hyper personalize the campaign and interaction with customers."

Kaustubh Dabral
Global Chief Information Officer, Dabur

7.2

E-commerce

In the fast-changing world of e-commerce, AI and Deep Tech are making a big difference by transforming the industry in exciting ways. The disruption in the sector is expected to be seen across all segments from supply chain to customer and platform management.

Deep Tech is making a profound impact on customer and platform management strategy. Here, the fusion of AI analytics takes center stage, unraveling invaluable insights from customer feedback, thereby informing strategic decision-making. Personalized marketing, orchestrated by AI, tailors interactions to individual preferences, offering a seamless and engaging experience. Additionally, AI-powered dynamic pricing is revolutionizing e-commerce by optimizing prices in real-time, maximizing revenue and profitability. With AI algorithms analyzing market trends and customer behavior, businesses can offer competitive prices that attract more buyers. This dynamic approach helps with pricing the products correctly, driving increased sales and customer satisfaction. Also, the implementation of predictive maintenance technologies ensures a reduction in downtime, fostering uninterrupted platform operations.

Other use cases include immersive stores allowing customers to interact with products, decentralized identity for secure verifications, quantum optimization for processing large data volumes, supply chain transparency providing end-to-end visibility, and efficient payment processing for secure, borderless, low-cost transactions.

Simultaneously, the impact also extends to supply chain management, transforming product sourcing, warehousing, packaging, and fulfilment processes. Innovations such as blockchain-enabled anti-counterfeiting enhances the security and authenticity of products, instilling confidence in consumers. Provenance tracking using IoT enhances data transparency by providing a clear and auditable trail of product's origins and modifications. This transparency becomes critical in industries where customer satisfaction plays a key role, such as quick commerce, food delivery, etc. fostering trust among consumers. Smart shelves and bins, powered by AI and Deep Tech, offer dynamic inventory management, triggering automatic reordering for streamlined operations. E-commerce generates up to 3 times more CO_2 emissions compared to brick-and-mortar retailing, with plastic packed e-commerce products playing a major role. These are being replaced by advanced materials that are CO_2 negative such as biodegradable polymers and recyclable plastics boosting environmental sustainability. The implementation of AI algorithms for route optimization serves to reduce delivery times, while cart recommendations based on customer preferences introduce a personalized touch, enhancing the overall shopping experience.

Exhibit 7.2.1

AI and Deep Tech is expected to transform the e-commerce channel by disrupting the process from supply chain to customer & platform management

Select disruptive themes

Customer & platform management | **Supply chain**

Customer acquisition and retention

AI

AI/ ML models can be employed to generate insights and enhance CX

- **Gen AI chatbots** provide personalized support to customers
- **AI analytics** to drive insights from customer feedback
- **Personalized marketing** uses AI that adapts to individual customers

AR/VR

Build immersive environments for customers to explore virtual stores

- **Immersive stores** let customers interact with products, reducing hesitation while purchasing

Blockchain

Implement blockchain solutions to enhance trust in digital platforms

- **Decentralized identity** to ensure secure verifications, simplify onboarding, and reduce fraud risk

Platform operations

AI and quantum computing

Utilize AI/ML and QC to enhance platform operations

- **Predictive maintenance** reduces downtime, ensuring smooth operations
- **Dynamic pricing** optimizes pricing based on demand and inventory
- **Quantum optimization** enhances the handling of large volumes of data

IoT and blockchain

Implement IoT and blockchain to enhance platform operations

- **Supply chain transparency** provides customers with end-to-end visibilit
- **Efficient payment processing** ensures secure, borderless, and low-cost payments

Product Sourcing

AI and IoT

Transforming procurement by optimizing management of inventory

- **Demand forecasting** models optimize inventory management
- **Provenance tracking** provides real-time visibility into supply chain, enabling proactive issue resolution

Blockchain

Enhancing the automation and transparency of procurement

- **Smart contracts** automate procurement, ensure compliance, and reduce quality disputes
- **Blockchain-enabled anti-counterfeiting** marks on products ensure authenticity

Warehousing and packaging

AI and IoT

Real-time monitoring and automating warehouse processes

- **Robotic handling,** automation, and sorting boost efficiency
- **Condition monitoring** provides real-time data on the condition of stored goods
- **Storage optimization** algorithms improve goods storage
- **Smart shelves and bins** monitor inventory and trigger automatic reordering

Advanced materials

Advanced packaging to boost sustainability and product protection

- **CO_2-negative materials** like biodegradable polymers and recyclable plastics
- Lightweighting **and high-barrier films**

Fulfilment

AI and blockchain

For personalization and optimizing fulfillment

- **Route optimization** implementing AI algorithms to reduce delivery times
- **Cart recommendations** analyze customer preferences and recommend additional products
- **Smart contracts** for returns automate returns, inspection, and refunds

Robotics

Automated inspection and delivery for reducing manual labor and costs

- **Drone deliveries** are cost-effective last-mile deliveries and cater remote locations
- **Automated inspection** of returned items, deciding whether to restock, refurbish, or recycle

Expected adoption Short-term → Long-term

Source(s): Secondary Research, Praxis analysis

Exhibit 7.2.2

Industry leaders' opinion on AI and Deep Tech transformation in e-commerce

FUTURE OF E-COMMERCE

ebay

"We've doubled down on our investment in generative AI and computer vision technologies because we believe that they have transformational value for impacting the customer experience, We've also been working on building internal generative AI tools to aid the productivity of our developers, analysts and data scientists."

Nitzan Mekel-Bobrov,
Chief AI Officer, eBay

amazon

"In a facility in San Marcos, Texas, Sparrow—our latest robotic handling system—is already picking and sorting hundreds of thousands of customer orders, taking on highly repetitive tasks. The latest advances in computer vision, machine learning, and AI are making possible today what was out of reach only a few years ago."

Robert Tekiela,
Vice President of Technology at Amazon

Rakuten

"We are focused on leveraging AI to enhance the customer experience across all of Rakuten's businesses, from e-commerce to fintech. By analyzing customer data and using machine learning algorithms, Rakuten can provide personalized and targeted recommendations to its customers. This not only improves customer satisfaction, but also drives business growth."

Ting Cai,
Chief Data Officer, Rakuten

"We use AI and ML to drive better customer experience on the platform across the value chain, be it discovering products through search, recommendations, and merchandising or carrying the right product selection at the right quality or building the best logistics network or enabling personalized user experiences and customer care."

Ravi Vijayaraghavan
Chief Data Analytics Officer and SVP, Flipkart

08

Next Gen Industrials

In the landscape of industrial manufacturing, AI and Deep Tech emerges as a transformative force, reshaping the entire value chain encompassing critical phases such as raw materials & procurement, processing & manufacturing, storage & warehousing, and distribution & fulfilment.

AI, blockchain, and IoT are playing a instrumental role in transforming raw materials procurement and industrial manufacturing, but robotics is taking the lead in this change, with applications ranging from autonomous mining to quality inspection robots. These robotic systems can execute labor-intensive tasks around the clock, significantly increasing the overall output of mines. Their precise execution minimizes material wastage, thereby reducing the overall environmental impact. Oceania is a frontrunner in deploying automated drills, followed by South America. Several advanced materials-based innovations are being used popularly such as composite materials for storing raw materials and erosion control materials which are geotextiles made from straw and coconut. These materials not only prevent material erosion during procurement but also limit the dispersion of erodent's into the environment, thereby reducing pollution.

Robotics and AI technologies are revolutionizing processing and manufacturing across various industries. Computer Numerical Control (CNC) robotics, for instance, is pivotal in precision machining, offering precise execution of computer-controlled manufacturing processes such as 3D printing and additive manufacturing. Giants like BMW, Siemens Energy, and Broetje are leveraging these technologies, significantly reducing waste, and promoting sustainable practices. Furthermore, autonomous robotic processing finds critical applications in heavy metal and mining, energy, and other sectors, where they bolster quality, efficiency, and precision. Particularly in handling hazardous materials like arsenic and lead or operating in extreme environments such as steel plants with high temperatures, these systems prove invaluable. Blockchain and IoT are also reforming the space with real-time quality monitoring and introduction of digital twins to optimize operations. Industry 4.0 is revolutionizing manufacturing by integrating advanced digital technologies and data analytics to create smart, interconnected production systems.

Quantum computing transforms storage management by creating digital twins for simulating warehouse operations. These twins analyze inbound and outbound routes, optimizing flow for seamless operations. AI enhances inventory tracking and replenishment based on forecasted demand, decreasing lead times. AI is also invaluable in storage optimization, visualizing storage units, and identifying incoming goods for easy navigation and tracking of available inventory.

Deep Tech's influence extends to distribution and fulfilment as new innovations are emerging using AI, blockchain, IoT, and robotic technologies such as provenance and order tracking, virtual assistants, product authentication, etc. Autonomous connected EV delivery vehicles are at the forefront to revolutionizing the domain by integrating seamlessly into outbound logistics. Powered by AI and IoT, these vehicles optimize routes and delivery times while leveraging predictive maintenance capabilities to monitor their health in real time. This enables the timely identification of potential faults and performance degradation. Additionally, these connected EVs can be shared across different verticals, minimizing fleet size and maximizing delivery output. The integration of these advanced technologies enhances efficiency, sustainability, and precision in industrial manufacturing and logistics, allowing them to meet dynamic market demands with greater reliability.

Major industry players such as JSW Steel, Tata Steel, Hindalco, Honeywell, and others are at the forefront of leveraging AI and Deep Tech in manufacturing. JSW Steel, for instance, harnesses the power of IoT-driven prediction models to optimize energy consumption in steelmaking, deploying custom optimization models through advanced analytics for efficient raw material and energy utilization. Real-time scheduling and tracking are employed to optimize logistics, enhancing overall operational efficiency. Similarly, Hindalco utilizes cloud technology to capture critical equipment data, which is then analyzed using AI-based models, ensuring predictive maintenance and operational excellence. These initiatives underscore the pivotal role of AI and Deep Tech in reshaping the landscape of industrial manufacturing, fostering sustainability, efficiency, and innovation.

Exhibit 8.1

The AI and Deep Tech enhances next gen industrials through advanced analytics, optimizing production and ensuring quality control throughout the value chain

Select disruptive themes

Raw materials and procurement	Processing and manufacturing	Storage and warehousing	Warehousing and distribution
AI, blockchain, and IoT Converging technologies can optimize procurement and inventory management • **Demand forecasting models** use big data to optimize raw material inventory • **Automation** by using smart contracts and strategic procurement • **Enhance raw material traceability**	**AI and robotics** AI models to optimize production and robotic processing to improve quality, efficiency, and accuracy of movements • **Manufacturing line optimization** to monitor QC and perform safety checks • **Autonomous robotic handling** to enhance production efficiency • **Precision machining through CNC robotics** to reduce waste • **Hazardous material handling** • **3D printing** for additive manufacturing	**AI, robotics, and IoT** Real-time monitoring and control of warehousing and distribution processes • **Inventory tracking and replenishment** using gen AI • **Storage optimization** using AI for maximizing space utilization • **Incoming goods identification and visual navigation** to assist warehouse workers better • **Climate control** IoT sensors ensure integrity of sensitive products • **Heavy material handling** using robotic assistance for palletizing and depalletizing	**AI, robotics, and IoT** AI helps in order scheduling and route planning to ensure order fulfilments whereas robotics automate delivery to mitigate inefficiencies • **Order tracking and route optimization** to provide customers with accurate ETA of products • **Generative AI-powered virtual assistants** that assist customers with inquiries, orders and troubleshooting • **Predictive maintenance of vehicles** by monitoring vital parameters continuously • **Autonomous delivery vehicles** that navigate predefined routes etc. to ensure smooth delivery
Robotics and space tech AI-powered robots can be used for raw material extraction and sample testing • **Autonomous mining robots** • **Quality inspection robots** to test incoming raw materials • **Satellite imagery** to survey and monitor remote sites	**Blockchain and IoT** Real-time quality monitoring for streamlining processing and using blockchain to protect IP • **Real-time quality monitoring** • **Conditional access control for machinery** to enhance security • **Industry 4.0** integrates digital tech and data in manufacturing • **Digital twins** optimize operations via visual representation of systems	**Quantum computing** Real-time data processing and agile changes to random shifts in demand and supply • **Disruption management using** multiple scenario stimulation, that quantifies impact on processes to improve inefficiencies	**Blockchain** Maintain transparent record of end-to-end product journey to ensure standardization • **Provenance tracking** helps in taking corrective measures in case of disruptions • **Product authentication** using blockchain to verify product authenticity, reducing the risk of counterfeit
Advanced materials Extended product life and sustainable procurement using advanced materialsi • **Composite materials** to enhance product durability and raw material storage • **Erosion control materials**			

Expected adoption Short -term → Long-term

Source(s): Secondary Research, Praxis analysis

Exhibit 8.2

Industry leaders' opinion on AI and Deep Tech transformation in next gen industrials

FUTURE OF NEXT GEN INDUSTRIALS

JSW Steel

"JSW Steel is leveraging multiple digital technologies to optimize operations like Industrial Internet of Things-driven power prediction model to optimize power consumption in steel-making, custom optimization models enabled through advanced analytics to ensure efficient use of raw materials and energy, real-time scheduling and tracking to optimize logistics."

Seshagiri Rao,
Group CFO,
JSW Steel

TATA STEEL
#WeAlsoMakeTomorrow

"The company has been able to improve numerous business KPIs over the years through the use of digital technologies and 60-70% of the solutions have some form of AI or data analytics built into them. Overall, digital initiatives have created improvement upwards of Rs 1,000 crore in the last 2 years for Tata Steel."

Jayanta Banerjee,
Group CIO,
Tata Steel Ltd

HINDALCO

"By using the cloud, Hindalco has been able to capture data of critical equipment and analyze them using AI-based models. For example, if a machine has run for 2000 hours, then the AI model can trigger an alert based on historical data of the possibility of the machine breaking down. This has helped in reducing downtime in a big way, through predictive maintenance."

Atanu Pramanic,
CIO, Hindalco

Honeywell

"Honeywell showcased a range of technologies designed to increase productivity, improve safety, and enhance the employee experience. To do this, Honeywell focused on simplifying processes, delivering automation and AI as well as enhancing the breadth of training options with mobility (tablets and smartphones), augmented reality (AR), and virtual reality (VR)."

Pramesh Maheshwari,
Vice President and General Manager, Honeywell

09

Financial Services

AI and Deep Tech are driving a significant shift in the finance and banking sector, reshaping core activities across various critical domains from optimizing lead generation and verification to enhancing operational processes. This transformation extends to key financial operations, including customer acquisition and management, product development, operational efficiency, and risk management.

Technologies like generative AI assistants have revolutionized the account setup process by automating data entry, minimizing errors caused by manual entry, communicating necessary requirements (documents, etc.) during the account setup process, and providing voice/prompt-based personalized guidance. These assistants can also help financial institutions validate customer information by mapping it with centralized data repositories. Additionally, robotics can streamline site inspections by using drones and automated systems to quickly gather detailed visual and environmental data of properties. This data can be processed and analyzed in real-time, enabling faster and more accurate property assessments, thereby expediting property-related lending approval processes.

Blockchain technology for tokenized ownership in real estate enables fractional ownership, allowing investors to buy and sell shares of properties easily. This increases liquidity by making real estate assets more accessible and tradable and enhances diversification by allowing investors to hold stakes in multiple properties, thus democratizing real estate investment and reducing entry barriers through broader market participation. Leveraging AI for algorithmic trading enables real-time trading decisions by analyzing vast amounts of market data, identifying patterns, and executing trades at optimal times with high accuracy. AI algorithms can adapt to changing market conditions, predict price movements, and manage risks effectively, thus increasing trade efficiency.

Apart from trading, AI and quantum computing can be leveraged by financial institutions for real-time portfolio management by using predictive analytics to assess liquidity needs and mitigate risks like bank runs, while quantum computing can handle complex financial models for faster and more accurate decision-making. This can enhance risk management and allows institutions to respond swiftly to market changes thereby increasing the resilience against systemic shocks. Implementing AI can significantly enhance claim processing by analyzing visuals of damaged assets to automate claim assessments. This involves using computer vision technology to quickly evaluate damage and reduce processing times. Other use cases include ensuring customer data privacy with blockchain, loan syndication through shared ledgers, optimizing maintenance schedules for ATMs, and using RPA to automate data entry, validation, and document verification which are optimizing operations and transforming administration to be more efficient.

Risk mitigation and fraud prevention are also being revolutionized. AI enables more accurate lending decisions, reducing default rates by analyzing detailed credit data and identifying patterns, it is aiding fraud detection systems to enhance security by quickly identifying suspicious activities, thereby reducing financial losses. Blockchain technology enables the creation of immutable records by creating a decentralized ledger where each transaction is recorded in a block, linked to previous blocks, and cryptographically secured, making it difficult for fraudsters to manipulate data. By leveraging smart contracts, financial transactions can be automated and secured, reducing the risk of manipulation and fraud, and ensuring transparency. This innovation not only enhances security and efficiency in financial transactions but also fosters trust among participants, leading to a more robust and resilient financial ecosystem. Further, implementing quantum-safe encryption, protects sensitive financial data from potential attacks, ensuring long-term security.

Leading players in the finance and banking industry, such as Axis Bank, Kotak Mahindra Bank, Capital One, Vanguard and others are actively adopting AI and Deep Tech in their day-to-day operations. For instance, Axis Bank utilizes AI-based fraud detection systems and chatbots for efficient customer support. The AI chatbots drove productivity gains for Axis Bank by reducing service costs and elevating total customer service queries. It is also using blockchain to revolutionize various aspects of digital banking, particularly in trade finance. Blockchain-based tech provides a seamless experience to all participants involved in trade transactions, by giving them visibility of the transaction and document, thus resulting in better management of working capital requirements.

Exhibit 9.1

The AI and Deep Tech revolution has potential to disrupt the financial services industry across the entire value chain, significantly improving operational efficiency

Select disruptive themes

Sales and customer acquisition	Products and offerings	Operations and administration	Risk mitigation and fraud prevention
AI AI can enhance lead prospecting and automate the onboarding process **Enhanced lead prospecting by** analyzing customer data **Gen-AI assistants** to automate account setup and data verification	**AI and quantum computing** Gen AI combined with QC can create new and personalized investment instruments and strategies based on risk and market conditions **Investment portfolio optimization** through AI analysis of market conditions and risk management **AI robo-advisors** to provide 24/7 investment advice **AI-based algorithmic trading to** automate real-time decisions and ensure accuracy in changing markets **Quantum computing for HFT** for ultra-fast data analysis solving complex trading problems	**Blockchain** Ensuring customer data privacy and creating secure, fast and authenticate ecosystem **Loan syndication** to provide a shared ledger for all stakeholders **Blockchain based data privacy** for transparent data sharing and storage	**AI** Enabling more accurate lending decisions and reducing default rates **AI-based fraud detection systems** reducing financial losses and improving security **AI-based credit rating and scoring** through pattern identification reducing defaults
Blockchain Utilizing blockchain for secure customer identity verification **Secure identity** verification ensuring the authenticity of customer identities and reducing fraud	**Blockchain** It can be used for tokenizing assets and create new investment opportunities **Tokenized ownership** enables fractional ownership for real estate, increased liquidity, and diversification **Blockchain-based NFTs** to secure assets through tamper-proof ownership records and provenance	**AI and quantum computing** Implementing AI can enhance claim processing and financial modelling **Claim automation through** AI by analyzing visuals of damaged assets **Real-time portfolio management** though quantum computing and AI by complex financial modeling	**Blockchain** Ensuring authenticity of customer information and reducing theft **Immutable records** of transactions to make it difficult for fraudsters to manipulate records **Smart contacts** to help automate and secure financial transactions and augment DeFi capabilities
Biotech and IoT Integrate IoT and biotech to assist insurance underwriting **Health and asset assessment** for accurate underwriting		**IoT and robotics** Optimizing maintenance schedules and reducing downtime **Asset management** of ATMs and banking equipment to reduce downtime **RPA** to automate data entry, validation and document verification	**Quantum computing** Implementing to protect sensitive financial data from quantum attacks, ensuring long-term security **Quantum-safe encryption** to safeguard sensitive financial data
Robotics Leveraging drones while lending for site mapping and project inspections **Site inspection via drones** to reduce the time for lending approvals			

Expected adoption Short -term → Long-term

Source(s): Secondary Research, Praxis analysis

Exhibit 9.2

Industry leaders' opinion on AI and Deep Tech transformation in financial services

FUTURE OF FINANCIAL SERVICES

AXIS BANK

"Enhanced security measures, such as AI-based fraud-detection systems, ensure the protection of customer data and transactions. As AI technology advances, chatbots are expected to play a more significant role in delivering seamless and efficient customer support. Blockchain, on the other hand, has the potential to revolutionize various aspects of digital banking. It offers advantages in areas such as remittances, trade finance and KYC processes."

Amitabh Chaudhry,
Managing Director and Chief Executive Officer, Axis Bank

Capital One

Here at Capital One, we've been using ML/AI to improve our fraud detection models, so that credit cards are declined less often. We've also used it to ensure people have an easier time opening accounts and getting authenticated when using our digital channels. We're trying to incorporate the power of ML at the earliest stages of our product design to improve the CX."

Bill McNulty,
Operating Partner, Capital One Ventures

kotak

"We have integrated AI models into our credit decisioning processes. Fortunately, banks possess abundant historical data that can be utilised to train these models, allowing us to build a robust real-time credit decisioning engine. Over the past 6-7 years, as we have expanded our use cases, the application of AI and ML has become more diverse and sophisticated."

Deepak Sharma,
President and Chief Digital Officer, Kotak Mahindra Bank

Vanguard

"AI/ML models are a tremendous enabler to unearth better insights into what our clients are looking to achieve, their investment behaviors and timelines—often better than clients can themselves. Every investor has different and unique goals, so a personalized approach to their needs can make a large impact on their outcomes."

Nitin Tandon,
Chief Information Officer, Vanguard

13

Conclusion

The next wave of disruption will undoubtedly be driven by AI and Deep Tech transformations within this decade, as ventures focus on converging scientifically developed solutions with engineering and technology to pioneer solutions for complex global challenges. These ventures are set to disrupt value chains across major industries and challenge long-standing industry norms, potentially threatening the existence of some companies and significantly impacting the job market.

India's AI and Deep Tech landscape is flourishing with ventures in fields like AI, biotechnology, and quantum computing, originating from prestigious centers of academic excellence such as IITs, IIMs, and IISc. Recognizing their potential, the government is developing a favorable regulatory framework to support these innovations. However, the Indian AI and Deep Tech ecosystem faces challenges, including high capital requirements for sustained R&D, difficulties in achieving product-market fit, longer gestation periods, and the need to develop economically viable solutions.

With strategic navigation of these challenges, robust government support, and private capital funding, these startups could deliver massive payoffs for investors and create value for all stakeholders in the coming decade, potentially surpassing the e-commerce boom of the mid-2010s.

About us

Praxis Global Alliance is the next-gen management consulting firm revolutionizing how consulting projects are delivered. It delivers practical solutions to the toughest business problems by uniquely combining domain practitioner expertise, AI-led research approaches, and digital technologies. The company operates three business units, including Praxis Global Alliance Transactions, offering pre-deal support, commercial due diligence, post-acquisition value creation, Praxis Global Alliance Strategy and Transformation for practitioner-led business advisory and consulting, and PraxDigital™ delivering data engineering and analytics, AI, OpenData and visualization solutions to clients across verticals.

With a presence across 6 locations in India, UAE, and Saudi Arabia, Praxis Global Alliance has successfully served over 40 countries with a dedicated team of consultants and data scientists. Team Praxis works with C-suite to the front-line executives across business streams, helping them with end-to-end business enablement, organizational transformation, and revenue maximization support in an agile environment.

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Our offerings

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- Playbook Creation
- Cost Efficiency
- Metric Movement

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- M&A and Due Diligence
- Future Tech Readiness
- Sustainability
- Exit: Vendor CDD and road to IPO

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Corporates

- AI transformation
- AI use case design
- AI maturity assessment and diagnostic
- AI use cases roadmap journey
- AI implementation
- AI change management
- AI-led customer experience improvement
- AI led revenue enhancement
- AI-let cost transformation

AI & ML Startups

- Offering design
- Adjacency expansion
- Go to market
- Sales acceleration
- Fundraise and vendor CDD

Investors

- Tech diligence
- Commercial diligence
- Sector scan and thesis

Connect with us

We will be happy to share perspectives

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