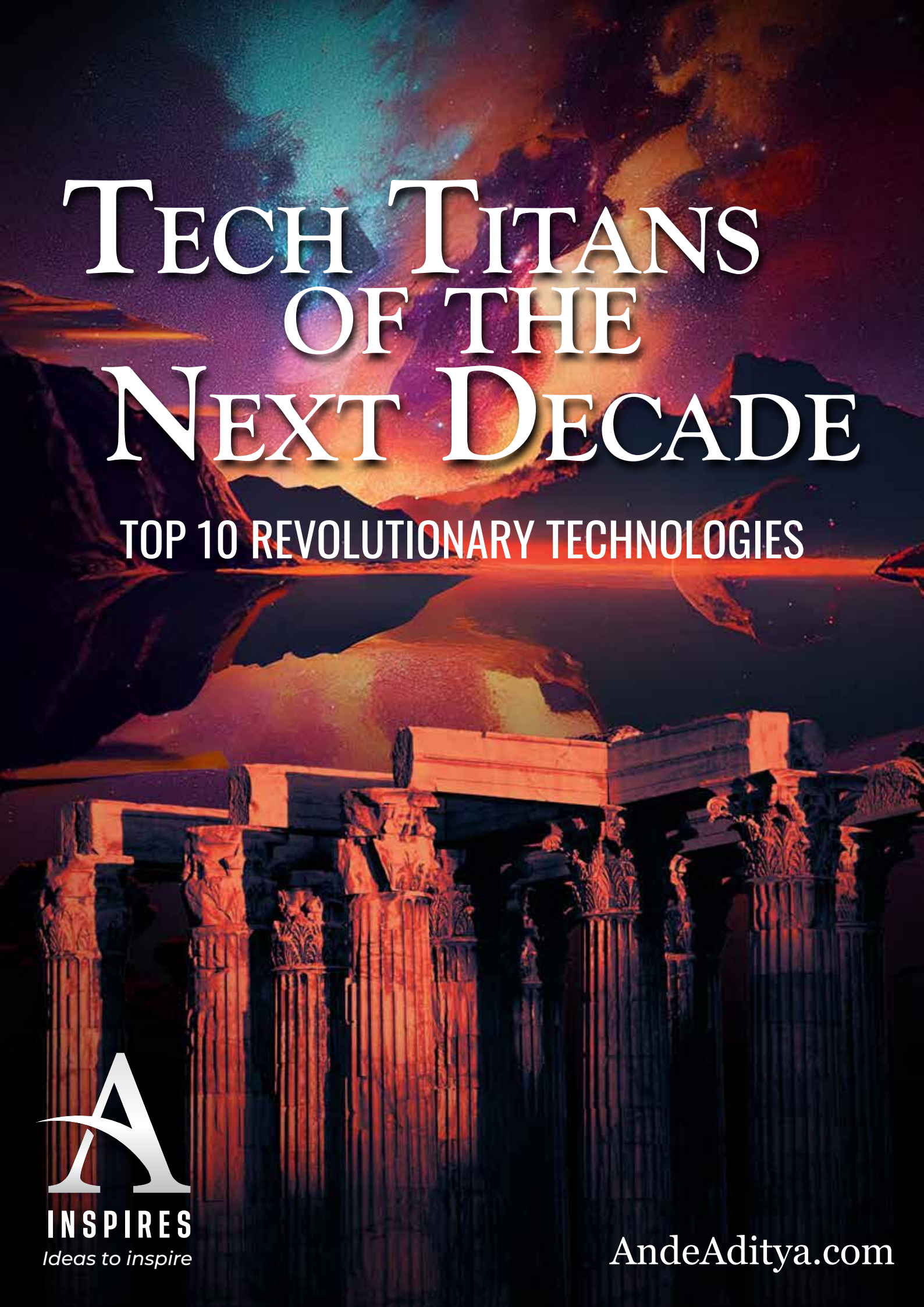
TECH TITANS
OF THE
NEXT DECADE
TOP 10 REVOLUTIONARY TECHNOLOGIES
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ABOUT ANDE ADITYA

Ande Aditya, an inspirational leader with a strong technological background, brings his passion for innovation and research to curate this ebook on the top 10 future technologies. With years of experience in the technology sector and a deep understanding of emerging trends, Ande has dedicated his career to exploring the potential of cutting-edge technologies and their impact on industries.

As a leader, Ande has demonstrated a remarkable ability to envision the possibilities that lie ahead and guide teams towards transformative outcomes. His keen insights and strategic mindset have propelled him to the forefront of technological advancements, making him a trusted authority in the field.

Driven by a desire to inspire and empower others, Ande's research for this ebook is a testament to his commitment to sharing knowledge and fostering innovation. By curating this collection of future technologies, Ande aims to equip entrepreneurs, leaders, and enthusiasts with the insights they need to navigate the rapidly evolving tech landscape and seize the opportunities that arise.
With his expertise and passion, Ande Aditya continues to inspire individuals and organizations to embrace the future, embrace innovation, and shape a better tomorrow through the power of technology.

Learn more about Ande Aditya - **andeaditya.com**

AUTHOR'S NOTE AND INTRODUCTION

In a world where technology is constantly evolving, it's crucial to stay ahead of the curve. That's why I am thrilled to present this comprehensive ebook on the top 10 future technologies that will shape our world in the next two decades.

As technology progresses at an unprecedented pace, it's important for entrepreneurs, business leaders, and individuals to understand the emerging trends and harness the potential of these technologies. Myself along with our team of experts has meticulously curated this ebook to provide you with valuable insights into the industries and businesses that are poised to thrive in the future.

As we delve into these cutting-edge technologies, we aim to shed light on their potential impact, both positive and challenging. We'll uncover the promising business opportunities they present, along with the ethical considerations that accompany their development.

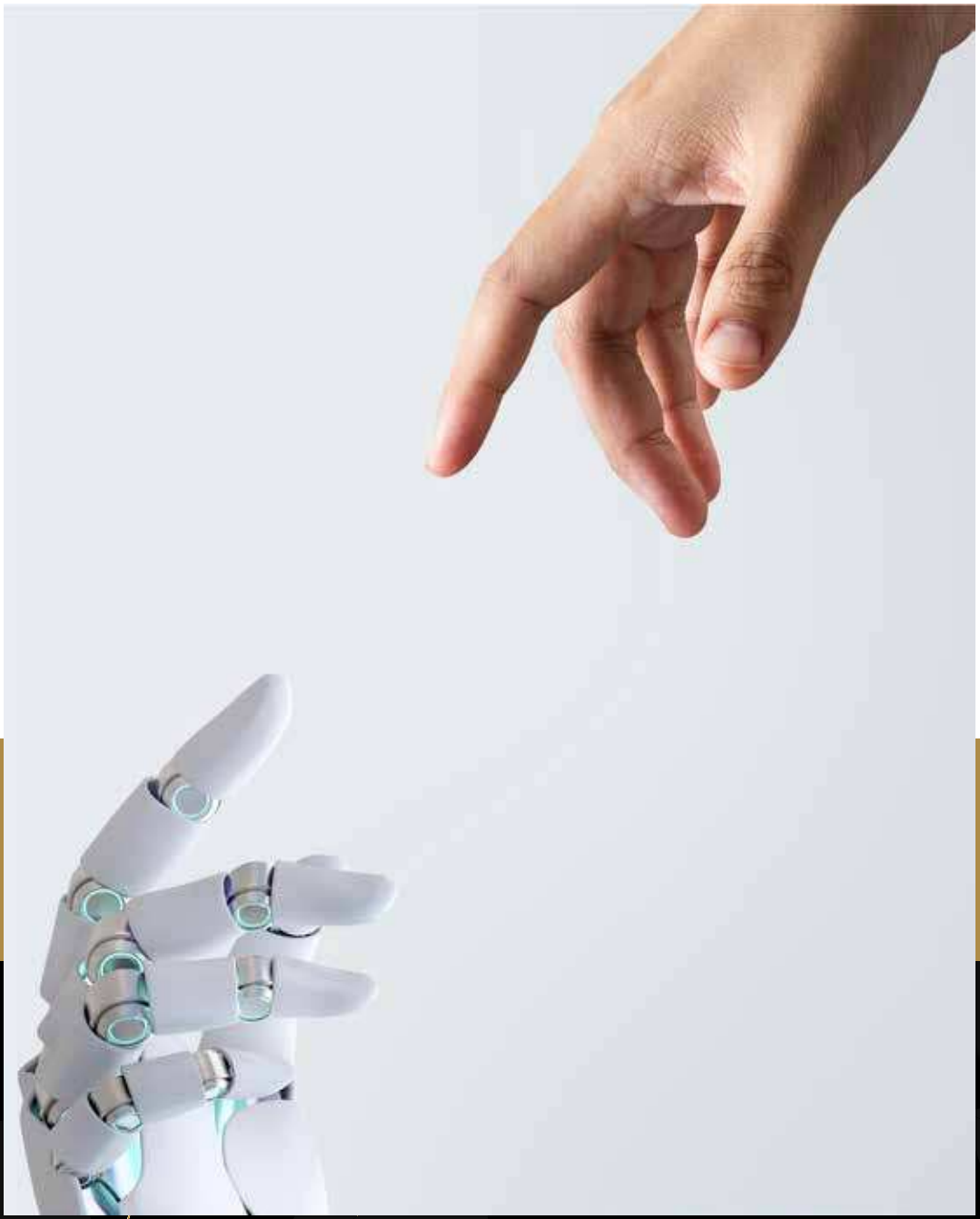
From artificial intelligence and bio revolution to clean energy and genetic engineering, each chapter delves into a transformative technology, offering a glimpse into its potential applications, impact, and the opportunities it presents. We also delve into the ethical considerations surrounding these technologies, highlighting the importance of responsible innovation.

Join us as we navigate the realms of innovation and envision a future where these technologies play a pivotal role in solving global challenges and driving economic growth. Together, we'll gain insights into the trends, opportunities, and implications of these future technologies, empowering entrepreneurs, leaders, and enthusiasts to chart their path toward a successful and sustainable future.

Whether you're a tech enthusiast, an aspiring entrepreneur, or a forward-thinking business leader, this ebook is your gateway to understanding the future of technology. Join us as we embark on an inspiring journey and unlock the possibilities that lie ahead.

Get ready to embrace the future and seize the opportunities it brings. The future is now, and it's time to be at the forefront of change.

ARTIFICIAL INTELLIGENCE (AI)



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WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence.

Artificial intelligence in business simply involves the use of intelligent computer software with human-like capabilities to boost revenue, improve customer experience, increase productivity and efficiency, and drive business growth and transformation.

Artificial intelligence (AI) has become a technological reality for businesses and organisations across industries. Even if its benefits may not always be easy to quantify, AI has proven itself capable of improving process efficiency, reducing human errors and labour, and extracting insights from big data.

AN OVERVIEW OF THE CURRENT STATUS AND APPLICATIONS OF ARTIFICIAL INTELLIGENCE (AI):

1. **In the medical field** - In the current scenario, artificial intelligence (AI) is going to change almost all areas of the medical field. The need is to study the research carried out with this technology and identify its different applications in the medical field.

Different technologies are adopted and experimented with increasing automation in the medical field. Nowadays, AI is being introduced in the medical field to keep a medical records in digital format and conduct patient checkups using smart technologies. It provides solutions, especially in targeted treatments, uniquely composed drugs and personalised therapies. AI is an innovative technology that helps to guide the surgeon during medication, treatment and operation. The main application of this technology is for better decision-making in complicated cases. It can also help to track, detect, investigate and control infection in the hospital. This technology develops and optimises online patient appointment platforms. In the future, it will be helpful in all medical areas to serve humanity.

Artificial Intelligence finds diverse applications in the healthcare sector. AI applications are used in healthcare to build sophisticated machines that can detect diseases and identify cancer cells. Artificial Intelligence can help analyse chronic conditions with lab and other medical data to ensure early diagnosis. AI uses the combination of historical data and medical intelligence for the discovery of new drugs.

2. AI Application in E-Commerce

- **Personalised Shopping** - Artificial Intelligence technology is used to create recommendation engines through which one can engage better with customers. These recommendations are made in accordance with their browsing history, preference, and interests. It helps in improving the relationship with the customers and their loyalty towards the brand.

- **AI-powered Assistants** - Virtual shopping assistants and chatbots help improve the user experience while shopping online. Natural Language Processing is used to make the conversation sound as human and personal as possible. Moreover, these assistants can have real-time engagement with the customers.

- **Fraud Prevention** - Credit card frauds and fake reviews are two of the most significant issues that E-Commerce companies deal with. By considering the usage patterns, AI can help reduce the possibility of credit card fraud taking place. Many customers prefer to buy a product or service based on customer reviews. AI can help identify and handle fake reviews.

3. Applications Of Artificial Intelligence in Education - Although the education sector is the one most influenced by humans, Artificial Intelligence has slowly begun to seep its roots in the education sector as well. Even in the education sector, this slow transition of Artificial Intelligence has helped increase productivity among faculties and helped them concentrate more on students than office or administration work.

4. Applications of Artificial Intelligence in Lifestyle - a few of the influence of Artificial Intelligence on our lifestyle is enlisted below

- **Autonomous Vehicles** - Automobile manufacturing companies like Toyota, Audi, Volvo, and Tesla use machine learning to train computers to think and evolve like humans when it comes to driving in any environment and object detection to avoid accidents.

- **Spam Filters** - The email that everyone uses in day-to-day lives has AI that filters out spam emails sending them to spam or trash folders, letting us see the filtered content only. The popular email provider, Gmail, has managed to reach a filtration capacity of approximately 99.9%.

- **Facial Recognition** - Personal devices like phones, laptops, and PCs use facial recognition techniques by using face filters to detect and identify to provide secure access. Apart from personal usage, facial recognition is a widely used Artificial Intelligence application even in high security-related areas in several industries.

- **Recommendation System** - Various platforms that are used in daily life like e-commerce, entertainment websites, social media, video sharing platforms, like youtube, etc., all use the recommendation system to get user data and provide customised recommendations to users to increase engagement. This is a very widely used Artificial Intelligence application in almost all industries.

5. **AI Applications in Navigation** - Based on research, GPS technology can provide users with accurate, timely, and detailed information to improve safety. The technology uses a combination of Convolutional Neural Networks and Graph Neural Networks, which makes lives easier for users by automatically detecting the number of lanes and road types behind obstructions on the roads. AI is heavily used by transport companies like Uber and many logistics companies to improve operational efficiency, analyse road traffic, and optimise routes.

6. **AI Applications in Robotics** - Robotics is a field where artificial intelligence applications are very commonly used. Robots powered by AI use real-time updates to sense obstacles in their path and pre-plan their journey instantly. It can be used for carrying goods in hospitals, factories, and warehouses, Cleaning offices and large equipment, Inventory management

7. **AI Applications in Human Resources** - Companies use intelligent software to ease the hiring process. Artificial Intelligence helps with blind hiring. Using machine learning software, one can examine applications based on specific parameters. AI drive systems can scan job candidates' profiles, and resumes to provide recruiters with an understanding of the talent pool they must choose from.

9. **AI Applications in Gaming** - Artificial Intelligence applications have found prominence in the gaming sector. AI can be used to create smart, human-like NPCs to interact with the players. It can also be used to predict human behaviour using which game design and testing can be improved. The Alien Isolation game released in 2014 uses AI to stalk the player throughout the game. The game uses two Artificial Intelligence systems - 'Director AI' that frequently knows your location and the 'Alien AI,' driven by sensors and behaviours that continuously hunt the player.

10. **AI Applications in Automobiles** - Artificial Intelligence is used to build self-driving vehicles. AI can be used along with the vehicle's camera, radar, cloud services, GPS, and control signals to operate the vehicle. AI can improve the in-vehicle experience and provide additional systems like emergency braking, blind-spot monitoring, and driver-assist steering.

11. AI Applications in Social Media -

- **Instagram** - On Instagram, AI considers people's likes and the accounts he follows to determine what posts would be shown on his explore tab.
- **Facebook** - Artificial Intelligence is also used along with a tool called DeepText. With this tool, Facebook can understand conversations better. It can be used to translate posts from different languages automatically.
- **Twitter** - Artificial Intelligence is used by Twitter for fraud detection, removing posts related to propaganda, and hateful content. Twitter also uses AI to recommend tweets that users might enjoy, based on what type of tweets they engage with.

THE FUTURE PROSPECT OF ARTIFICIAL INTELLIGENCE

Research reveals that revenue from the artificial intelligence (AI) software market worldwide is expected to reach 126 billion dollars by 2025. 37% of organisations have implemented AI in some form or the other. The percentage of enterprises employing AI grew 270% over the past four years.
According to some, by 2025, 95% of customer interactions will be powered by AI.

A report from a couple of years back reveals that the global AI software market is expected to grow approximately 54% year-on-year and is expected to reach a forecast size of USD 22.6 billion.

Leaders and business owners looking for business opportunities should be updated and invest in Artificial Intelligence as it indeed has a promising future in the coming decades. In almost every walk of life, the need and importance of Artificial Intelligence are already being realised and it is bound to increase with leaps and bounds in the coming days. So this domain would reveal a promising investment opportunity.

WHY IS ARTIFICIAL INTELLIGENCE IMPORTANT FOR THE FUTURE?

Artificial intelligence is impacting the future of virtually every industry and every human being. Artificial intelligence has acted as the main driver of emerging technologies like big data, robotics and IoT, and it will continue to act as a technological innovator for the foreseeable future. Artificial intelligence is drastically important to the future because AI forms the very foundation of computer learning. Through AI, computers have the ability to harness massive amounts of data and use their learned intelligence to make optimal decisions and discoveries in fractions of the time that it would take humans. It is becoming responsible for everything from medical breakthroughs in cancer research to cutting-edge climate change research.

Enlisted below are a few ways Artificial Intelligence can make an impact in the coming days:

Scientific Breakthrough

The scope of AI in science is the largest. There is a possibility of AI playing a bigger role in science in future, not just merely for augmentation. AI will be able to create science. Automation using AI for drug discovery is a field that is rapidly growing, mainly because machines work faster than humans. AI is also being applied in related areas such as synthetic biology for the manufacture and rapid design of microorganisms for industrial uses. Taking all of this into consideration, AI is sure to transform science.

Cyber Security
The incidence of cybercrime is an issue that has been escalating through the years that costs enterprises both in terms of brand image as well as material cost. Credit card fraud is one of the most prevalent cybercrimes. Despite there being detection techniques, they still prove to be ineffective in curbing hackers. The future application of AI in cybersecurity will ensure curbing hackers.

Face Recognition
Authenticating personal content is not the only use of facial recognition. Governments and security forces make use of this feature to track down criminals and identify citizens. In the future, facial recognition can go beyond physical structure to emotional analysis. For example, it might become possible to detect whether a person is stressed or angry with the help of AI.

Data Analysis
AI would be able to perceive and analyse patterns in data that humans cannot. This enables businesses to target the right customers for the product.

Transport
Self-driving cars have already populated the market, however, a driver is required at the wheel for safety purposes. With Google, Uber and General Motors trying to establish themselves at the top in this market, it will not be long before driverless vehicles become a reality. Machine Learning will be crucial in ensuring that these Automated Vehicles operate smoothly and efficiently.

Marketing & Advertising
Considering that marketing professionals always try ways to benefit their businesses, the application of AI in sales and marketing seems definite. Artificial Intelligence can increase the efficiency of sales and marketing organisations. The main focus will be on improving conversion rates and sales. Personalised advertising, knowledge of customers and their behaviour gleaned through facial recognition can generate more revenue.

The future scope of Artificial Intelligence has paved the way for smart monitoring, quicker feedback, and improved business lines. Robotic process automation will reduce the time taken to complete repetitive tasks, making the strategies less cumbersome and more effective.

Artificial Intelligence comes with its own ethical and security issues. It causes privacy concerns to businesses, which need to be mitigated if one wants the user to stay within the company for a while. Also, the people who have engaged with a company for years need to be relocated to some other job so that they can stay motivated and engaged. The idea is to transform the future of AI without harming the goodwill of loyal people. Thus it would help if one introduces the overall culture and organisation-level changes to build a robust AI-induced enterprise. The future of Artificial Intelligence is exciting and extremely promising for the decades to come.

BIO REVOLUTION

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Life sciences have made great advances in the past years. The life sciences and the digitization megatrend are becoming increasingly intertwined, enabling a Bio Revolution generating new inventions that impact the daily lives of everyone. This revolution is reinforced by rapid increases in computing power and the emergence of new capabilities in Artificial Intelligence, automation, and data analytics, further accelerating the pace of innovation. A new wave of innovation is being fueled by a confluence of advances in biological science and the accelerating development of computing, automation, and artificial intelligence. This Bio Revolution would have a significant impact on economies and the lives of people, from health and agriculture to consumer goods, and energy and materials. Like the industrial revolution, the Bio Revolution represents a convergence of technologies, with advances in biological science being driven forward by developments in computing, automation and artificial intelligence.

Innovations at times come with profound risks rooted in the self-sustaining, self-replicating, and interconnected nature of biology that argue for a serious and sustained debate about how this revolution should proceed. Accidents can always have major consequences. Especially if used unethically or maliciously, manipulating biology could become disastrous. Much like Pandora's box that, once opened, unleashes lasting damage to the health of humans, ecosystems, or both. The risks are particularly acute because many of the materials and tools are relatively cheap and accessible. Also, tackling these risks is complicated by a multiplicity of jurisdictional and cultural value systems, which makes collaboration and coordination across countries difficult.

However, new biological applications are already improving the response to global challenges including climate change and pandemics. The urgency of the global responses to the novel coronavirus illustrated substantial advances in biological science in just the past few years. The speed with which scientists sequenced the virus's genome bore witness to the new world of biology described in this research.Yet, sequencing is just the start: biological innovations are enabling the rapid introduction of clinical trials of vaccines, the search for effective therapies, and a deep investigation of both the origins and the transmission patterns of the virus.

Developments in biotechnology have enormous potential for the welfare and well-being of humanity - through the production of vaccines for diseases that have not been treated before, increased food production, and prevention of many genetic diseases and malformations.
The biotechnology revolution with stem cell therapy, along with its benefits, holds enormous healing potential as well.

As much as 60 per cent of the physical inputs to the global economy could, in principle, be produced biologically—about one-third of these inputs are biological materials (wood or animals bred for food) and the remaining two-thirds are nonbiological (plastics or fuels) but could potentially be produced or substituted using biology. Therefore, it is possible that bio innovations could impact up to 60 per cent of physical inputs, although attaining that full potential is a long way off. Even modest progress toward it could transform economies, societies, and the lives of people. This would include what we eat and wear, the medicines we take, the fuels we use, and how we construct our physical world. In human health, at least 45 per cent of the current global disease burden could be addressed using science that is conceivable today.

A pipeline of about 400 use cases, almost all scientifically feasible today, is already visible. These applications alone could have a direct economic impact of up to $4 trillion a year over the next ten to 20 years. More than half of this direct impact could be outside human health in domains such as agriculture and food, consumer products and services, and materials and energy production. Taking into account potential knock-on effects, new applications yet to emerge, and additional scientific breakthroughs, the full potential could be far larger.

Major Trends in Biotechnology Today

There are many current trends involving the genome modification of living organisms, including microorganisms, plants, and animals. These developments open up many potential applications of the bio revolution, such as promoting the production of biochemicals, increasing food production and maintaining better value for food.

There are several developments in other areas such as metabolic engineering and synthetic biology, which help to produce many chemicals and fuels rather than relying on fossils. In addition, there are many amazing developments in healthcare and the medical sector, including stem cell therapy, and many other things that help to address health problems.

Where will the Bio Revolution take us in the coming decades?

Bio Revolution through Biotechnology would become commonplace such as mobile phones and the Internet. A larger number of biotech companies would emerge, along with an increasing number of specialised companies.

The use of this technology would spread across geography, to every village and even in homes. It would also be possible to recycle the waste using biotechnology rather than discarding it.

Biotechnology can also help solve major national problems such as health care.

Healthcare costs around $ 8 trillion worldwide, which is very high, but biotechnology is expected to reduce this cost by finding effective prevention methods for different diseases and producing organs in the human body and cells.

By 2030, biotechnology will become part of human life and will be used in all areas of medicines and drugs for environmentally friendly chemicals and fuel production.

How the Bio Revolution Could Transform the Competitive Landscape for Companies at Large

A McKinsey Global Institute research found that more than half of the potential direct economic impact from changing biological technologies applied to nearly 400 use cases in multiple sectors, is outside of healthcare, notably in agriculture and food, materials and energy, and consumer products and services. The likely disruption of the Bio Revolution is vast and set to influence a wide range of industries. New crosscurrents are already emerging, with four rising to the top:

- the importance of biological capabilities as a source of competitive advantage
- the growth of platform-based business models accelerating scientific discoveries
- the opportunity for more personalization and precision products and services
- the spread of new relationships driven by barbell-shaped ecosystems

New entrants are preparing to take some markets by storm and incumbents in others are investing aggressively to stay in the game and win. Though, there is considerable uncertainty around the speed of technology development, commercialization, and consumer adoption, as well as around the response of regulatory agencies to these new opportunities. The complexities of biological technologies raise many new risks, ethical issues, and, at times, fear, far beyond the current paradigm of regulating biotech products in pharmaceuticals and agriculture. With the scope of change that lies ahead, working through those uncertainties and business shifts to the opportunities is a critical priority for leaders today.

APPLICATION OF BIO REVOLUTION IN DIFFERENT DOMAINS

Human health and performance - Applications include cell, gene, and RNA therapies to treat or even prevent disease, a range of anti-ageing treatments to extend lifespans, innovations in reproductive medicine, improvements to drug development and delivery and new predictive modelling of human health and disease. Many more options are being explored and becoming available to treat monogenic (caused by a single gene) diseases such as sickle-cell anaemia, polygenic diseases such as cardiovascular disease, and infectious diseases such as malaria. The direct annual global potential impact is estimated at $0.5 trillion to $1.3 trillion over the next ten to 20 years or 35 per cent of the total (including the impact from bio machine interfaces).

Agriculture, aquaculture, and food - Applications in this domain include innovative new ways to conduct the breeding of animals and plants using molecular or genetic markers that are many times quicker than established selective-breeding methods; new, more precise tools for the genetic engineering of plants; fast-developing work using the microbiome of plants, soil, animals, and water to improve the quality and productivity of agricultural production; and the development of alternative proteins including lab-grown meat. The direct annual impact could be between about $0.8 trillion and $1.2 trillion over the next ten to 20 years, or 36 per cent of the total.

Consumer products and services - Opportunities are opening up to use increasing volumes of biological data to offer consumers personalised products and services based on their biological makeup. Applications in this domain include direct-to-consumer genetic testing, beauty and personal care increasingly based on increased knowledge of the microbiome as microbiome testing spreads, and innovative approaches to wellness (or fitness) not only in humans but in pets. There could be an annual direct economic impact over the next 10 to 20 years of $200 billion and $800 billion, or 19 per cent of the total (including the impact from bio machine interfaces).

Materials, chemicals, and energy - New biological ways of making and processing materials, chemicals, and energy could transform many industries and the daily lives of people, although economics are challenging. Applications in this domain include innovations related to the production of materials such as improved fermentation processes, new bio routes utilising the ability to edit the DNA of microbes to develop novel materials with entirely new properties (self-repairing fabrics is one example), and building on advances in biofuels to innovate new forms of energy storage. Over the next ten to 20 years, the direct annual global impact could be $200 billion to $300 billion a year, or 8 per cent of the total.

Biology has many other potential applications, although some of these are likely to be further in the future. It could be deployed to help the environment through biosequestration—using biological processes to capture carbon emissions from the atmosphere—and bioremediation. The impact is also emerging in bio machine interfaces and biocomputing where the science and development are at an early stage but applications seem promising. Applications that have already been developed include neuroprosthetics to restore hearing and vision.

Eventually, the impact would radiate out to almost every sector of the economy with effects on societies and the environment as biological innovation transforms profit pools, value chains, and business models. The impact could go much further, with biology potentially being used to address some of the great challenges of our time including mitigating climate change. By 2040 to 2050, the direct applications might reduce annual average man-made greenhouse-gas emissions by 7 to 9 per cent from 2018 emissions levels.

According to the researchers, Bio Revolution is bringing with it a new array of capabilities that will fundamentally transform how companies compete. Like the recent rise in data-science and software-engineering skills, new speciality skills in fields such as genomics, molecular biology, biochemistry, and neuroscience would emerge and would be in increasingly high demand. It would indeed be the merging of digital skills with biological skills is a potent combination. These new capabilities would drive faster and cheaper production methods, creating better-performing inputs with superior characteristics, and, ultimately, delivering added-value products and services to end customers. It is thus no wonder that many players would try to gain a first-mover advantage.

Cost-saving capabilities -New, more scalable fermentation and bioengineering processes would be able to replace traditionally expensive and resource-intensive production methods.

For example, Amyris now produces squalane, a moisturising oil used in many skin-care products, via the fermentation of sugars through genetically engineered yeast. Squalane traditionally has been obtained from processing deep-sea-shark liver oil, a costly and environmentally questionable source. Amyris's new production method provides a pure, stable product in high volume at a low cost and from a renewable source.

Developing a better understanding of the economic benefits of new biological technologies would become increasingly important for incumbents striving to maintain a competitive edge.

Performance-enhancing capabilities - New biological production methods can also radically improve the quality and characteristics of products.
For example, US business startup Tandem Repeat produces self-repairing, biodegradable, and recyclable fabric using proteins encoded by squid genes. Other bioengineering methods aim to develop novel materials to meet consumer trends. Biotech company Zymergen is creating renewable biomaterials for optical films used in displays; hard, scratch-proof coatings; and flexible electronics circuits. These new, biologically enhanced inputs are set to propel a wave of innovation that may open new top-line opportunities.

To be in compete, companies would need to master not only the science and ability to innovate but also the ability to scale to industrial levels. Converting scientifically feasible methods into scalable and profitable business capabilities would help separate winners from losers. As companies navigate the flood of bio capabilities entering the market, assessing the direct and indirect impact on their business will inform the decision to invest in or source out these new capabilities. To identify, assess, and execute in this new marketplace, companies would need to build their knowledge associated with the Bio Revolution.

As with most revolutions, it is hard to imagine where exactly the nio revolution leads to till we see it unfold in reality. It is expected that the next few decades would see the introduction of a profusion of biological products across a wide range of industries that have the potential to disrupt business completely in unforeseen ways. Business leaders, scientists, and regulators would need to work together to engage on public concerns and ensure that innovations do not cross ethical boundaries—even while giving science and businesses the room to explore exciting new directions.

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CLEAN ENERGY

Clean Energy

Clean energy is the energy that comes from renewable, zero-emission sources that do not pollute the atmosphere when used, as well as energy saved by energy efficiency measures. A clean energy revolution is taking place across the globe, underscored by the steady expansion of the renewable energy sector. The clean energy industry generates hundreds of billions in economic activity and is expected to continue to grow rapidly in the coming years. There is tremendous economic opportunity for the countries that invent, manufacture and export clean energy technologies. Responsible development of all of the rich energy resources -- including solar, wind, water, geothermal, bioenergy & nuclear -- would help ensure countries' leadership in clean energy. Moving forward, the Energy Department would continue to drive strategic investments in the transition to a cleaner, domestic and more secure energy future.

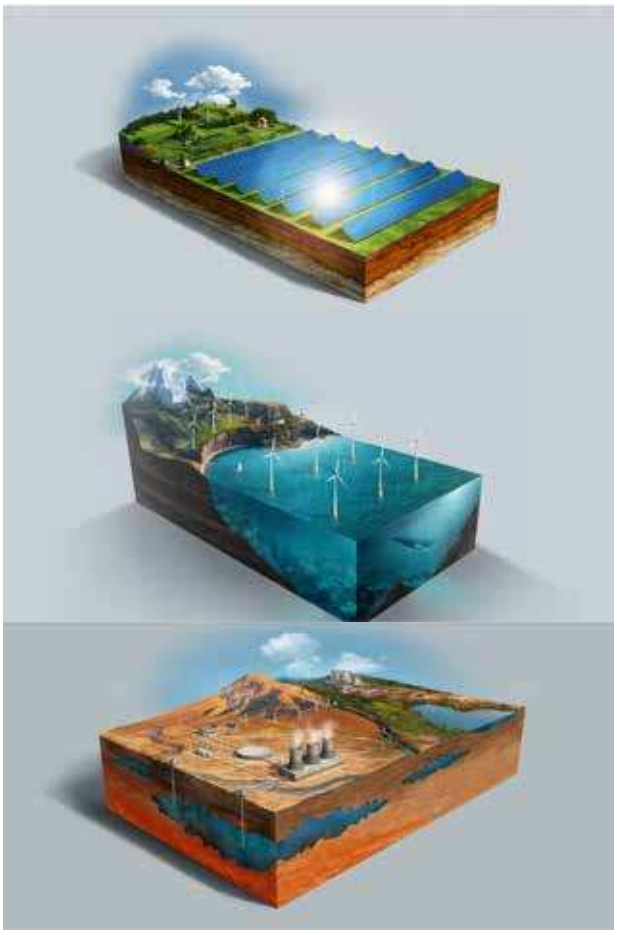
The most important aspect of clean energy is the environmental benefits as part of a global energy future. While clean, renewable resources also preserve the world's natural resources, they also reduce the risk of environmental disasters, such as fuel spills or the problems associated with natural gas leaks. With fuel diversification, through different power plants using different energy sources, it is possible to create reliable power supplies to enhance energy security, ensuring there is enough to meet our demands. Clean energy provides a variety of environmental and economic benefits, including a reduction in air pollution. A diverse clean energy supply also reduces the dependence on imported fuels and the associated financial and environmental costs that incur. Renewable clean energy also has inherent cost savings, as there is no need to extract and transport fuels, such as oil or coal, as the resources replenish themselves naturally. Another industrial benefit of a clean energy mix is the creation of jobs to develop, manufacture and install the clean energy resources of the future.

Clean energy does not produce GHG emissions, or any other environmental pollution, which aids in the fight against global climate change. However, clean energy possesses geographic limitations and offers intermittent production peaks depending on weather conditions that would highly benefit from a smart grid.

A few Clean energy sources are listed below:

Solar Energy: When photovoltaic cells in solar panels absorb energy from sunlight, an electrical charge is created that moves in response to an internal electric field in the cell and creates electricity. This process is renewable because the sun would continue to emit energy until it goes supernova. It is also clean because no GHGs are emitted during operation. Following proper disposal methods of hazardous chemicals associated with PVCs and placing solar panels in less populated areas or on top of buildings minimises any negative environmental impacts, making it a green energy source.

Wind Energy: Natural wind turns the blades of wind turbines around a rotor, which spins a generator to generate electricity. This process is renewable because as long as the wind blows, wind power can be harnessed. It is also clean because no GHGs are emitted during its operation. Land use, wildlife impact, and public health concerns are mitigated by proper planning and siting of wind farms thus making them a green energy source.



Geothermal Energy: Drilling down to hot water reservoirs creates steam that rotates a turbine, which spins a generator to generate electricity. This process is renewable because the Earth has an almost unlimited supply of heat generated by its core, and the water extracted from the reservoirs can be recycled via re-injection into the ground. The process is also clean because although it does release minute amounts of carbon dioxide, the amount is almost negligible. Negative environmental impacts are minimised by only drilling to shallow depths, siting power plants away from major fault lines, and properly disposing of hazardous waste captured by the scrubbers, making it a green energy source.

Low-Impact Hydropower: These are projects that generate 10 MW or less of power. Flowing water turns turbines, which spin a generator to generate electricity. This process is renewable because the water cycle is a continuous process that recharges itself. It is also clean because, on a small scale, hydropower produces very few GHGs. Installing small turbines in irrigation canals, water-treatment plant outfalls, and existing hydroelectric facilities mitigates emissions and environmental impact, making it a green energy source.

Nuclear Energy: During nuclear fission, an enormous amount of energy is released when electromagnetic radiation is used to split the nucleus of a uranium atom (U-235). The process of nuclear fission is clean because it does not produce GHG emissions, but nuclear energy is not green because it does require mining, extraction, and long-term radioactive waste storage which are threats to the environment. It is also not renewable because there is a finite supply of U-235, the uranium isotope used in nuclear power plants, on Earth. Already most of our U-235 has been used up because it has a half-life of about 700 million years.
Nuclear energy is clean because the generation of energy does not produce GHGs. It is not green though because mining, extraction, and long-term radioactive waste storage are threats to the environment, and U-235 is a nonrenewable resource.

How Can Clean Energy Be Used?

Clean energy can be used for a variety of different applications, from electricity generation to heating water and more, depending on the source of the energy.

Electricity generation - Solar energy can be used for heating and lighting buildings, generating electricity, heating water directly, cooling and more. Solar panels acquire energy from the sun and turn it into electricity. Solar panels are frequently used for small electric tasks, such as charging batteries. However, this same clean energy technology can be scaled up to larger panels that are used to provide power for homes or other buildings or even installations of multiple solar panels, such as with a community solar panel array to power entire towns.

Water is another clean resource with some surprising applications. Most obvious are hydroelectric power plants, which take the flow of water from rivers, streams or lakes to create electricity. A less obvious use of water comes through municipal pipes in towns and cities. With lots of water running through pipes in homes each day, there is a move towards harnessing this energy to help meet domestic and other power needs. As generators become smaller and less expensive to build, this use of municipal water is becoming closer to being a daily reality.

Wind power works by attaching a windmill to a generator which turns the turning of the windmill blades into power. This form of energy has been used for a long to grind grain, pump water or perform other mechanical tasks, but is now being used more often to produce electricity. Onshore and offshore wind farms are becoming increasingly prevalent, but wind power can also be used on a much smaller scale to produce electricity, even to provide a source of power for recharging mobile telephones.

The Future of Clean Energy

The future of clean energy looks promising, with recent years showing that more renewable energy capacity has been installed globally than new fossil fuel and nuclear capacity combined. Renewable sources now make up over one-third of globally installed power capacity. As the world population continues to grow, there is an ever-increasing demand for energy. Renewable sources of energy are the answer to providing sustainable energy solutions, while also protecting the planet from climate change.

The take-up of clean energy is not just happening on a national level as cities and states are also creating policies to increase renewable energy use. In the United States, 29 states have set renewable energy portfolios to mandate that a certain percentage of energy consumed should come from renewable sources and over 100 cities around the world now use at least 70% renewable energy. As more cities drive towards becoming 100% renewable, corporations are also playing a part by purchasing record levels of renewable power.

Due to fossil fuels being a finite resource, it makes sense that the future is renewable and so it is expected that renewable sources will continue to increase in number, driving down the cost too.

Reduction of Global Warming

Humans have been using fossil fuels for centuries and, as their use increases, the release of the greenhouse gases that are produced when these fuels are burned also increased. These greenhouse gases trap heat in the atmosphere causing the temperature of the Earth to rise. This global warming is one symptom of climate change that has seen a rise in extreme weather events, shifting wildlife habitats and populations, rising sea levels and other impacts.

Because renewable energy sources do not emit greenhouse gases such as carbon dioxide, they do not contribute to global warming. While measures such as reforestation can help to alleviate the damage already done to the climate, these renewable sources mean that climate change is not being advanced, combining to reduce global warming.

Financial Impacts of Clean Energy on the Economy

There are financial benefits related to clean energy. There is a creation of work to improve the infrastructure, manufacture clean energy solutions and install and maintain them. Renewable and clean energy are growth sectors as the world begins to move away from fossil fuels, meaning that more opportunities would arise in areas ranging from eMobility to power generation and storage.

The expertise that comes with developing these next-generation power solutions can be of benefit to those that attain it, offering work and contracts to those who are slow to update to clean energy.The renewable energy industry is more labour-intensive than its fossil fuel counterpart, meaning on average greater job creation. The industry also creates positive ripple effects down to the renewable energy supply chain and unrelated businesses due to increased household incomes.

Notwithstanding the financial implications of clean energy, the real incentive behind clean energy is creating a better future for the planet. But, as fossil fuel use declines, so will the associated financial rewards, meaning that clean energy is not just good for the environment but it is a forward step for the industry too.

Clean energy appears to be the future for the power needs of humanity across the globe as reliance on fossil fuels continues to decrease with every passing day. As the drive towards clean, green and renewable energy continues to advance, the cost will fall and work will be created to develop and install these new power solutions. Renewable energy sources such as wind, solar, hydro and geothermal do not entail fuel costs or require transportation, and therefore offer greater price stability. In fact, some electric utilities factor this into their retail electricity prices, exempting customers that buy renewables from certain fuel-related charges.

More and more people are recognising the environmental, societal and economic benefits of clean energy and, as more cities, states and nations sign up to a green power agenda, this will continue to advance.

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CYBER SECURITY AND CLOUD COMPUTING

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Cyber Security and Cloud computing

The one aspect of IT that has experienced the maximum growth in the last few years is undoubtedly the use of the cloud. In the coming decades, it is thus only expected that cloud computing can only keep blazing forward.

It might be debatable how prominent the use of passwords would be or how the position of the cloud will be in the coming future. The key role that Artificial Intelligence would play in cybersecurity is something that can be vouched for. AI will be the catalyst in determining whether the industry can keep up with the threat.

Much like AI, data breaches are expected to be more prevalent in the coming years than they are now — which is both unfortunate and scary. As more data and devices appear online, the risk of a breach only grows.

Cloud security, also known as cloud computing security, is a subset of cybersecurity, devoted to securing cloud computing systems. Cloud security encompasses the policies, hardware and software, best practices, techniques, procedures and processes used to maintain the integrity and security of cloud data, infrastructure, applications, and systems.

The security measures in place protect data privacy, uphold regulatory compliance, provide governance, oversee data retention, and control authentication and access to data. The steps used to secure data and infrastructure might vary between organisations, serving to filter malicious traffic and limit access to authorised users. Responsibility and security efforts are divided between the platform provider and end users. The most robust cloud security solutions utilise processes, automated protection, and education of the end users and infrastructure administrators.

The Bureau of Labour Statistics projects that job growth for Information Security Analysts will grow 33% from 2020 to 2030, which might seem rapid growth. Information technology and computer specialist jobs are projected to grow 11% as a whole over the same time period, which is also much faster than average.

The acceleration of cloud computing adoption is fueling demand for cybersecurity specialists to monitor and manage internal and external threats in both large and small organisations.

Cloud is the new normal but brings along threats

In the new post-pandemic world of hyper-connectivity, enterprises are investing in hybrid Cloud solutions, PaaS systems, augmented reality, and open-partner ecosystems. The past has taught us to never underestimate the growth potential of cyber criminals. The coronavirus pandemic revealed what attackers are capable of.

The Cloud holds the world's cyberinfrastructures and global economies in place.. It takes minutes for companies to slip up and leak highly sensitive data due to gaps in Cloud data protection and applications. This would mean business owners would have to remain worried about governance, security, and compliance issues when choosing Cloud vendors.

Cloud technology intertwines with everyday lives and helps share experiences as people, cultures, and worldwide events. It is the hidden medium used to define and understand the world for the better. The global pandemic forced businesses to migrate towards remote working models. This led to the rapid growth of Cloud solutions. But the security aspect was neglected. European Cybergang DarkSide fell under the FBI's radar when it launched the Colonial Pipeline Attack on May 7, 2021, and forced the organisation to shut down its operations by infecting servers with ransomware. A group of researchers from the Royal Holloway, University of London, discovered how Telegram bots could be manipulated and force chats to get reordered. This meant adversaries could steal plain text from encrypted messages and find ways to "hack" the app. Despite Telegram offering the best End-to-End encryption via secret chats, this proved how threats can find ways to exploit emerging Cloud apps and services. Cloud is not equipped to handle insider threats, since trusted employees can drop off malicious codes to infect systems. Unfortunately, this could just be the beginning.

Thus, data governance is no longer a topic that can be ignored by CIOs, CEOs, and CISOs. Business owners are on the hunt for Cloud platforms that offer reliability, functionality, and responsible access to public and private cloud data.

Researches suggest that Cloud security misconfigurations are the leading causes of data breaches and over 265,000 accounts were found misconfigured out of the 1 million that were surveyed across Southeast Asia. Cloudstar became victim to a highly sophisticated ransomware attack this year and its systems went completely offline when hackers hijacked a critical flaw found in their services. Unauthorised access to Cloud data, Distributed Denial of Service (DDoS) attacks, lack of secure APIs, and sensitive data leaks are the top Cloud security threats being faced by global organisations. Businesses that were not using Cloud security platforms were at risk of lacking architectural visibility and future data breaches. There are many tools available for conducting security audits of these services that enterprises should take advantage of.

Future of Cloud computing

Cloud has just taken off. Thus the future of the cloud might not be able to be predicted exactly. With the explosiveness of IoT networks and 5G, Cloud seems to have a promising future though. Today's data surges in high volumes and Cloud infrastructures would be better equipped to handle abundant amounts of processing at lower rates. Software development takes place from many different angles and modular software development would be prioritised by Cloud vendors. There would be improvements seen in Cloud service offerings within SaaS, IaaS, and PaaS sectors and many researchers predict that Cloud Computing would be the leading technology in the future.

Cloud vendors would be focusing on cyber security while developing apps or services. Businesses might expect to enjoy a greater sense of reliability and privacy that way. With the advent of automation and virtualization, data processed on the Cloud would not require human intervention and security reviews or audits are expected to be automated by Artificial Intelligence by a huge margin as well.

Cloud Gaming is taking a quantum leap and Microsoft is on track to conquer the gaming segment by introducing the latest updates to its Xbox Game Pass Subscription Services. Amazon Luna integrated Twitch, a popular video game streaming, and broadcasting website, and provided 4k resolution support at 60fps for modern games, thus competing directly with Google's Stadia and Microsoft xCloud.

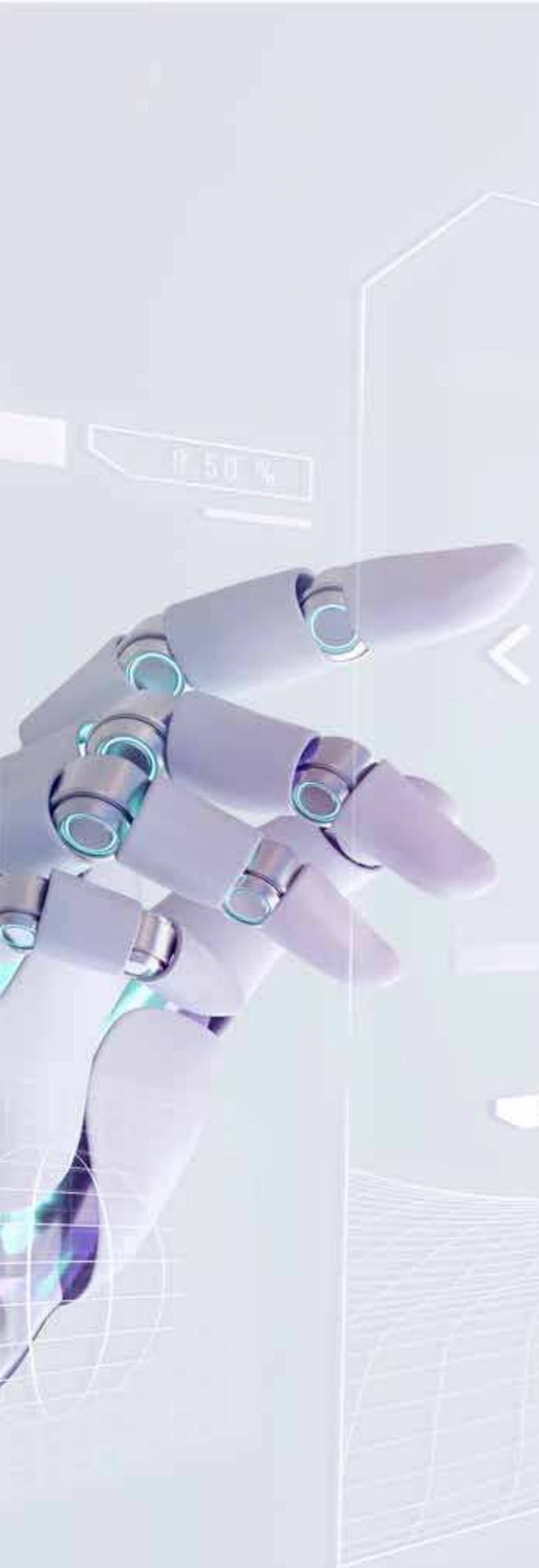
A prime example of how the Cloud revolutionised not just gaming but the video streaming services industry is YouTube, the tech giant that massively scaled up in the last decade and how it improved its user experiences.

Future of Cybersecurity

Passwords - Passwords were predicted to die a few decades ago but even today they are still relevant. This is partial because of their ease of use and general accessibility. At the same time, the desire of intruders to acquire the passwords would remain irrepressible in the coming days. Thus experts hope that this trend would evolve and there would be more opportunities to authenticate without passwords.

In the next ten years, more biometrics and the use of additional authentication methods would come up with mobile devices that are already accessible to almost all.

Artificial Intelligence - AI would have a key role to play in cybersecurity in the coming days. It is predicted that the use of AI will be even more critical than we think. AI might be the catalyst in determining whether the industry can keep up with the threat. There would be better computer security algorithms for particular bots. It is eventually going to be bot versus bot. Human intervention might still be required to some extent, which might get gradually reduced.



Large-Scale and Supply Chain Breaches - More supply chain attacks and even more nation-state attacks can be expected in the coming days .Thus Nation-states are more likely to go after infrastructure as the infrastructures are becoming more digital. However, the same attack types might happen, caused by the same mistakes made today and in the past as people bring more systems online and make them more accessible.

The only way to prevent more infrastructure attacks is to pass a Geneva Convention-style digital act amongst nations prohibiting them from attacking infrastructures.

The Cybersecurity Skills Gap - There is an overwhelming number of unfilled cybersecurity positions. This critical piece of the cybersecurity problem has to be addressed with immediate urgency.

Women in Cybersecurity - There is an issue of getting more women interested in the field of cybersecurity.

Though shocking, the percentage of women in the IT security field at present is lower than the percentage twenty years ago. Thus the female perspective is somewhat missing or very less. Long-term planners often say that women are better planners and can add value with an impact. Thus their point of view is extremely critical. The future of cybersecurity depends on it.

Cloud Security is the future of cybersecurity

Cyberattacks and the extraordinary growth of ransomware are often launched by sophisticated attackers, sometimes state sponsored that overpower traditional and legacy security. The modern attackers are cyber spies that use traditional espionage tactics, together with innovative and disruptive malware to bypass passive, defence-based security measures. To defeat such attacks, security must transform itself into an active profile that hunts current attacks as aggressively as it predicts the threats of the future.

To predict and defeat attacks in real time, cybersecurity must move to the cloud. The cloud can leverage big data and instant analytics over a large number of end users to instantly address known threats and predict threats that seek to overwhelm security.

Cloud security must create a collaborative approach that analyses event streams of normal and abnormal activity across all users to build a global threat monitoring system.
Cyberattacks continue to disrupt our way of life with innovative new approaches to seeding malware and stealing our data. Security must in turn actively work to disrupt the cyber spies, attackers and terrorists through a collaborative security approach that leverages the big data and analytics that thrive within the cloud.

Predictive security in the cloud has innovated security in a manner that will frustrate cyber spies for the coming years. This technology collects and analyses unfiltered endpoint data, using the power of the cloud, to make predictions about, and protect against future and currently unknown attacks. This means predictive security in the cloud can identify attacks that other endpoint security products miss, and provides visibility into attacks that evolve over time. It gives the ability to hunt threats before the attacker begins hunting.

This new approach to security will not just level the playing field between the attacker and security teams, it would shift the balance in the opposite direction and provide security with an advantage. Cyberattacks rely on stealth and surprise to disrupt, destroy and steal. Predictive security in the cloud works like a counterintelligence agency that hunts the spies before they attack. This innovative approach is the next generation of security.

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FUTURISTIC BUSINESSES THAT MAY EVOLVE IN THE COMING TWO DECADES

Futuristic businesses that may evolve in the coming two decades

The pace of change in the technology sector has always been fast. According to research, it is being predicted that more technological progress would be experienced in the coming decades than what happened in the preceding 100 years put together. Any change can be unsettling and keeping pace with developments even more so. Part of the challenge is knowing which are the most significant changes and which are the ones that are less likely to bear fruit.

Some industries are most likely to feature prominently in the changing face of the modern workplace. Understanding the impact these tech trends would have on organisations and on the people whose jobs will be affected, could be key to avoiding any of the worst downsides of the disruption that may follow.

For business leaders looking for business opportunities to start a business startup, foraying into industries that have a promising future should be beneficial. A few of the futuristic businesses that may evolve in the next two decades are as follows:

1. Applied Artificial Intelligence (AI) - AI is one of the biggest tech trends. The world is still only in the early days of the development of AI. As the technology becomes more sophisticated, it will be applied to further develop tech-based tools, such as training machines to recognize patterns, then act upon what it has detected. By 2024, AI-generated speech would be behind more than 50% of people's interactions with computers. Companies are still searching for ways to use AI effectively though.

2. Bio Revolution - Bio Revolution is a confluence of advances in biological science that promises a significant impact on economies and people's lives and would affect industries from health and agriculture to consumer goods, energy and materials.

Propelled by AI, automation and DNA sequencing, the bio revolution promises the development of gene-therapies, hyper-personalised medicines and genetics-based guidance on food and exercise. These tech trends would create new markets and opportunities but would also raise some important ethical questions. Organisations need to assess their bQ or biological quotient – the extent to which they understand biological science and its implications. They should then sort out the resources they need to allocate to biological technologies and capabilities and whether to integrate those into their existing R&D or partner with science-based start-ups.

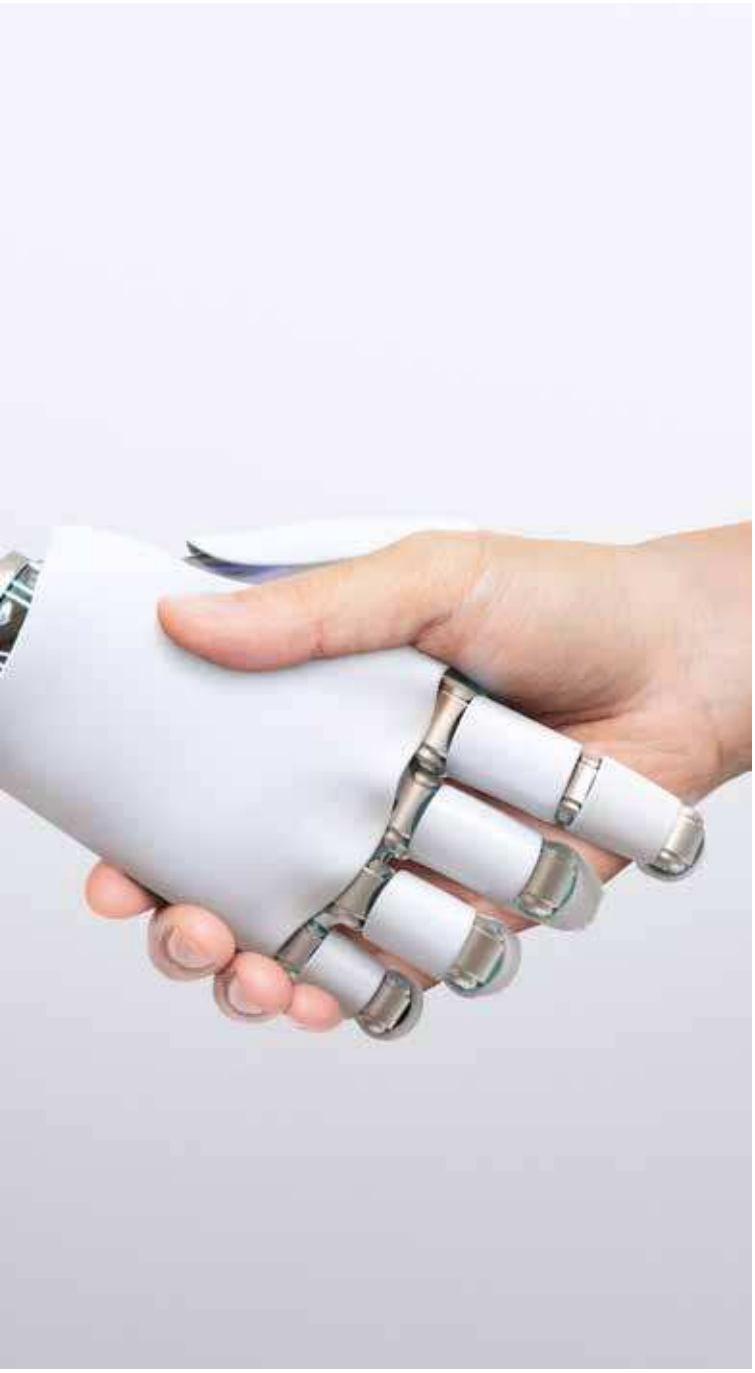
3. Clean Energy - A clean energy revolution is taking place across the globe, underscored by the steady expansion of the renewable energy sector. The clean energy industry generates hundreds of billions in economic activity, and is expected to continue to grow rapidly in the coming years. There is tremendous economic opportunity for the countries that invent, manufacture and export clean energy technologies. Responsible development of all of the rich energy resources -- including solar, wind, water, geothermal, bioenergy & nuclear -- would help ensure countries' leadership in clean energy. Moving forward, the Energy Department would continue to drive strategic investments in the transition to a cleaner, domestic and more secure energy future.

4. Genetic engineering - Genetic engineering has applications in medicine, research, industry and agriculture and can be used on a wide range of plants, animals and microorganisms. Bacteria, the first organisms to be genetically modified, can have plasmid DNA inserted containing new genes that code for medicines or enzymes that process food and other substrates. Plants have been modified for insect protection, herbicide resistance, virus resistance, enhanced nutrition, tolerance to environmental pressures and the production of edible vaccines. Most commercialised GMOs are insect resistant or herbicide tolerant crop plants. Genetically modified animals have been used for research, model animals and the production of agricultural or pharmaceutical products. The genetically modified animals include animals with genes knocked out, increased susceptibility to disease, hormones for extra growth and the ability to express proteins in their milk.

Biology is being recognized as another form of readable, writable, and hackable information technology with we humans as the coders.

The impact of genetic engineering is being first experienced in healthcare. Gene therapies including those extracting, re-engineering, then reintroducing a person's own cells enhanced into cancer-fighting supercells are already performing miracles in clinical trials. Thousands of applications have already been submitted to regulators across the globe for trials using gene therapies to address a host of other diseases.

Recently, the first gene editing of cells inside a person's body was deployed to treat the genetically relatively simple metabolic disorder Hunter syndrome, with many more applications to come. These new approaches are only the very first steps in the shift from the current system of generalised medicine based on population averages to precision medicine based on each patient's individual biology to predictive medicine based on AI-generated estimations of a person's future health state.



5. Machine Learning - Machine learning addresses the question of how to build computers that improve automatically through experience. At present it is one of the most rapidly growing technical fields, lying at the intersection of computer science and statistics, and at the core of artificial intelligence and data science. Recent progress in machine learning has been driven both by the development of new learning algorithms and theory and by the ongoing explosion in the availability of online data and low-cost computation. The adoption of data-intensive machine-learning methods can be found throughout science, technology and commerce, leading to more evidence-based decision-making across many walks of life, including health care, manufacturing, education, financial modelling, policing, and marketing.

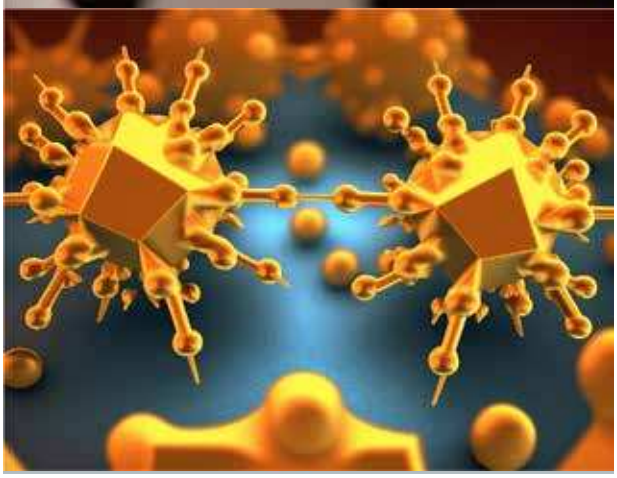
Machine learning solutions continue to incorporate changes into businesses' core processes and are becoming more prevalent in daily lives. The global machine learning market is predicted to grow from $8.43 billion in 2019 to $117.19 billion by 2027.

6. Internet of Things - The future of Internet of Things (IoT) has the potential to be limitless. Advances to the industrial internet will be accelerated through increased network agility, integrated artificial intelligence (AI) and the capacity to deploy, automate, orchestrate and secure diverse use cases at hyperscale. The potential is not just in enabling billions of devices simultaneously but leveraging the huge volumes of actionable data which can automate diverse business processes. As networks and IoT platforms evolve to overcome these challenges, through increased capacity and AI, service providers will edge furthermore into IT and web scale markets – opening entire new streams of revenue.

7. Sustainability - In recent years among the environmental community, a parallel vision of the future has emerged. Almost everyone, from CEOs of progressively minded companies to activists on the street, is talking about building a more sustainable future.

Companies which develop stellar sustainability practises now will be more resilient in the future. They will be more attractive to consumers, recruits, and investors - which will directly affect their bottom-line. New legislation will also be less likely to impact sustainable businesses, along with Internet activism and protests. Therefore, today's sustainable businesses are likely to become tomorrow's industry leaders. Indeed, failing to address global issues such as climate change and slavery may ultimately be to a business' detriment. All companies have an opportunity to make some significant sustainable changes in their organisation. To create a better future - for all.

8. Cyber Security: Cloud computing - The one aspect of IT that has experienced the maximum growth in the last 10 years is undoubtedly the use of the cloud. In the coming decades, it can only be expected that cloud computing can only keep blazing forward.



How prominent the use of passwords would be or how the position of the cloud will be in the coming future might be up for debate, but the key role that AI will play in cybersecurity is something that can be vouched for.AI will be the catalyst in determining whether the industry can keep up with the threat actor community.

Much like AI, data breaches are expected to be more prevalent in the coming years than what they are now — which is both unfortunate and scary. As more data and devices appear online, the risk of a breach only grows.

9. Nano Technology - Nanotechnology is an emerging science which is expected to have rapid and strong future developments. It is predicted to contribute significantly to economic growth and job creation in the coming decades.

In the next 20 years, nano-technology will touch the life of nearly every person on the planet. The potential benefits are humongous and brain enhancing. But like many of the great advancements in earth's history, it is not without risk

In the future, nanotechnology might help us make electrical lines, solar cells, and biofuels more efficient, and make nuclear reactors safer. Nanotechnology might lead to huge advances in health care, improving methods for detecting and treating diseases like cancer.

10. Virtual Reality - Virtual Reality (VR) is set to see significant growth in the next ten years, with researchers estimating it will become a $51 billion (€44bn) industry by 2030. The VR market remains heavily oriented around gaming, but VR is gaining traction in areas such as social media and live streaming. It is expected of enterprise to become the key market for VR over the next three years, outpacing the consumer segment. VR is already in use across the retail, defence, airlines, oil and gas, and healthcare industries – primarily for training purposes. However, the Covid-19 pandemic triggered a shift to remote working that has boosted the adoption of VR by enterprises not just for training, but for collaboration, data visualisation and customer experience.

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GENETIC ENGINEERING

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Genetic Engineering

Genetic engineering is the artificial manipulation, modification, and recombination of DNA or other nucleic acid molecules in order to modify an organism or population of organisms. The term genetic “engineering” is generally used to refer to methods of recombinant DNA technology, which emerged from basic research in microbial genetics. The techniques employed in genetic engineering have led to the production of medically evolved products, including human insulin, human growth hormone, and hepatitis B vaccine, as well as to the development of genetically modified organisms such as disease-resistant plants.

The potential public health benefits of genetic engineering are immense, but there are potential harms as well. Genetic engineering may help to promote health and prevent illness by increasing the quality and quantity of food, by cleaning up toxic environments, and by reducing human health problems for existing and subsequent generations.

Genetic engineering might also threaten human health, in producing unsafe foods, polluting the environment, and otherwise undermining or compromising the health status.

How Genetic engineering impacts our everyday lives

Genetic engineering has advanced the understanding of many theoretical and practical aspects of gene function and organisation. Through recombinant DNA techniques, bacteria have been created that are capable of synthesising human insulin, human growth hormone, alpha interferon, a hepatitis B vaccine, and other medically useful substances. Plants may be genetically adjusted to enable them to fix nitrogen, and genetic diseases can possibly be corrected by replacing dysfunctional genes with normally functioning genes.Genes for toxins that kill insects have been introduced in several species of plants. Bacterial genes that bestow resistance to herbicides also have been introduced into crop plants. Other attempts at the genetic engineering of plants have been aimed at improving the nutritional value of the plant.

Application of genetic engineering in the food industry

Genetic engineering finds major application in the food industry due to modification of the genetic material of plants or animals. Many genetically modified whole foods or ingredients present in the food industry available today are a result of gene modification.

In general, a number of enzymes are involved in fermentation and digestion of foods. This has led to the concept of production of recombinant enzymes from genetically modified microbes such as chymosin and lipase for cheese production, and alpha- amylase for flavour enhancement in the beer industry. A mixture of enzymes called Rennet is used to coagulate milk into cheese. This specific enzyme was initially available from the stomach of calves, and or from microbial sources - thus it was expensive and caused unpleasant tastes. Genetic engineering has succeeded in isolating and cloning rennet-producing genes from animals into bacteria, fungi or yeasts to produce chymosin-a key enzyme present in rennet. A number of organisms like E. coli, Kluyveromyces lactis, and Aspergillus niger are cloned to produce recombinant chymosin. One of the latest technologies involves production of cow milk containing increased amounts of a cheese making protein, casein and foods without beta-lactoglobulin (an allergen in milk) by RNA interference Technology.

Genetically modified foods are obtained from genetically modified organisms, or “transgenic crops”. Genetic engineering has resulted in a number of improved traits in transgenic plants by genetic alteration. Some of these traits are:

- Production of extra nutrients in the food
- Increased growth rate
- Disease resistance
- Herbicide resistance
- Enhanced taste
- Increased shelf life
- Lesser requirement of water

Application of genetic engineering in the pharmaceutical industry and Medicine

By genetic engineering a variety of medical products are available today. Among these products, insulin and human growth hormone were the first commercially available products obtained from recombinant E. coli. Recombinant insulin is the result of successful genetic engineering. It is now commercially available in several forms and is involved in diabetes Therapy.

The production of pharmaceutical products from transgenic animals is called “Pharming”. Pharming involves the use of genetic engineering techniques. The recombinant proteins produced by pharming act as drugs for various human diseases. These therapeutic products can be directly injected into the bodies of the patient to treat the disease and cure deficiencies. The recombinant vaccines are an important group of therapeutic products. A number of vaccines are now available for animals, and humans which are going to have a major impact in the healthcare industry. One of the initial vaccines produced by rDNA method involves the cloning of the surface antigen of the hepatitis B virus (HBsAg) in the yeast S. cerevisiae under the control of the alcohol dehydrogenase promoter. A number of recombinant vaccines are now commercially prepared by the recombinant DNA technology, where only the outside coat protein of the microorganism is expressed in the host to create the vaccine. The expressed protein can then be purified from the recombinant host and used for inoculation. This method has the advantage of safe delivery of antigen without transferring the actual disease-causing microbe to the host. Currently recombinant vaccines for the hepatitis B virus, herpes type 2 viruses, and malaria are under trial for use in the future.
The latest development involves the production of edible vaccines using transgenic plants as a delivery mechanism, which involves the presence of vaccines in the edible part of the plant. This technology has tremendous potential as it enables easy delivery of vaccines by mere consumption of the edible part. The trials for development of a vaccine-containing banana or tomato are currently under way. With the advancement of genetic engineering it would be possible to treat the genetic defects by the replacement of the defective gene with a functional copy by gene therapy. This technique has great potential in the treatment of genetic diseases.

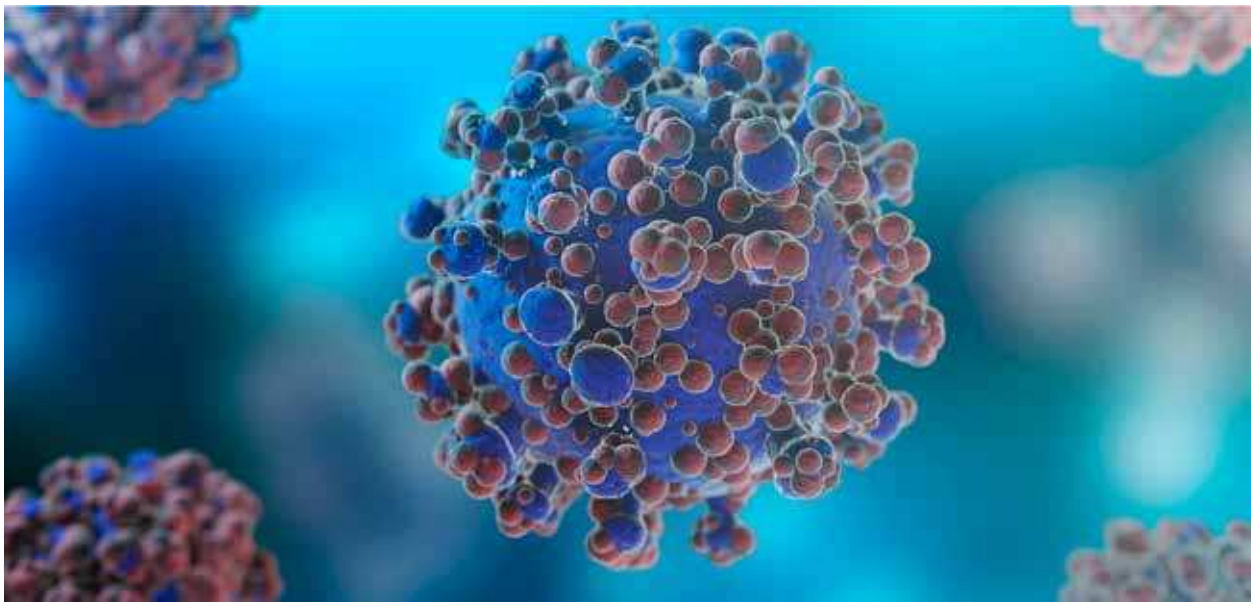
The gene therapy protocol can be made effective by the following approaches:

- Insertion of a normal gene to compensate for a nonfunctional gene
- Repair of an abnormal gene by selective reverse mutation
- Alteration in the regulation of gene pairs

A number of genetic disorders caused by single-gene defects, such as cystic fibrosis, muscular dystrophy, haemophilia, sickle cell anaemia and AIDS can be treated by gene therapy approach for which the clinical trials are in process.

Application of genetic engineering in Environment

Genetic engineering is exploiting the huge potential of microorganisms, plants, and animals for the restoration of the environment. Genetic engineering is actively involved in the development of microorganisms and biocatalysts for remediation of contaminated environments, and in development of eco-friendly processes such as developing recombinant strains for biofuel production etc.
A number of genetically engineered microorganisms (GEMs) are developed which are involved in the biodegradation of waste materials. As the genes for enzymes involved in the bio-degradation pathway are mainly located on the plasmids, it is possible to create new strains by genetic manipulations of such plasmids. Using this technique, a new strain of bacterium Pseudomonas was developed and named as “Superbug”. This superbug is able to produce a combination of enzymes involved in degradation of a number of hydrocarbons present in petroleum.



Genetically modified organisms are used in clearing up oil spills which are a major environmental hazard. New strains of Pseudomonas have been developed to break down a variety of hydrocarbons present at the oil-spill site, thus decreasing the use of toxic chemical dispersants. Some microorganisms which are involved in the degradation of hydrocarbons are pseudomonads,corynebacteria and some yeasts.

Increased use of herbicides, pesticides and insecticides cause the problem of soil pollution. The overuse of chemical herbicides, pesticides and fertilisers are detrimental to the environment. That can also be solved by using recombinant microorganisms. An attempt is being made to develop bacterial and viral pesticides which will help in reduced use of chemical pesticides. Genetically engineered bacteria in which toxic genes from Bacillus thuringiensis are cloned and are used as biological pesticides.

Application in trait improvement of animals through transgenesis

Genetic engineering involves the introduction of transgene into animal to improve the trait of transgenic animals. Transgenic animals finally express the trait of the introduced gene. Transgenic animals are also created to study the function of different genes to develop proper treatment of a disease.
Transgenic animals can be a successful means to provide an economical production of enzymes, proteins, quality and quantity improvement of meat and other animal products. Since the successful cloning of Dolly, a sheep by genetic engineering, there has been continuous effort in the direction of cloning of useful livestock.

Some of the remarkable products developed through transgenesis in animals include:

- Production of human proteins in animal milk
- Production of BioSteel, a high strength silk product, from goat's milk
- Growth of tissues on 3-D printers by a genetic manipulation of stem cells can be used as a skin substitute for wound healing.
- Production of therapeutic proteins, such as monoclonal antibodies, from the milk of transgenic cows, goats, and mice, which is used to administer drugs in various diseases.

Future prospects of Genetic Engineering

Genetic engineering and transgenesis thus holds tremendous potential in the field of basic research and also commercial and industrial consideration of different products.

In recent years one of the most important developments in genetic engineering involves a new gene-splicing technique called “clustered regularly interspaced short palindromic repeats” - known by its acronym, CRISPR. This new method greatly improves scientists’ ability to accurately and efficiently “edit” the human genome, in both embryos and adults. The development of CRISPR-Cas proteins for genome editing applications now has a profound impact on biology and biotechnology over the past few years. These tools have democratised the ability to rewrite the information contained in genomes and thereby to both understand and alter genetic traits.It is being believed that CRISPR technology would positively change the lives of millions of people. Over the next decade, researchers would continue to advance the use of CRISPR-based tools to treat and in some cases cure diseases, develop more nutritious crops, and eradicate infectious disease. It is a profoundly powerful technology, but one must be mindful of potential unintended or undesirable consequences and apply it responsibly.

The responsible and ethical application of the latest genome editing tools is to work toward curing patients who suffer debilitating genetic diseases. This endeavour would demand the cooperation of researchers across government, academic, and industrial sectors, working together in a spirit of transparency and a common desire to propel cutting-edge science forward in order to both advance the field and make an impact on human health and genetic disease. As with any bold challenge, cross-sector collaboration, informational transparency, honest dialogue, and a commitment to scientific excellence and integrity are essential while treating genetic disease through the modification of a patient’s DNA. If dealt with responsibly, genetic engineering would have an immense impact on the lives of people in the coming decades.

How genetic engineering will reshape humanity in the coming decades

New genetic technologies are exhilarating but can be terrifying as well. Society might overcome diseases by tweaking individual genomes or selecting specific embryos to avoid health problems. But it might also give rise to "superhumans" who are optimised for certain characteristics like intelligence, power or looks and exacerbate inequalities in society.

The impact of this transformation is being first experienced in the healthcare industry. Gene therapies including those extracting, re-engineering, then reintroducing a person's own cells enhanced into cancer-fighting supercells are already performing miracles in clinical trials. Thousands of applications have already been submitted to regulators across the globe for trials using gene therapies to address a host of other diseases. The progress of genetic engineering would ensure that millions and then billions of people would have their genomes sequenced as the foundation of their treatment. Big data analytics will then be used to compare at scale people's genotypes to their phenotypes.

These massive data sets of genetic and life information would then make it possible to go far beyond the simple genetic analysis of today and to understand far more complex human diseases and traits influenced by hundreds or thousands of genes. The understanding of the complex genetic system within the vast ecosystem of our bodies and the environment around us would transform healthcare for the better and help cure terrible diseases that have plagued our earlier generations for millennia.

The most profound application of genetic engineering would be in the future baby-making. Before making a decision about which of the fertilised eggs to implant, women undergoing in vitro fertilisation would elect to have a small number of cells extracted from their pre-implanted embryos and sequenced. With current technology, this can be used to screen for single-gene mutation diseases and other relatively simple disorders. Polygenic scoring would soon make it possible to screen these early stage pre-implanted embryos to assess their risk of complex genetic diseases and even to make predictions about the heritable parts of complex human traits.

The overlapping of genomics and AI revolutions is expected to happen far sooner than most people recognize.

Current scientific advancements show that CRISPR is not only an extremely versatile technology, it is proving to be precise and increasingly safe to use. Though a lot of progress still has to be made.

Technological and ethical hurdles still stand between the current world and a future in which the planet would be fed with engineered food, eliminate genetic disorders, or bring extinct animal species back to life. Technological advancements are well on the way to progress and with proper planning and implementation, a brighter and advanced future awaits for sure.

INTERNET OF THINGS (IOT)

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Internet of Things (IoT)

The Internet of Things (IoT) describes the network of physical objects—“things”—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. The Internet of things is made up of devices that connect to the internet and share data with each other. IoT devices include not only computers, laptops and smartphones, but also objects that have been equipped with chips to gather and communicate data over a network. These devices range from ordinary household objects to sophisticated industrial tools. With more than 7 billion connected IoT devices today, experts are expecting that this number would grow to 22 billion by 2025.

Internet of Things Applications

The Internet of Things can be used in many different aspects of life, in both the private and public sectors. With IoT, people can track things like lost pets, their house’s security systems, or appliance maintenance schedules. Consumers can use the IoT to help them make restaurant reservations, monitor their exercise progress and overall health, and receive coupons for a store only by virtue of walking by the business in question.

Businesses can use IoT to monitor supply chains, track customers’ spending habits as well collect their feedback, monitor and maintain inventory levels, and engage in predictive maintenance of their machines and devices.

The IoT also proves helpful in ITIL - a set of IT service management, an important detail, since IT departments are called on to do more and more in a world that is getting increasingly digital, with more reliance on wireless networks.

Blockchain, which is being increasingly used as a more efficient and secure method of transaction and data processing, is a natural beneficiary of IoT technology. One can expect to see IoT and Blockchain coming together more often in the future.

IoT Applications by Industries

IoT's versatility makes it an attractive option for so many businesses, organisations, and government branches, that it does not make sense to ignore it.

1. IoT Applications in Agriculture - For indoor planting, IoT makes monitoring and management of micro-climate conditions a reality, which in turn increases production. For outside planting, devices using IoT technology can sense soil moisture and nutrients, in conjunction with weather data, better control smart irrigation and fertiliser systems. For example, If the sprinkler systems dispense water only when needed this prevents wasting a precious resource.

2. IoT Applications in Consumer Use - For common p[eople, IoT devices in the form of wearables and smart homes make life easier. These devices improve entertainment, network connectivity, health, and fitness.

Smart homes take care of things like activating environmental controls so that the house is at peak comfort when one comes home. Dinner that requires either an oven or a crockpot can be started remotely, so the food is ready when one arrives. Security is made more accessible as well, with the consumer having the ability to control appliances and lights remotely, as well as activating a smart lock to allow the appropriate people to enter the house even if they don't have a key.

3. IoT Applications in Healthcare - Wearable IoT devices let hospitals monitor their patient's health at home, thereby reducing hospital stays while still providing up-to-the -minute real-time information that could save lives. In hospitals, smart beds keep the staff informed as to availability, thereby cutting wait time for free space. Putting IoT sensors on critical equipment means fewer breakdowns and increased reliability, which can mean the difference between life and death.

Elderly care becomes significantly more comfortable with IoT. In addition to the above-mentioned real-time home monitoring, sensors can also determine if a patient has fallen or is suffering a heart attack.

4. IoT Applications in Insurance - Insurance companies can offer their policyholders discounts for IoT wearables. By employing fitness tracking, the insurer can offer customised policies and encourage healthier habits, which in the long run, benefits everyone, insurer, and customers alike.

5. IoT Applications in Manufacturing - RFID and GPS technology can help a manufacturer track a product from its start on the factory floor to its placement in the destination store, the whole supply chain from start to finish. These sensors can gather information on travel time, product conditions, and environmental conditions that the product was subjected to. Sensors attached to factory equipment can help identify bottlenecks in the production line, thereby reducing lost time and waste. Other sensors mounted on those same machines can also track the performance of the machine, predicting when the unit will require maintenance, thereby preventing costly breakdowns.

6. IoT Applications in Retail - Online and in-store shopping sales figures can control warehouse automation and robotics, information gleaned from IoT sensors. Mostly these rely on RFIDs, which are already in heavy use worldwide.

Business tends to fluctuate, and the advent of online shopping has driven down the demand for brick and mortar establishments. However, IoT can help analyse mall traffic so that stores located in malls can make the necessary adjustments that enhance the customer's shopping experience while reducing overhead.

IoT helps retailers target customers based on past purchases. Equipped with the information provided through IoT, a retailer could craft a personalised promotion for their loyal customers, thereby eliminating the need for costly mass-marketing promotions that don't stand as much of a chance of success. Many of these promotions can be conducted through the customers' smartphones, especially if they have an app for the appropriate store.

7. IoT Applications in Transportation - Huge progress is being made with self-driving cars. But that is just one bit of the vast potential in the field of transportation. The GPS is another example of IoT which is being utilised to help transportation companies plot faster and more efficient routes for trucks hauling freight, thereby speeding up delivery times.

There is already significant progress made in navigation, once again alluding to a phone or car's GPS. But city planners can also use that data to help determine traffic patterns, parking space demand, and road construction and maintenance.

There is even a possibility that apps can be made that can prevent a car from starting if the driver is inebriated.

8. IoT Applications in Utilities/Energy - IoT sensors can be employed to monitor environmental conditions such as humidity, temperature, and lighting. The information provided by IoT sensors can aid in the creation of algorithms that regulate energy usage and make the appropriate adjustments, eliminating the human equation.

With IoT-driven environmental control, businesses and private residences can experience significant energy savings, which in the long run, benefits everyone, including the environment.

On a larger scale, data gathered by the IoT can be used to help run municipal power grids more efficiently, analysing factors such as usage. Also, the sensors can help pinpoint outages faster, thereby increasing the response time of repair crews and decreasing blackout times.

The Internet of Things is poised to create life-changing conditions in our lives, both in a professional and personal capacity. Many of the innovations mentioned are already in place to one extent or another.The IoT offers an unprecedented degree of control and efficiency that no industry can ignore.

The Internet of Things, and its association with technologies such as ITIL, Blockchain, and Big Data, is a lucrative field with lots of potential for business opportunities as well as investment opportunities.

IoT in the coming decades - Predictions

Here are a few predictions about the future of IoT in the coming decades:

1. By 2025, it is estimated that there will be more than 21 billion IoT devices - According to IoT Analytics, Compared to 2016 when there were more than 4.7 billion things connected to the internet, in 2022 the market is expected to increase to nearly 11.6 billion IoT devices.

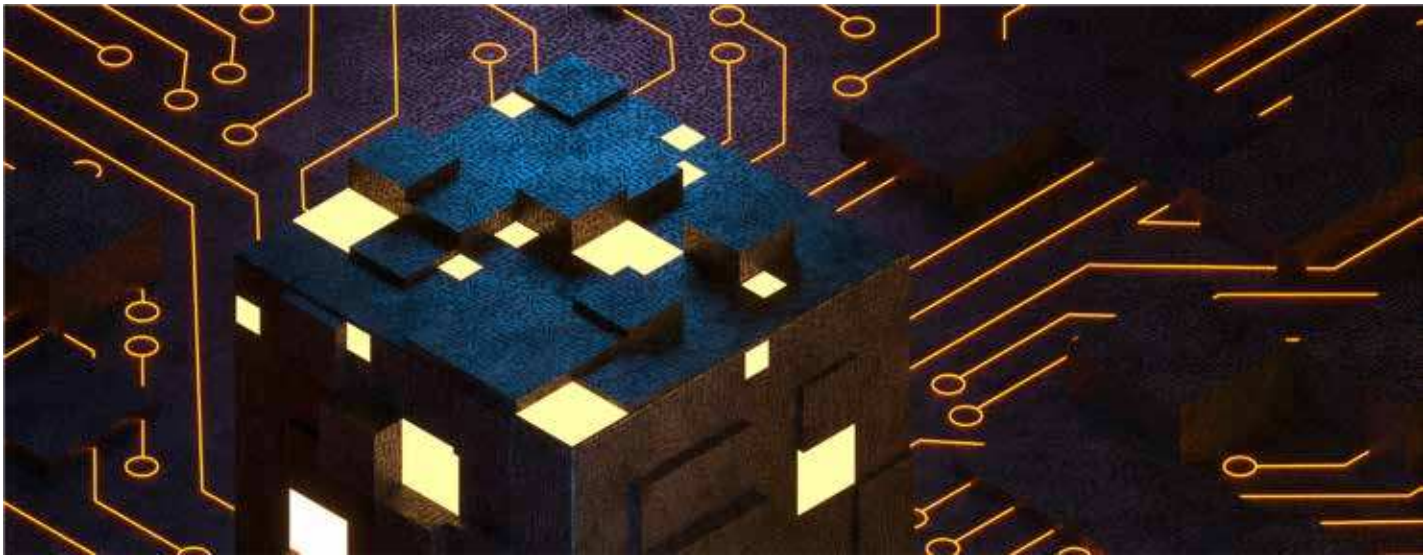
2. Cybercriminals will continue to use IoT devices to facilitate DDoS attacks - The world was introduced to the first “Internet of Things” malware in 2016 — a strain of malicious software that could infect connected devices such as DVRs, security cameras, and more. The Mirai malware accessed the devices using default passwords and usernames.

The malware turned the affected devices into a botnet to facilitate a Distributed Denial of Service (DDoS) attack, which aims to overwhelm websites with internet traffic. The attack ended up flooding one of the largest website hosting companies in the world, bringing a variety of major, well-known websites and services to a halt for hours.

IoT would be vulnerable to such attacks in the coming days as well. IoT-based DDoS attacks would take on more dangerous forms - Botnet-powered distributed denial of service (DDoS) attacks have used infected IoT devices to bring down websites. In future, more IoT devices can be used to direct other attacks.

For instance, there may be future attempts to weaponize IoT devices. A possible example would be a nation shutting down home thermostats in an enemy state during a harsh winter.

3. More cities would become “smart cities” - Consumers will not be the only ones using IoT devices. Cities and companies would increasingly adopt smart technologies to save time and money.This would give rise to cities that would be able to automate, remotely manage, and collect data through things like visitor kiosks, video camera surveillance systems, bike rental stations, and taxis.



4. Artificial intelligence will continue to become a bigger thing - Smart home hubs, thermostats, lighting systems, and even coffee makers collect data on consumer habits and patterns of usage. When voice-controlled devices are set up , they are allowed to record what is said to them and store those recordings in the cloud. In most cases, the data is collected to help facilitate what is called machine learning.

Machine learning is a type of artificial intelligence that helps computers “learn” without someone having to program them. The computers are programmed in a way that focuses on the data that they receive. This new data can then help the machine “learn” what the preferences are and adjust itself accordingly.

These technologies would be much more in vogue in the coming decades across all walks of life.

5. Routers will continue to become more secure and smarter - Most consumer IoT devices reside in the home and can’t have security software installed on them. Thus they can be vulnerable to attacks. A lot of manufacturers work to get their IoT products to market quickly, so security sometimes, though rarely, becomes an afterthought. This is where the home router plays a very important role. The router is essentially the entry point of the internet into one’s home. While many of the connected devices cannot be protected, the router has the ability to provide protection at the entry point. A conventional router provides some security, such as password protection, firewalls, and the ability to configure them to only allow certain devices on your network.

Router makers would likely continue to seek new ways to boost security. Once security is in place, the whole network is safe from any untoward attacks.

6. 5G Networks will continue to fuel IoT growth - Major wireless carriers would continue to roll out 5G networks. 5G or fifth-generation cellular wireless promises greater speed and the ability to connect more smart devices at the same time.

Faster networks mean the data accumulated by the smart devices would be gathered, analysed and managed to a higher degree. That would fuel innovation at companies that make IoT devices and boost consumer demand for new products.

7. Cars would get even smarter - The arrival of 5G will shift the auto industry into a higher gear. The development of driverless cars as well as the connected vehicles already on the road would benefit from data moving faster.

Apparently one might not think of a car as an Internet of Things device. But new cars would increasingly analyse available data and connect with other IoT devices — including other high-tech vehicles on four wheels.

8. 5G's arrival would also open the door to new privacy and security concerns - In time, more 5G IoT devices will connect directly to the 5G network than via a Wi-Fi router. This trend will make those devices more vulnerable to direct attacks. For personal users, it would become more difficult to monitor all IoT devices, because they will bypass a central router.

On a broader scale, the increased reliance of consumers on cloud-based storage would give attackers new targets to attempt to breach.

The future of the Internet of Things (IoT) has the potential to be limitless. Advances to the industrial internet will be accelerated through increased network agility, integrated artificial intelligence (AI) and the capacity to deploy, automate, orchestrate and secure diverse use cases at hyper-scale. The potential is not just in enabling billions of devices simultaneously but leveraging the huge volumes of actionable data which can automate diverse business processes. As networks and IoT platforms evolve to overcome these challenges, through increased capacity and AI, service providers will edge furthermore into IT and web-scale markets – opening entire new streams of revenue.

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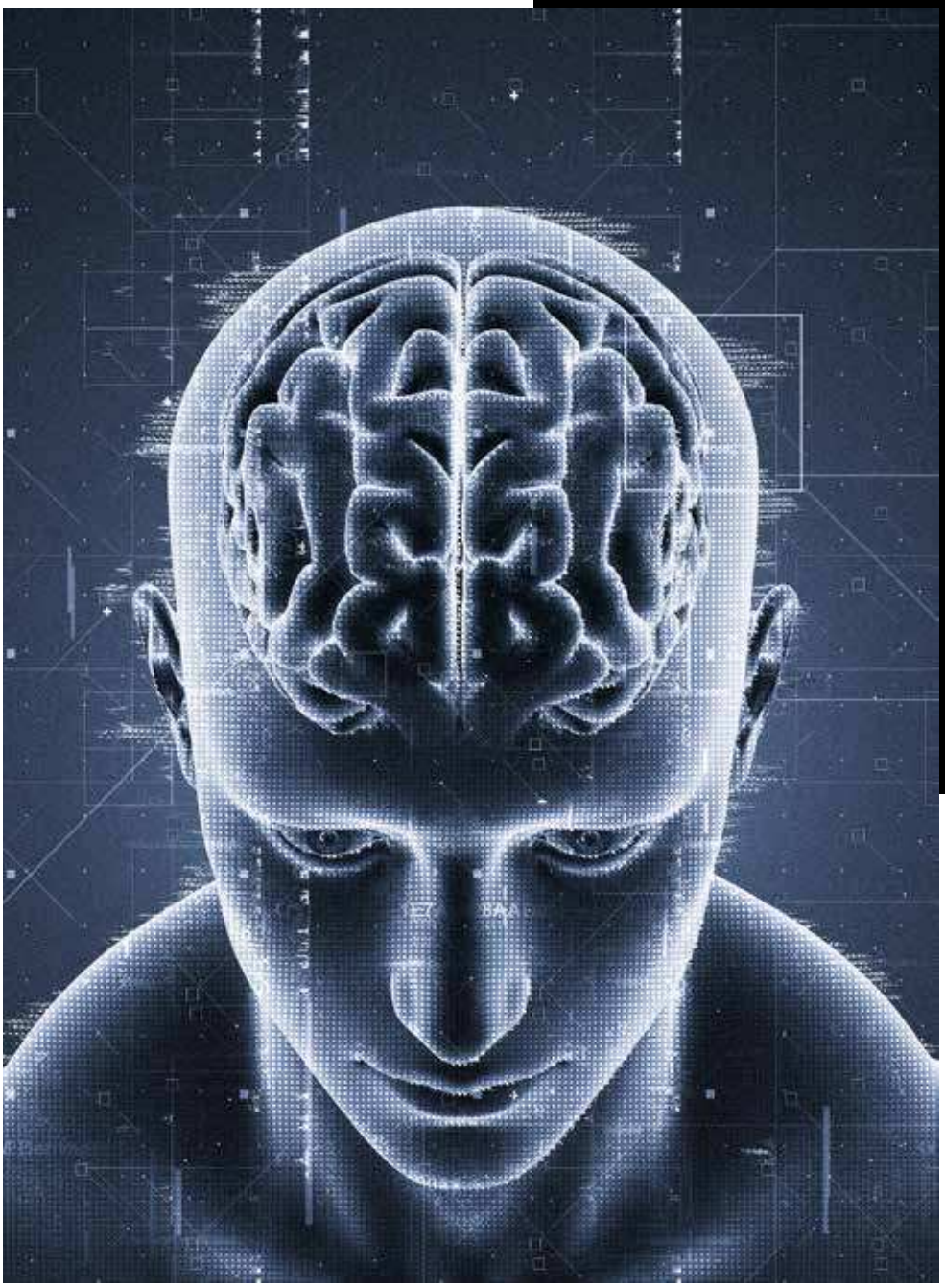
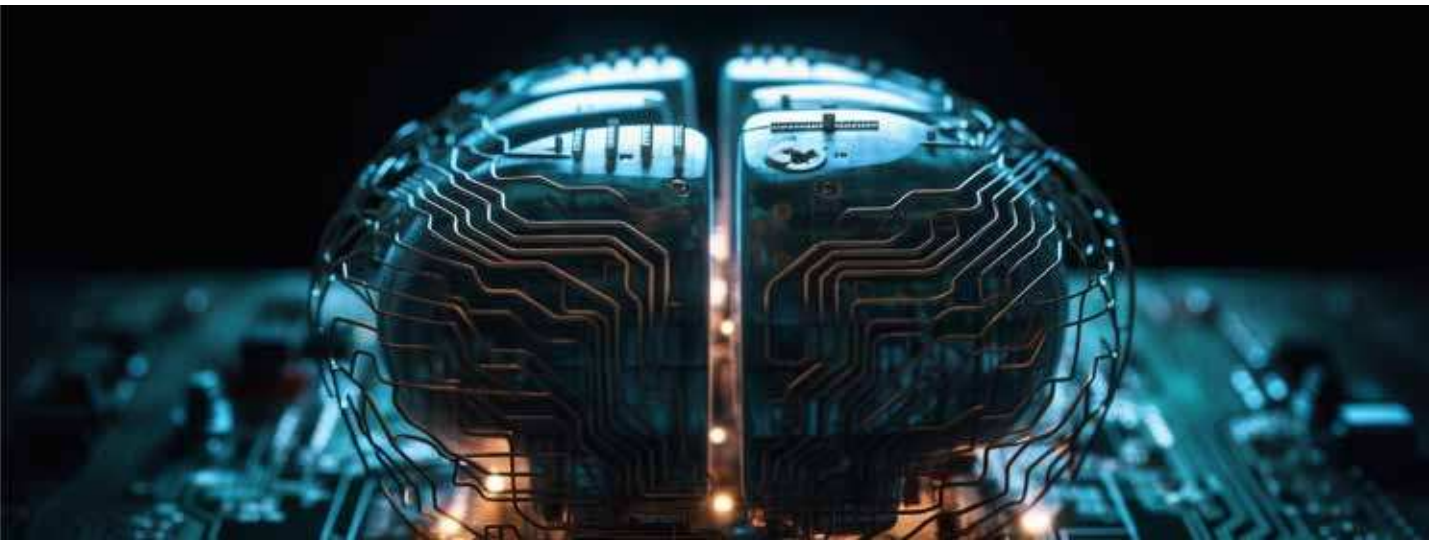
MACHINE LEARNING

– NOW AND IN THE COMING YEARS



Machine Learning - Now and in the coming years



Machine learning (ML) is a commonly used type of artificial intelligence (AI), and is one of the fastest-growing fields in technology. As the workplace, products, and service expectations are changing exponentially through digital transformations, more companies are leaning into machine learning solutions to optimise, automate, and simplify their operations

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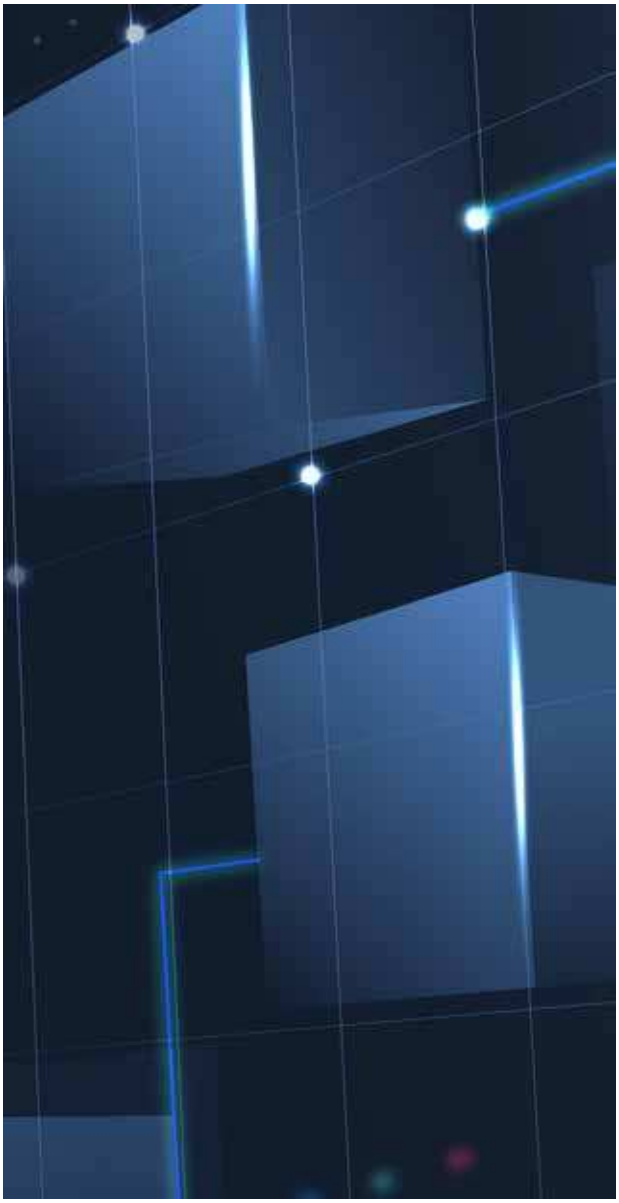
Machine learning addresses the question of how to build computers that improve automatically through experience. It is one of the most rapidly growing technical fields, lying at the intersection of computer science and statistics, and at the core of artificial intelligence and data science. Recent progress in machine learning has been driven both by the development of new learning algorithms and theory and by the ongoing explosion in the availability of online data and low-cost computation. The adoption of data-intensive machine-learning methods can be found throughout science, technology and commerce, leading to more evidence-based decision-making across various walks of life, including health care, manufacturing, education, financial modelling, policing, and marketing.

The field of machine learning is quite young but expanding rapidly, often by inventing new formalizations of machine-learning problems driven by practical applications. One major trend driving this expansion is a growing concern with the environment in which a machine-learning algorithm operates. Here the word “environment” refers in part to the computing architecture; whereas a classical machine-learning system involved a single program running on a single machine, it is now common for machine-learning systems to be deployed in architectures that include many thousands or ten of thousands of processors, such that communication constraints and issues of parallelism and distributed processing take centre stage.

The word “environment” also refers to the source of the data, which ranges from a set of people who may have privacy or ownership concerns, to the analyst or decision-maker who may have certain requirements on a machine-learning system (for example, that its output be visualizable), and to the social, legal, or political framework surrounding the deployment of a system.



The environment might include other machine learning systems or other agents, and the overall collection of systems may be cooperative or adversarial. Broadly speaking, environments provide various resources to a learning algorithm and place constraints on those resources. Increasingly, machine-learning researchers are formalising these relationships, aiming to design algorithms that are probably effective in various environments and explicitly allow users to express and control trade-offs among resources.

Enlisted below are some of the top trends in machine learning at present:

5 Emerging Trends To Watch In Machine Learning

- Automation through MLOps
- ML democratisation and broadening access
- Achieving scalability through containerization
- APIs and wider availability of prepackaged tools
- ML and time series solutions for future planning

1. Automation Through MLOps

Many businesses are investing significant time and resources into Machine Learning development because they recognize its potential and urgency for automation.

When a Machine Learning model is designed with business processes in mind, it can automate a variety of business functions across marketing, sales, HR, and even network security. MLOps and AutoML are two of the most popular applications of machine learning today, giving teams the ability to automate tasks and bring DevOps principles to machine learning use cases.

According to scientists, scaling AI for the enterprise requires a new set of tools and skills designed for modern infrastructure and collaboration. Teams using manual deployment and management find they are quickly strapped for resources and after getting a few models into production, cannot scale beyond that. Machine learning operations (MLOps), is the set of practices and technology that enable organisations to scale and manage AI in production, essentially bringing the development practice of DevOps to machine learning. MLOps helps data science and IT teams collaborate and empowers IT teams to lead production machine learning projects, without having to rely on data science expertise.

AutoML solves a few of the biggest blockers to ML adoption, including faster time to ROI and more quickly and easily developing models. AutoML automates key parts of the data science workflow to increase productivity, without compromising model quality, interpretability, and performance. With AutoML, one can automate algorithm selection, feature generation, hyper-parameter tuning, iterative modelling, and model assessment. By automating repetitive tasks in the workflow, data scientists can focus on the data and the business problems they are trying to solve and speed time from experiment to impact.

Automation through ML is desirable in theory, but in practice, it is sometimes difficult for business leaders to envision how ML tools can optimise their business operations.

2. ML Democratisation And Broadening Access

Machine learning is still considered a niche and complex technology to develop, but a growing segment of tech professionals are working to democratise the field, particularly by making ML solutions more widely accessible.

Researchers believe that ML democratisation involves creating easier access to develop and deploy ML models as well as giving more people access to useful ML training data.

Many times good training data is scarce. Low-data learning techniques are helping in enterprise AI use cases, where customers want to adapt pre-trained out-the-box models to their unique business context. In most cases, their own data sets are not that big, but methods such as transfer learning, self-supervised learning, and few-shot learning help minimise the amount of labelled training data needed for an application. ML democratisation is also about creating tools that consider the backgrounds and use cases of a more diverse range of users. More users and developers are starting to recognize the benefit of a diverse team for developing ML solutions.

Ignoring the technical aspect momentarily, one must focus on the human aspects of AI as well at times. There seems to be a trend building around the democratisation of the ML ecosystem, bringing in more diverse stakeholders at every junction in the value chain.

Bias is probably the greatest obstacle to ML efficacy, and leading companies are learning and inventing ways to combat bias and build better applications by embracing diversity and inclusion (D&I).

3. Achieving Scalability Through Containerization

ML developers are increasingly creating their models in containers. When a machine learning product is developed and deployed within a containerized environment, users can ensure that its operational power is not negatively impacted by other programs running on the server. More importantly, ML becomes more scalable through containerization, as the packaged model makes it possible to migrate and adjust ML workloads over time.

Senior scientists attached with companies working with a variety of ITOps solutions, believe that containerized development of machine learning is the best way forward, particularly in the case of digital enterprises incorporating autonomous operations. Containers allow autonomous digital enterprises to have isolation, portability, unlimited scalability, dynamic behaviour, and rapid change through advanced enterprise DevOps processes.

ML workloads are typically spiky and require high scalability and real-time stream processing in some cases. For example when one takes a look at ML projects, they typically have two phases - algorithm creation and algorithm execution. The first involves a lot of data and data processing. The second typically requires a lot of compute power in production. Both can benefit from container deployment to ensure scalability and availability.

4. APIs And Wider Availability Of Prepackaged Tools

In another trending effort toward Machine Learning democratisation, a number of ML developers have perfected their models over time and found ways to create template-like versions, available to a wider pool of users via API and other integrations.

According to some experts, prepackaged ML tools, particularly via APIs and digital storefronts, are some of the most common and useful applications of machine learning today:

5. ML And Time Series Solutions For Future Planning

Machine learning models can only improve their functionality over time if they are consistently fed new data in intervals. Since so many Machine Learning models rely on timeline-based updates, a number of ML solutions are using a time series approach to improve the model's understanding of the what, when, and why behind different data sets.

The prospects of Machine Learning are immense. Celebrated entrepreneur through his latest passion project Neuralink is claiming to develop a brain implant that would link the human brain directly to computers. He claims this brain-computer interface (BCI) would enable humans to carry out actions through thought alone. Musk hopes that the company's technology will one day not only treat but cure brain disorders and even save memories so people can revisit them like photo albums.

Future of Machine Learning in the coming decades

Machine learning solutions continue to incorporate changes into businesses' core processes and are becoming more prevalent in daily lives. The global machine learning market is predicted to grow from $8.43 billion in 2019 to $117.19 billion by 2027.

The following few areas are thought out as futuristic machine learning advancements:

- **Accurate Results for the Search on the Web Engine:** When one scrolls through a search engine in search of an article,he is probably not aware that the ranking and the hierarchical order of the search result outcomes is done with a purpose. The techniques of machine learning have a tremendous impact on search engine outcomes. Over the next few years, search engines would boost both the user experiences and the host experiences rapidly in fast progress. With further neural network growth and development blended with evolving deep learning techniques, the future search engines will be far better in providing responses and perceptions that are significantly germane to the searchers, explorers of the web.

- **Accurate Tailor-made Customisation:** Corporations could refine their understanding of their target audience using machine learning to inform the enhancement of the existing products, new product development, merchandising, and gross revenue. Developers, programmers, and engineers could customise products far more precisely than ever before with algorithms to break down exactly how their products are used, maximising value for both the organisation and the clients. With more advancements and discoveries in the dynamic field of machine learning and its algorithms, for the clients on a larger scale, it would be possible to see exact targeting and fine-tuned customisation in the near future.

- **Surge in Quantum Computing:** No commercially-ready quantum hardware or algorithms applications are readily accessible at present. Nonetheless, in order to get quantum computing off the ground, several government agencies, academic institutions, and think tanks have spent millions. In the futurity of machine learning, quantum computing is set to have an enormous role. As the world would witness instant processing, rapidly learning, expanded capacities, and enhanced capabilities the introduction of quantum computing into machine learning would metamorphose the domain completely. This implies that in a tiny split moment, complicated issues that one might not have the capacity to tackle with conventional methods, and existing technologies might well be done so.

- **Mass Growth of Data Units:** It would not be unusual to be engrossed with coding, systematic activities, engineering by technology, and information units. Further developments in machine learning can further improve these units' everyday operations towards the efficient realisation of the targets. In the coming decades, machine learning would be one of the cornerstone methods for creating, sustaining, and developing digital applications. It implies that data curators and technology engineers spend a comparatively lesser time period in programming, upgrading ML techniques, so instead make them understand and continuously improve their operations.

- **Fully Automated Self-Learning System:** In software engineering, machine learning would be just another component. In addition to standardising the way people implement machine learning algorithms, open-source frameworks such as Keras, PyTorch, and Tensorflow have also eliminated the basic requirements for doing just that. These types of ecosystems are slowly but steadily coming out, with so many technologies, databases, and resources accessible online today. This would lead to environments that really are near or close to zero codings, and so an automated system emerges.

- **Cyber Security:** Banks and financial institutes implement machine learning to halt malpractices. Phishing is one of the major concerns these days, to rectify phishing emails various classification and regression techniques are imposed to prevent customers from online frauds.

- **Computer Vision:** As the name suggests "Computer Vision" works the same as it is known for. It provides vision to the machine or computer. This technique empowers the machines to recognize and analyse digital images, videos and graphics. On the basis of the reorganisation and analysing it would deliver the output with minimum error.

- **Automotive Industry**: With the help of Machine Learning, the concept of "Safe Driving" would be clearer. In the present scenario renowned firms like Google, Tesla, Mercedes Benz have already invested a huge amount of effort in designing the "Auto Pilot" concept. By means of wireless sensors, Internet of Things, HD cameras and audio/ video recognition systems it is possible to implement this concept properly.

Scientists and experts have been working to develop a computer that acts more like humans in the post-industrialized phase. The thought machine is the greatest blessing of Artificial Intelligence to civilization; the fantastic entry of this self-propelled machine has swiftly altered business operational laws. Self-driving cars, automated assistants, autonomous factory workers, and smart cities have recently shown that smart machines are feasible. The machine Learning revolution will stay with us for a long time and so will be the future of Machine Learning.

NANOTECHNOLOGY

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NANOTECHNOLOGY

Nanotechnology is an emerging science which is expected to have rapid and strong future developments. It is predicted to contribute significantly to economic growth and job creation in the coming decades.

In the next 20 years, nano-technology would touch the lives of nearly every person on the planet. The potential benefits are humongous and brain-enhancing. But like many of the great advancements in earth's history, it is not without risk

In the future, nanotechnology might help us make electrical lines, solar cells, and biofuels more efficient, and make nuclear reactors safer. Nanotechnology might lead to huge advances in health care, improving methods for detecting and treating diseases like cancer.

In the natural world, there are many technologies that have incidentally involved nanostructures for many years but only recently has it been possible to do it intentionally.

APPLICATIONS OF NANOTECHNOLOGY

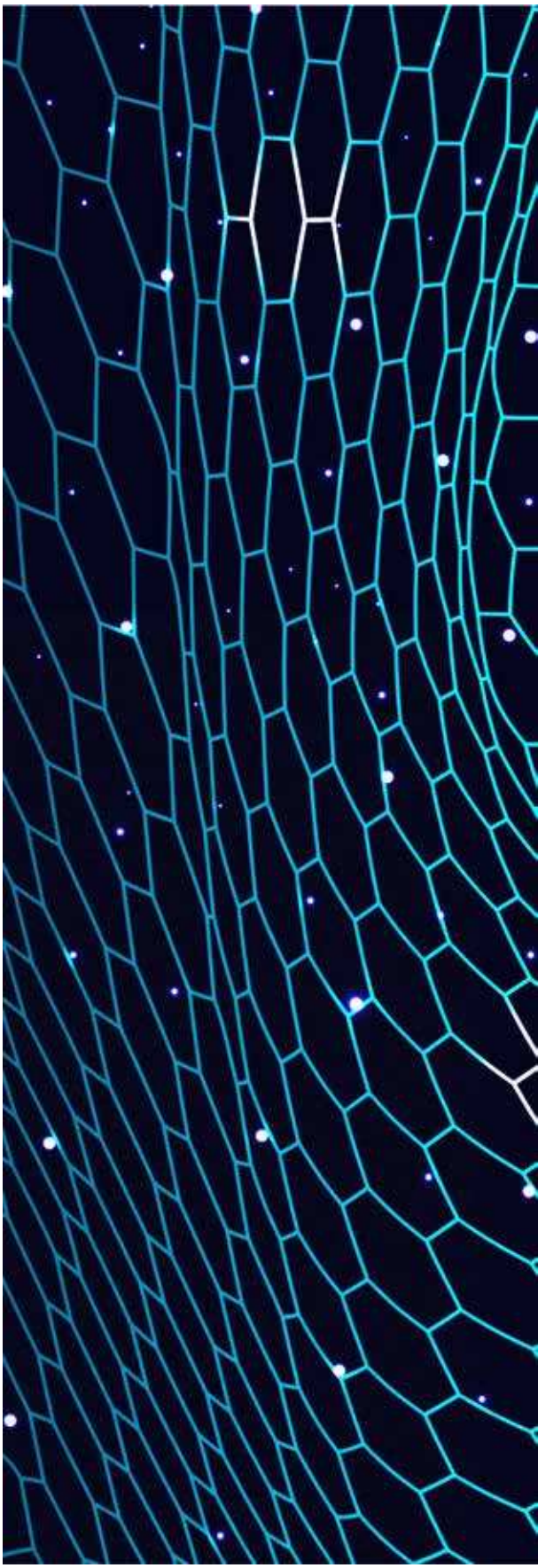
Many of the applications of nanotechnology involve new materials that have very different properties and new effects compared to the same materials made at larger sizes. This is due to the very high surface to volume ratio of nanoparticles compared to larger particles, and to effects that appear at that small scale but are not observed at larger scales. The applications of nanotechnology can be very beneficial and have the potential to make a significant impact on society. Nanotechnology has already been embraced by industrial sectors, such as the information and communications sectors, but is also being used in food technology, energy technology, as well as in some medical products and medicines. Nanomaterials may also offer new opportunities for the reduction of environmental pollution.

Nanotechnology is helping to considerably improve, even revolutionise, many technology and industry sectors like information technology, homeland security, medicine, transportation, energy, food safety, and environmental science, among many others.

1. **Everyday Materials and Processes** - Many benefits of nanotechnology depend on the fact that it is possible to customise the structures of materials at extremely small scales to achieve specific properties. This greatly extends the materials science toolkit. Using nanotechnology, materials can effectively be made stronger, lighter, more durable, more reactive, more sieve-like, or better electrical conductors, among many other traits. Many everyday commercial products are currently on the market and in daily use that relies on nanoscale materials and processes:

- Nanoscale additives to or surface treatments of fabrics can provide lightweight ballistic energy deflection in personal body armour, or can help them resist wrinkling, staining, and bacterial growth.
- Clear nanoscale films on eyeglasses, computer and camera displays, windows, and other surfaces can make them water and residue-repellent, anti-reflective, self-cleaning, resistant to ultraviolet or infrared light, anti-fog, antimicrobial, scratch-resistant, or electrically conductive.
- Nanoscale materials are beginning to enable washable, durable “smart fabrics” equipped with flexible nanoscale sensors and electronics with capabilities for health monitoring, solar energy capture, and energy harvesting through movement.
- Lightweighting of cars, trucks, aeroplanes, boats, and spacecraft could lead to significant fuel savings. Nanoscale additives in polymer composite materials are being used in baseball bats, tennis rackets, bicycles, motorcycle helmets, automobile parts, luggage, and power tool housings, making them lightweight, stiff, durable, and resilient. Carbon nanotube sheets are now being produced for use in next-generation air vehicles. For example, the combination of lightweight and conductivity makes them ideal for applications such as electromagnetic shielding and thermal management.
- Nano-bioengineering of enzymes is aiming to enable the conversion of cellulose from wood chips, corn stalks, unfertilized perennial grasses, etc., into ethanol for fuel. Cellulosic nanomaterials have demonstrated potential applications in a wide array of industrial sectors, including electronics, construction, packaging, food, energy, health care, automotive, and defence. Cellulosic nanomaterials are projected to be less expensive than many other nanomaterials and, among other characteristics, tout an impressive strength-to-weight ratio.

- Nano-engineered materials in automotive products include high-power rechargeable battery systems; thermoelectric materials for temperature control; tires with lower rolling resistance; high-efficiency/low-cost sensors and electronics; thin-film smart solar panels; and fuel additives for cleaner exhaust and extended range.
- Nanostructured ceramic coatings exhibit much greater toughness than conventional wear-resistant coatings for machine parts. Nanotechnology-enabled lubricants and engine oils also significantly reduce wear and tear, which can significantly extend the lifetimes of moving parts in everything from power tools to industrial machinery.
- Nanoparticles are used increasingly in catalysis to boost chemical reactions. This reduces the number of catalytic materials necessary to produce desired results, saving money and reducing pollutants. Two big applications are in petroleum refining and in automotive catalytic converters.
- Nano-engineered materials make superior household products such as degreasers and stain removers; environmental sensors, air purifiers, and filters; antibacterial cleansers; and specialised paints and sealing products, such as self-cleaning house paints that resist dirt and marks.
- Nanoscale materials are also being incorporated into a variety of personal care products to improve performance. Nanoscale titanium dioxide and zinc oxide have been used for years in sunscreen to provide protection from the sun while appearing invisible on the skin.



2. Electronics and IT Applications - Nanotechnology has greatly contributed to major advances in computing and electronics, leading to faster, smaller, and more portable systems that can manage and store larger and larger amounts of information. These continuously evolving applications include:

- Transistors, the basic switches that enable all modern computing, have gotten smaller and smaller through nanotechnology. At the turn of the century, a typical transistor was 130 to 250 nanometers in size. In 2014, Intel created a 14 nanometer transistor, then IBM created the first seven nanometer transistor in 2015, and then Lawrence Berkeley National Lab demonstrated a one nanometer transistor in 2016! Smaller, faster, and better transistors may mean that soon your computer's entire memory may be stored on a single tiny chip.
- Using magnetic random access memory (MRAM), computers will be able to "boot" almost instantly. MRAM is enabled by nanometer-scale magnetic tunnel junctions and can quickly and effectively save data during a system shutdown or enable resume-play features.
- Ultra-high definition displays and televisions are now being sold that use quantum dots to produce more vibrant colors while being more energy efficient.
- Flexible, bendable, foldable, rollable, and stretchable electronics are reaching into various sectors and are being integrated into a variety of products, including wearables, medical applications, aerospace applications, and the Internet of Things. Flexible electronics have been developed using, for example, semiconductor nanomembranes for applications in smartphone and e-reader displays. Other nanomaterials like graphene and cellulosic nanomaterials are being used for various types of flexible electronics to enable wearable and "tattoo" sensors, photovoltaics that can be sewn onto clothing, and electronic paper that can be rolled up. Making flat, flexible, lightweight, non-brittle, highly efficient electronics opens the door to countless smart products.
- Other computing and electronic products include Flash memory chips for smart phones and thumb drives; ultra-responsive hearing aids; antimicrobial/antibacterial coatings on keyboards and cell phone casings; conductive inks for printed electronics for RFID/smart cards/smart packaging; and flexible displays for e-book readers.
- Nanoparticle copper suspensions have been developed as a safer, cheaper, and more reliable alternative to lead-based solder and other hazardous materials commonly used to fuse electronics in the assembly process.

3. **Medical and Healthcare Applications** - Nanotechnology is already broadening the medical tools, knowledge, and therapies currently available to clinicians. Nanomedicine, the application of nanotechnology in medicine, draws on the natural scale of biological phenomena to produce precise solutions for disease prevention, diagnosis, and treatment. Below are some examples of recent advances in this area:

- Commercial applications have adapted gold nanoparticles as probes for the detection of targeted sequences of nucleic acids, and gold nanoparticles are also being clinically investigated as potential treatments for cancer and other diseases.
- Better imaging and diagnostic tools enabled by nanotechnology are paving the way for earlier diagnosis, more individualised treatment options, and better therapeutic success rates.
- Nanotechnology is being studied for both the diagnosis and treatment of atherosclerosis, or the buildup of plaque in arteries. In one technique, researchers created a nanoparticle that mimics the body's "good" cholesterol, known as HDL (high-density lipoprotein), which helps to shrink plaque.
- The design and engineering of advanced solid-state nanopore materials could allow for the development of novel gene sequencing technologies that enable single-molecule detection at low cost and high speed with minimal sample preparation and instrumentation.
- Nanotechnology researchers are working on a number of different therapeutics where a nanoparticle can encapsulate or otherwise help to deliver medication directly to cancer cells and minimise the risk of damage to healthy tissue. This has the potential to change the way doctors treat cancer and dramatically reduce the toxic effects of chemotherapy.
- Research in the use of nanotechnology for regenerative medicine spans several application areas, including bone and neural tissue engineering. For instance, novel materials can be engineered to mimic the crystal mineral structure of human bone or used as a restorative resin for dental applications. Researchers are looking for ways to grow complex tissues with the goal of one day growing human organs for transplant. Researchers are also studying ways to use graphene nanoribbons to help repair spinal cord injuries; preliminary research shows that neurons grow well on the conductive graphene surface.
- Nanomedicine researchers are looking at ways that nanotechnology can improve vaccines, including vaccine delivery without the use of needles. Researchers also are working to create a universal vaccine scaffold for the annual flu vaccine that would cover more strains and require fewer resources to develop each year.

4. Energy Applications - Nanotechnology is finding application in traditional energy sources and is greatly enhancing alternative energy approaches to help meet the world's increasing energy demands. Many scientists are looking into ways to develop clean, affordable, and renewable energy sources, along with means to reduce energy consumption and lessen toxicity burdens on the environment:

- Nanotechnology is improving the efficiency of fuel production from raw petroleum materials through better catalysis. It is also enabling reduced fuel consumption in vehicles and power plants through higher-efficiency combustion and decreased friction.
- Nanotechnology is also being applied to oil and gas extraction through, for example, the use of nanotechnology-enabled gas lift valves in offshore operations or the use of nanoparticles to detect microscopic down-well oil pipeline fractures.
- Researchers are investigating carbon nanotube "scrubbers" and membranes to separate carbon dioxide from power plant exhaust.
- Researchers are developing wires containing carbon nanotubes that will have much lower resistance than the high-tension wires currently used in the electric grid, thus reducing transmission power loss.
- Nanotechnology can be incorporated into solar panels to convert sunlight to electricity more efficiently, promising inexpensive solar power in the future. Nanostructured solar cells could be cheaper to manufacture and easier to install, since they can use print-like manufacturing processes and can be made in flexible rolls rather than discrete panels. Newer research suggests that future solar converters might even be "paintable."
- Nanotechnology is already being used to develop many new kinds of batteries that are quicker-charging, more efficient, lighter in weight, have a higher power density and hold electrical charge longer.
- An epoxy containing carbon nanotubes is being used to make windmill blades that are longer, stronger, and lighter-weight than other blades to increase the amount of electricity that windmills can generate.
- In the area of energy harvesting, researchers are developing thin-film solar electric panels that can be fitted onto computer cases and flexible piezoelectric nanowires are woven into clothing to generate usable energy on the go from light, friction, and/or body heat to power mobile electronic devices. Similarly, various nanoscience-based options are being pursued to convert waste heat in computers, automobiles, homes, power plants, etc., to usable electrical power.
- Energy efficiency and energy saving products are increasing in number and types of application. In addition to those noted above, nanotechnology is enabling more efficient lighting systems; lighter and stronger vehicle chassis materials for the transportation sector; lower energy consumption in advanced electronics; and light-responsive smart coatings for glass.

5. Environmental Remediation - In addition to the ways that nanotechnology can help improve energy efficiency (see the section above), there are also many ways that it can help detect and clean up environmental contaminants:

- Nanotechnology could help meet the need for affordable, clean drinking water through rapid, low-cost detection and treatment of impurities in water.
- Engineers have developed a thin film membrane with nanopores for energy-efficient desalination. This molybdenum disulphide (MoS2) membrane filtered two to five times more water than current conventional filters.
- Nanoparticles are being developed to clean industrial water pollutants in ground- water through chemical reactions that render the pollutants harmless. This process would cost less than methods that require pumping the water out of the ground for treatment.
- Researchers have developed a nanofabric "paper towel" woven from tiny wires of potassium manganese oxide that can absorb 20 times its weight in oil for cleanup applications. Researchers have also placed magnetic water-repellent nanoparticles in oil spills and used magnets to mechanically remove the oil from the water.
- Many aeroplane cabins and other types of air filters are nanotechnology-based filters that allow “mechanical filtration,” in which the fiber material creates nanoscale pores that trap particles larger than the size of the pores. The filters also may contain charcoal layers that remove odors.
- Nanotechnology-enabled sensors and solutions are now able to detect and identify chemical or biological agents in the air and soil with much higher sensitivity than ever before. Researchers are investigating particles such as self-assembled monolayers on mesoporous supports (SAMMS™), dendrimers, and carbon nanotubes to determine how to apply their unique chemical and physical properties for various kinds of toxic site remediation. Another sensor has been developed by NASA as a smartphone extension that firefighters can use to monitor air quality around fires.

6. **Future Transportation Benefits** - Nanotechnology offers the promise of developing multifunctional materials that will contribute to building and maintaining lighter, safer, smarter, and more efficient vehicles, aircraft, spacecraft, and ships. In addition, nanotechnology offers various means to improve the transportation infrastructure:

- As discussed above, nano-engineered materials in automotive products include polymer nanocomposites structural parts; high-power rechargeable battery systems; thermoelectric materials for temperature control; lower rolling-resistance tires; high-efficiency/low-cost sensors and electronics; thin-film smart solar panels; and fuel additives and improved catalytic converters for cleaner exhaust and extended range. Nano-engineering of aluminium, steel, asphalt, concrete and other cementitious materials, and their recycled forms offers great promise in terms of improving the performance, resiliency, and longevity of highway and transportation infrastructure components while reducing their life cycle cost. New systems may incorporate innovative capabilities into traditional infrastructure materials, such as self-repairing structures or the ability to generate or transmit energy.
- Nanoscale sensors and devices may provide cost-effective continuous monitoring of the structural integrity and performance of bridges, tunnels, rails, parking structures, and pavements over time. Nanoscale sensors, communications devices, and other innovations enabled by nanoelectronics can also support an enhanced transportation infrastructure that can communicate with vehicle-based systems to help drivers maintain lane position, avoid collisions, adjust travel routes to avoid congestion, and improve drivers' interfaces to onboard electronics.
- "Game-changing" benefits from the use of nanotechnology-enabled lightweight, high-strength materials that would apply to almost any transportation vehicle. For example, it has been estimated that reducing the weight of a commercial jet aircraft by 20 per cent could reduce its fuel consumption by as much as 15 per cent. A preliminary analysis performed for NASA has indicated that the development and use of advanced nanomaterials with twice the strength of conventional composites would reduce the gross weight of a launch vehicle by as much as 63 percent. Not only could this save a significant amount of energy needed to launch spacecraft into orbit, but it would also enable the development of single-stage to orbit launch vehicles, further reducing launch costs, increasing mission reliability, and opening the door to alternative propulsion concepts.

NANOTECHNOLOGY IN THE FUTURE

According to scientists, nanotechnology is predicted to have four distinct generations of advancement. Currently we are experiencing the first, or maybe the second generation of nanomaterials.

The first generation is all about material science with an enhancement of properties that are achieved by incorporating "passive nanostructures". This can be in the form of coatings and/or the use of carbon nanotubes to strengthen plastics.

The second generation makes use of active nanostructures, for example, by being bioactive to provide a drug to a specific target cell or organ. This could be done by coating the nanoparticle with specific proteins.

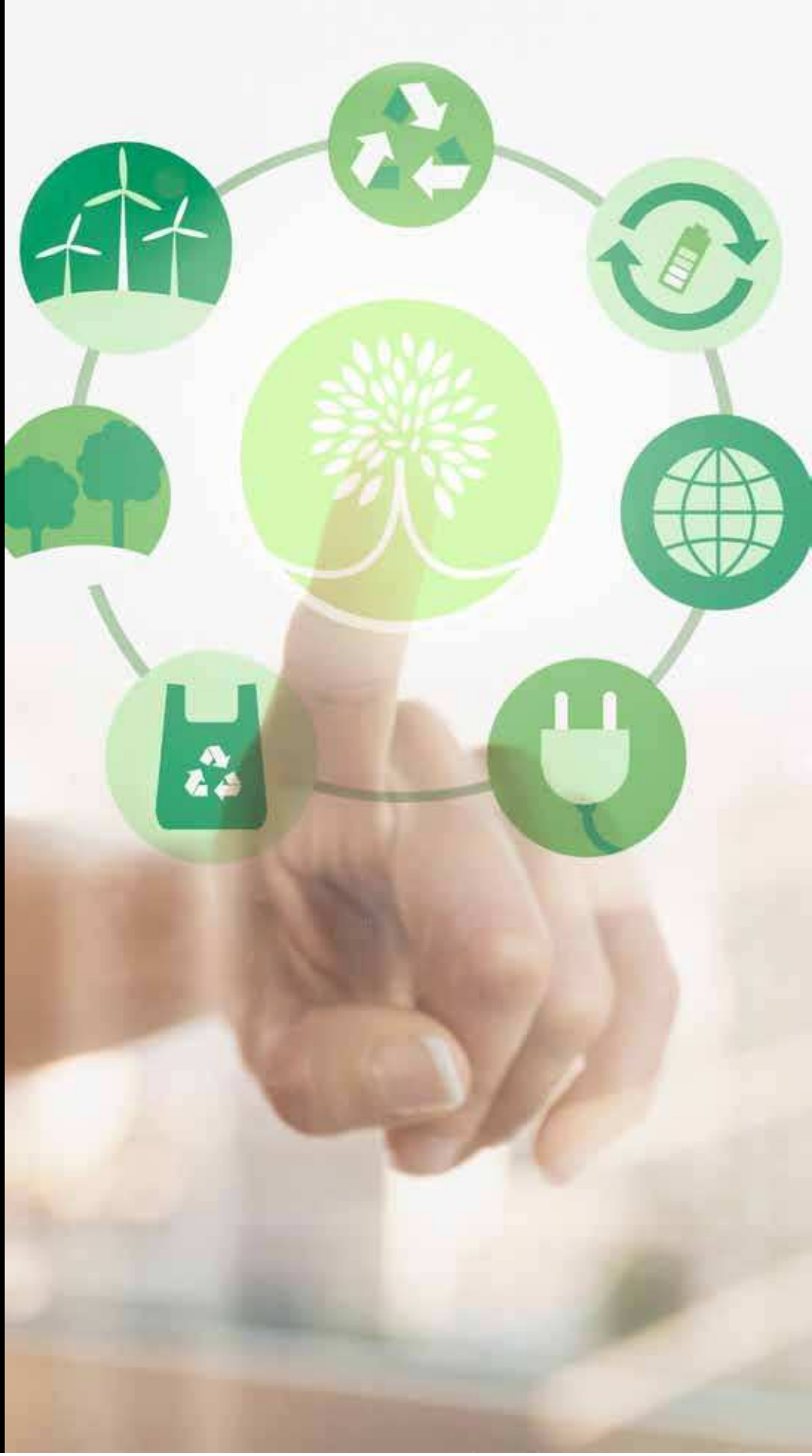
The complexity advances further in the third and fourth generations. Starting with an advanced nanosystem for example. nanorobotics and moving on to a molecular nanosystem to the control growth of artificial organs in the fourth generation of nanomaterials.

There are bright and dark spots in the future of nanotechnology. On the one hand, the sector is expected to grow globally, driven by technological advances, increased government support, increased private investment and growing demand for smaller devices, to name a few. However, the environmental, health and safety risks of nanotechnology and concerns related to its commercialisation could hamper market expansion.

The United States, Brazil and Germany will lead the nanotechnology industry in 2024, with an important presence in the Top 15 Asian countries such as Japan, China, South Korea, India, Taiwan and Malaysia. The cosmetics sector will climb positions stealing third place from the biomedical sector in a ranking that will be led by electronics and energy, as it is now.

INSPIRES

Ideas to inspire



SUSTAINABILITY

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Sustainability

In recent years among the environmental community, a parallel vision of the future has emerged. Almost everyone, from CEOs of progressively minded companies to activists on the street, is talking about building a more sustainable future.

Companies which develop stellar sustainability practices now will be more resilient in the future. They will be more attractive to consumers, recruits, and investors - which will directly affect their bottom-line. The new legislation will also be less likely to impact sustainable businesses, along with Internet activism and protests. Therefore, today's sustainable businesses are likely to become tomorrow's industry leaders. Indeed, failing to address global issues such as climate change and slavery may ultimately be to a business' detriment. All companies have an opportunity to make some significant sustainable changes in their organisation. To create a better future - for all.

Sustainability trends - present day and in the coming decades

1. Sustainable Products Would Become the Norm

At present, sustainable products are one of the top sustainability trends. Sustainable products can be expected to become mandatory among consumers in the coming days. The current generation is aware of climate change, loss of biodiversity, and the responsibility they must try and fix these issues. Research suggests that 54% of these young adults think a company's environmental and social efforts are extremely important when considering whether to purchase a service or a product.These youth are gaining more purchasing power as they join the workforce, so all organisations need to take the environmental and sustainability seriously if they want to attract customers.

The types of consumer products that are expected to become sustainable are food, fashion, and lifestyle products:

Food - Food production is currently responsible for 26% of greenhouse gases and has a major part to play in habitat destruction and freshwater consumption. Consumers are more aware of these facts and thus the growth of veganism and plant-based diets. Consumption of plant-based meat and dairy substitutes rose during the pandemic. Research shows , sales of meat alternatives were up 140% in the US. Unilever expects to increase its plant-based meat and dairy alternatives sales to €1bn in the coming five to seven years. Meanwhile, sustainable grocery delivery services which sell products that would ordinarily be discarded, are gaining popularity.

Fashion - Fashion brands must get sustainable – or risk losing out on consumers. Research from BCG found that 38% of consumers switched from their preferred clothing brand to a different one that has better environmental and social practices.

Lifestyle - Lifestyle changes like switching to electric vehicles, demanding sustainable packaging and digitalization is expected to rise among consumers in the coming years.

- Organisations producing packaged products should work on reducing plastic packaging or work on the transition to more sustainable packaging methods like plant-based compostable and biodegradable packaging.

- All fashion brands must start using sustainable materials, making their supply chains transparent and ethical, and creating circular fashion systems through designing, producing, and selling products that reuse and recycle post-consumer textiles.

Organisations must monitor the emissions, energy and water use, and waste amounts so they can start working to reduce them.

2. ESG Investments Would Continue to Rise

ESG (Environmental, Social and Governance) is a form of investing with the environment and social good as its guiding principles. ESG has become one of the popular sustainability trends to get involved in since the onset of the pandemic. Investors and organisations have realised the importance of non-financial considerations and are looking beyond profits in such challenging times.

ESG might be an intimidating arena for some. They should refer to the guides from GRESB and CNBC to get started.

3. Renewable Energy Might Become Increasingly Cheaper

Although fossil fuels used to be cheaper than renewable energy, it is quickly changing as Wind and solar plants became 70% and 89% cheaper in the past decades. Their capacity would exceed coal and gas in less than a decade, according to the IEA's Renewables 2020. Solar power is now cheaper than coal.

Renewable energy would continue to get cheaper because renewable technology costs get cheaper as the capacity increases. When countries like the U.S. deploy renewables, they lower the costs for everyone and make the technology accessible to the entire world.

Green energy procurement should be researched by organisations to decide if it could be a good fit for the company at present or in the future.

4. Remote Working is here to stay

One of the more unconventional sustainability trends is working from home which is surprisingly effective. With the outbreak of COVID-19, Work-from-home took off as a necessity but it turned out that working remotely is very good for the environment. The number of cars on the road and energy used by office buildings is much reduced in this setup, thus reducing overall greenhouse gas emissions and fossil fuel consumption. Major companies like Twitter, Shopify, and other tech companies have already committed to their staff working from home full time even when lockdowns lift and situations normalise. This means widespread benefits to the environment generally from less consumption.

If possible, organisations should leave the option open for the employees to work from home as part-time or full-time. If employees need to work in person, public transportation vouchers might be provided to help limit the number of cars on the road.

5. Carbon Offsetting Will Go Mainstream

Carbon offsetting means making up for the emission of CO2 or other greenhouse gases into the atmosphere. A carbon offset occurs when an organisation funds carbon-offset projects that remove greenhouse gases from the atmosphere or prevent some greenhouse gases from being released. Carbon offsetting can be planting trees or more complicated carbon capture technology. Carbon offsetting is already common in sustainability circles, but with the rise in popularity of net zero emissions, it is expected in the coming days that carbon offsetting would go mainstream and public. Offsets are often seen as greenwashing, but this would likely change as more credible options are becoming available, contributing to high-quality offset projects.

The different types of carbon offsets available should be explored and business owners should try to understand which ones would work best for the company. Excessive offsetting should be avoided to ensure that the actions are not just greenwashing but providing meaningful action and true environmental responsibility.

6. Climate Positive Is the Next Big Thing

If a company is already embarked on the carbon offset journey and committed to net zero, it might be expected that things would go to the next level in the coming years. The net zero emissions initiative is currently booming but it is expected to soon be superseded by climate positivity, whereby a company's activities are actually creating an environmental benefit by removing additional carbon dioxide from the atmosphere.

If your company is already working towards a net zero target, leaders and decision makers can begin to assess climate-positive actions. Climate-positive actions include tree planting, carbon capture and sequestration, investing in regenerative agriculture (which helps reverse climate change by restoring soil organic matter and biodiversity) and more.

7. Companies have to Disclose Climate Risks to the Public

It is expected that many states and cities would require buildings and organisations to report on their emissions and energy use. This will lead to big changes for any organisation in terms of share prices, financing options, the willingness of investors to invest, etc.

Before one can begin reporting on emissions and energy use, he must be able to measure Energy and sustainability management software like WatchWire from EnergyWatch which can help him gather and organise the necessary data. The different platforms on the market can be considered and get set up with one – it would give him an edge and he would be ready when reporting requirements are inevitably passed.

8. Clean Air Will Become a Higher Priority

The importance of air quality came into stark focus during the pandemic when clear non-polluted skies were seen. In addition, with a respiratory disease like coronavirus still a major threat to the entire global population at large, clean air is vital for health and wellness. Improvement in air quality is expected to be a big issue in the coming days.

With energy and sustainability management software, one can manage what cannot be measured, and that includes the building(s) emissions. Energy and sustainability management software should be used to determine how much greenhouse gas emissions an organisation is producing. An efficiency project should be created to reduce that amount. This should be verified to check the effectiveness If a company uses vehicle fleets for operations, they might consider switching to hybrid or electric in order to reduce the overall emissions.

9. Organisations Will Face Consequences for Insufficient Climate Action

We have seen how poor social and environmental performance caused the CEO of the world's largest mining company to resign, the stock of three chemical giants plummeted; and corporations were called to the carpet for poor emissions offset programs. All these show that climate action is no joke among the public, and the stakes are only going to get higher.

When an organisation announces new sustainability and climate plans, it should be expected that all claims will be carefully inspected by shareholders and the public. All plans should be carefully vetted and data to be double checked. Emissions spanning the entire value chain should be addressed as being transparent is the best thing that one can do.

One important thing to avoid is "greenwashing," i.e., touting the organisation's actions or products as being more sustainable than they actually are. The investors and customers are smart, and they would figure out the truth in due course of time.

10. Electric Utilities Will Face Increasing Pressures to Re-invent Themselves

Heat waves have tested grid reliability. Thus Resilience is top of mind for utilities right now. Utilities exploring new business models that use microgrids, smart grid technology, distributed energy resources (DERs), and energy storage to build stronger and more intelligent services can be expected.

If one works for a utility, the best thing to do is invest in a customer engagement platform. An Energy and Sustainability customer engagement portal enables customer value and visibility for a business leader to identify the correct programs for his clients. Controlling costs and reducing usage and carbon are key goals that the clients are trying to meet. A customer engagement platform, like WatchWire from EnergyWatch, allows commercial and industrial users to turn their utility data into actionable insights both in and out of the territory.

Collaborations between scientists and engineers on the one hand and social scientists on the other are of course needed to translate environmental and technical challenges into societal challenges and action. In such collaborative efforts, it needs to be recognized that technological change entails phases such as concept development, pilot and demonstration projects, market formation and diffusion of technology, but also with important iterations among all of these phases. It should be considered how bridges between different technical and social science disciplines can be built, in order to gain a more in-depth understanding of how technology-specific engineering inventions can be commercialised in various institutional contexts. Transition studies, innovation and environmental economics, as well as the innovation system and the innovation management literature could help provide such bridges.

The green economy transition should also benefit from research that involves various impact evaluations - digitalization and automation, globalisation versus nationalisation, etc., on environmental and distributional outcomes but also on the prospects for green innovation collaborations and various circular economy-inspired business models. Such evaluations could be particularly relevant for understanding possible future pathways for the greening – and de-carbonization – of key process industries.

VIRTUAL REALITY – THE ROAD AHEAD

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Virtual Reality - The road ahead

Virtual Reality (VR) is a computer-generated environment with scenes and objects that appear to be real, making the user using the Virtual Reality headset feel they are immersed in their surroundings. Unlike Augmented Reality, It is fully immersive and everything the user sees is part of an environment artificially constructed through images, sounds, etc.

Main applications of Virtual Reality

Medicine, culture, education and architecture are some of the areas that have already taken advantage of this technology. From guided museum visits to the dissection of a muscle, Virtual Reality allows people to cross boundaries that would otherwise be unimaginable.

Virtual Reality in education and training

Virtual Reality is already making great inroads into education, with a large number of ***business startups*** and established companies offering packaged experiences and services aimed at schools. A study published in 2019 found that medical students trained using VR were able to carry out certain procedures quicker and more accurately than peers trained using traditional methods.

These new methods of teaching and learning would become increasingly effective as new technologies emerge. Teslasuit is one remarkable product, which uses a full-body suit to offer haptic feedback, enhancing the immersion through the sense of touch. It also offers an array of biometric sensors enabling the user's heartbeat, perspiration, and other stress indicators to be measured. The suit is already used in NASA astronaut training, but the potential uses that it promises are unlimited.

For training, Virtual Reality could be used to safely simulate any number of hazardous or stressful conditions and monitor the way people respond to them. Virtual Reality can also be used as a training tool to deal with dangerous situations. It would drastically reduce the financial risks involved with letting students and inexperienced recruits loose with expensive tools and machinery in any industry.

Virtual Reality in industry and work

The COVID -19 pandemic has changed many things about the way people work, including the wholesale shift to home working for large numbers of employees. This brings challenges, including the need to retain an environment that fosters cooperative activity and the building of company culture. Solutions involving Virtual Reality are quickly emerging to help tackle these.

Spatial, which creates a tool best described as a VR version of Zoom, reported a 1,000% increase in the use of its platform since March 2020. In total, the value of the market for VR business equipment is forecast to grow from $829 million in 2018 to $4.26 billion by 2023, according to research conducted by ARtillery Intelligence.

Communication giant Ericsson, which had provided Oculus VR headsets to employees working from home during the pandemic for VR meetings, has talked about creating the "Internet of Senses." This involves developing projects involving simulating touch, taste and smell, and sensations such as hot or cold. They predict that by 2030, people would be able to enter digital environments that appear completely real to all of the five senses simultaneously.

This would lead to the advent of what it calls the “dematerialized office” – where the office would effectively vanish from our lives as we would be able to create entirely interactive and collaborative working environments wherever we are in the world, simply by slipping on a headset and whatever other devices are needed for the task at hand.

Virtual Reality in socialising

There are a number of VR-based social platforms that allow friends or strangers to meet up and chat or play in virtual environments, such as VR Chat, AltspaceVR, and Rec Room. As with VR in other fields, the growing level of immersion that is possible due to new technological developments would make them more useful and more attractive to mainstream audiences throughout the coming decades.

Facebook, which has long had a stake in VR due to its acquisition of headset manufacturer Oculus, unveiled its Horizon World platform. It allows people to build and share collaborative online worlds where they can hang out, play games, or work together on collaborative projects.

The social lives of people are becoming increasingly remote. More of the social interaction would gradually move into the online realm, too with the increasingly busy daily life of people. People would have more meaningful ways to connect with other humans as technology improves in this area.

Virtual Reality in games and entertainment

The major impact that Virtual Reality has on gaming.The reason the technology is developing at the pace it is today is due to the large market of people willing to spend money on the most impressive and immersive entertainment experiences.

There could be two markets for consuming VR entertainment – at least in its early days. While the most immersive and impressive tech is big, expensive, and requires technical skill to operate, it is more viable to offer it at dedicated venues rather than as an in-home experience. As with movies, the stay-at-home offerings would provide something perhaps a little less spectacular but more convenient.

The Future of Virtual Reality

Over the next few years, Virtual Reality is going to see a huge transformation. The effects of this transformation would be far broader, touching on overall work, education, and social lives.

Today's most popular VR applications involve taking total control of a user's senses (sight and hearing) to create a totally immersive experience that places the user in a fully virtual environment that feels absolutely realistic. Very soon, VR creators would extend this sensory hijacking to other faculties – for example, touch and smell – to deepen that sense of immersion. At the same time, the devices that are used to visit these virtual worlds would become cheaper and lighter, removing the friction that can currently be a barrier.

Virtual Reality is one of the technologies with the highest projected potential for growth. The market is demanding applications that go beyond leisure, tourism or marketing and are more affordable for users. Virtual interfaces also need to be improved to avoid defects such as clipping, which makes certain solid objects appear as though they can be passed through. Efforts are to be given to work in areas to minimise the effects that VR produces in people. For example, motion sickness, which consists of a dizziness induced by the mismatch between the movement of our body and what is being seen in the virtual world needs to be worked upon.

The big technology companies are already working to develop headsets that do not need cables and that allow images to be seen in HD. They are developing Virtual Reality headsets in 8K and with much more powerful processors. It is being worked upon so that in the next few years Virtual Reality could integrate Artificial Intelligence. The latest 5G standard can also provide very interesting scenarios for the evolution of Virtual Reality. This standard will allow more devices and large user communities to be connected. In addition, it's almost imperceptible latency would make it possible for consumers to receive images in real time, almost as if they were seeing them with their own eyes.

Virtual Reality is no longer a fantasy limited to science fiction. It is integrated into the present world and, in the coming years, it will lead to advances that will shape a new future.

What lies ahead - Virtual Reality in the coming few decades

Researchers predict that extended reality (XR) – a term that covers virtual reality (VR), augmented reality (AR), and mixed reality (MR) – would be one of the most transformative tech trends in the coming few years. It would be enabled and augmented by other tech trends, including super-fast networking, that would let us experience VR as a cloud service just like currently music and movies are consumed . Artificial intelligence (AI) would provide us with more personalised virtual worlds to explore, even giving us realistic virtual characters to share our experiences with.

Virtual Reality (VR) is set to see significant growth in the next ten years, with researchers estimating it will become a $51 billion (€44bn) industry by 2030. The VR market remains heavily oriented around gaming, but VR is gaining traction in areas such as social media and live streaming. It is expected of enterprise to become the key market for VR over the next three years, outpacing the consumer segment. VR is already in use across the retail, defence, airlines, oil and gas, and healthcare industries – primarily for training purposes. However, the Covid-19 pandemic triggered a shift to remote working that has boosted the adoption of VR by enterprises not just for training, but for collaboration, data visualisation and customer experience.

Smartphones, coupled with headsets, have been the most common use of delivering a Virtual Reality experience for a few years now. This has been the most accessible entry-point for consumer VR use. Virtual reality is a lot more mature than the existing augmented reality market. The required software tools and hardware platforms to create an immersive VR experience are already available. With the availability of more advanced systems such as the Oculus Rift, coupled with 360 cameras, virtual reality experiences are quickly finding new avenues into our lives.

The Future of Virtual Reality: Business Opportunities

The future of VR is looking pretty good. Virtual Reality has the potential to disrupt a number of industries as many companies are looking for innovative ways to increase their productivity while improving their processes and maintaining their company culture intact, and as remoteness gains traction, VR's chances of helping achieve these goals become more of a reality.

Like many other technologies, the future of VR depends strongly on how both the hardware and software evolve. However, this is no impediment to imagine what the future of VR may look like. Speculating about the future is a great way to develop new products, and most importantly, it can help companies be prepared to embrace what the future holds.

There are many ways in which the future of VR seems promising. Although it often feels like an overstatement, this technology would definitely rewrite the rules for many industries. Just as Machine Learning and Artificial Intelligence are pushing digital transformations forward, so will also Virtual Reality.

One of the secrets of building a powerful VR product is to work with someone who has the right vision and skills to succeed in the market. ***Business consultants*** can help businesses stand out in highly competitive markets. They can help to either understand the future of the business and the role VR plays, or guide to develop a powerful and state of the art VR product.