TECHNIUM – THE SEVENTH KINGDOM

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Certificate of Originality

The work embodied in this report entitled **"Technium – The Seventh Kingdom"** has been carried out by **Akshit Jain, Bhavya Tewari, Bhavya Verma, Gaurav Dubey, Shivam Goyal, Yashu Garg** for the paper "**Science, Philosophy, Truth: Impact of technology**". We declare that the work and language included in this project report is free from any kind of plagiarism.

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1. Abstract

‘**Technium**’ is a term coined by futurist and author **Kevin Kelly**. Technium refers to everything which humans have thought of and produced over time.

Apart from the six fundamental kingdoms of nature, Technium - The Kingdom of Technology has silently emerged to the point where it has gained enough potential to overpower and topple the currently dominating kingdoms.

The objective of the project would be to study and analyze the evolution of Technology over the past few decades.

We aim to learn about the concept of “Technium”, explained by the futurist. Henceforth, we will discover the similarities and differences of this seventh kingdom from the rest and try to predict the future prospects of this study.

2. Introduction

We divide the world into the natural and the artificial — that which grows and that which is made. There exist six biological kingdoms: three kingdoms of microorganisms namely, Eubacteria, Archaebacteria, Protista and the other three being Plantae, Animalia and Fungi.

Now, we know that the six kingdoms of biology are co-evolving. They compete and collaborate for the resources available on Earth and they keep expanding through reproduction. Within each of these six categories, or kingdoms of life, all species share a common biochemical blueprint. Three of these kingdoms are the tiny microscopic stuff: one-celled organisms. The other three are the biological kingdoms of organisms we normally see: fungi (mushrooms and molds), plants, and animals. (Kelly, 2010)

Humans form part of the kingdom of animals. Through our years of expanse, we've given rise to a seventh kingdom called the 'Technium'.

Early humans had a relationship of wonder with their universe, especially with those phenomena they could not rationally understand. To solve these mysteries, they created a vast pantheon of gods and goddesses to explain anything that was beyond their understanding—thunder, tides, earthquakes, volcanoes, infertility, plagues, etc.

Figure 1: Futurist and Author, Kevin Kelly

'Technium' is a term coined by futurist and author Kevin Kelly. Technium refers to every idea that humans have come up with and produced. So it involves everything from the alphabet to religions, from hammers to rockets and the modern day democracy. With the current rate at which Technium is expanding

its roots, speculations have arisen of a new order taking its place. This would further expand into a novel non-living species.

These lifeless species evolved almost exactly as if they were living—becoming gradually more complex, adapting to and propagating in new environments, testing new variations, some surviving, others going extinct. A perfect mirror of Darwinian adaptive change, these new organisms had developed at a blinding rate and now made up an entirely new kingdom—the Seventh Kingdom—which took its place beside Animalia and the others.

The extended human is the Technium. Marshall McLuhan, among others, noted that clothes are people's extended skin, wheels extended feet, camera and telescopes extended eyes. Our technological creations are great extrapolations of the bodies that our genes build. In this way, we can think of technology as our extended body.

If technology is an extension of humans, it is not an extension of our genes but of our minds. Technology is therefore the extended body for ideas.

The future is, factually speaking, uncertain. We don’t know if we’ll find a cure for cancer, the economic outlook, if we’ll be living in an algorithmic world or if our work cubical mate will soon be replaced by a robot. While futurists can dish out some exciting and downright scary visions for the future of technology and science, there are no future facts. However, the uncertainty presents opportunity.

3. Role of Technology in Civilizations

The world we live in has been shaped in various aspects by human actions. Using technology, we have created tools and methods to prevent, eliminate, or lessen threats to life and the environment and to fulfil social needs. Since the dawn of the first civilizations, settlements and empires, each society has come up with some form of technology or invention to help improve society. Ancient civilizations from the beginning of civilization, the classical period, and the post-classical period have introduced several new concepts, techniques, ideas and inventions that people still use today. Initial technological advancements and inventions influenced trade and growth through an interaction between people and their culture.

3.1.Technology during the Stone Age

Even to the people of Stone Age, technology was an important matter. The Stone Age lasted from about 200,000 years ago to about 6,000 years ago. Over that period there were important changes and great inventions. Civilizations had very little back then.

Methods of clothing and providing shelter were unknown. Tools and equipment for dealing with situations that might arise in hunting, for example, were no better than odd bits of stones that were picked up off the ground. Then, over the millennia, people discovered that one could make better tools, not just by picking up stones in their natural state, but by shaping them as per their requirements.

Two independent methods of shaping were discovered. In one technique people took stones and chopped bits off until the required shape was left. The other technique was to take larger stones and to make tools out of the chippings left after employing the first technique. The tools came useful in hunting for food, carving leaves into clothes, making other equipment and several other daily purposes.

Figure 2: Tools made from Stone

3.2.Information technology and the growth of Civilizations

The ability to store and process information was crucial to the growth of ancient societies. Ancient civilizations faced information bottleneck when they reached a certain population and size, a point also known as the scale threshold. Without innovations like writing, printing or a system of currency and transactions, further expansion became difficult. However, once advances in information processing and storage were achieved, cultures and empires started to grow. (University, 2020)

Very few civilizations in the ancient America were able to cross the scale threshold. Hence, there was less pressure to develop writing and other forms of information processing and storage in the America that spurred further technological development in Europe and Asia.

Figure 3: Information storage in ancient times and Manuscripts

3.3. Improvement in Agriculture

Agriculture is still considered the most crucial economic activity as food is the basis of human survival. Ancient agricultural practices have seen a radical improvement with the mechanization of agriculture. Various methods involving manual and animal labor were modified using simple equipment to reduce the effort needed. This resulted in more automated, efficient farm practices to produce far more abundant food resources for the growing population. These days much of the farming processes are carried out through automated machines and even robots.

Figure 4: Ploughing with a yoke of horned cattle

3.4. Transportation

Around 1300 BC, the Sumerians invented sailboat which is still widely used today. Early civilizations used sailboats for various reasons, such as locomotion, transport goods through trade, and an efficient way to gather fish. Hence, the Sumerians developed new ways of life and strategies to help improve their civilization.

With the civilization being located next to two important rivers (the Tigris and Euphrates), the sailboat was immensely helpful to their lives. Even today, with new modifications in design, technology and other improvements, the sailboat plays a crucial role in the worldwide transportation of people, necessities and ideas.

3.5. Use of Technology to improve weapons

Before 904 AD when the Chinese began using gunpowder as a weapon, gunpowder was used for firework explosion during the Tang dynasty, but not for any other purpose. When Chinese scientists found out that gunpowder could be used a weapon, their methods of combat changed in their favor.

The Chinese army began using gunpowder by attaching it to their fiery arrows and spears. After that, they transformed the gunpowder into rockets by inserting stone balls into tubes made of bamboo and firing them out by igniting the gunpowder at the end of the tube. It is also believed that the Chinese used it to carry out controlled explosion in some areas to allow for the constructions of roads and canals. This enabled the Chinese empire to improve their infrastructure and continue to grow.

Knowledge of gunpowder eventually spread to other empires and no longer was a unique weapon in China. As the other empires learned how to use gunpowder for several reasons, scientists continuously studied and developed other chemical compositions to make it more powerful. Gunpowder and its use as a weapon shaped much of today's world, ranging from war and combat to mining and building.

Figure 5: Igniting gunpowder to fire a rocket

3.6. Construction Materials

Romans are credited with the invention and use of concrete. Different than today's concrete, Roman concrete was composed of various elements derived from the natural environment. They built numerous structures and buildings and some are even standing today, despite time and

environmental conditions, due to the strong and durable quality of concrete used. The use of a strong building material positively impacted Rome's success by enhancing the infrastructure.

For the preparation of Roman concrete, volcanic ash was used to make a mortar and mixed with volcanic rock fragments. Scientists found out that volcanic ash creates a unique chemical bond when mixed with other materials. The physical process of mixing the cement is identical to the known process of maxing cement.
It is quite remarkable how Roman concrete is unusually strong and durable compared to concrete prepared using modern chemical technology.

3.7. Medicines and Health Care

Ancient Egyptians (3000 -300 BC) believed that the gods heal disease, priests were trained to be physicians who believed that the body was a system of discrete channels (air, blood, tears, urine) that could be healed by leeches and bloodletting. Hippocrates (4th century BC) was considered the father of western medicine. Prior to Hippocrates health care was done by a witch doctor, evil spirits as the cause, life span was 20 years.

Aristotle, was known as the father of anatomy, carried out dissections of animals for study and believed that diet and hygiene were factors that could prevent diseases. Ancient Romans (753 BC – 410 AD) were the first to have an organized healthcare system by providing treatment to soldiers. They had developed a system of public health and sanitation (through aqueducts/sewers), and drained wetlands to reduce the spread of malaria.

During the Middle Ages (500 – 1500 AD) major diseases known to people were smallpox, diphtheria, tuberculosis, typhoid, malaria and the bubonic plague. Barbers performed medical processes like surgery, amputations and bloodletting. Regulation and licensing were introduced for male physicians, though most caregivers were religious practitioners. Life expectancy increased from 20-30 years in Dark ages to 35-40 years in the Middle ages. The Renaissance (1300 – 1600 AD), known as the Age of Enlightenment, saw the advancement of scientific practices and techniques. Microscope models were invented during this period and it led

to a greater insight in the study of human anatomy as composition of body tissues were now known precisely. (Lumen Learning, n.d.)

4. Evolution of Technology

The society has been drastically changed with the evolution of technology. Before the advent of modern technology, life was burdensome and everyday chores consumed too much of our time. Immense opportunities are being provided by technologies which play an important role in human life. The access to education, medicine, industry, transportation, has been simplified due to modern technology. Due to the convenience and efficiency provided by technology, our lives have improved significantly.

To understand how we left the dark ages (which really wasn't all that long ago) to where we are today, it is important to understand how technology evolves and why it matters. Technology is evolving by building new devices and methods from existing ones and in turn providing these as potential elements – building blocks – to create additional new devices and elements. The expansion of scientific research and understanding is strongly linked to technological development. In the last 50 years, there has been unparalleled innovation and technological development in virtually every area of human endeavour, from health and transportation to industrial production and education, thanks to exponential increases in computing capacity and microchip design and manufacture. (Nelson)

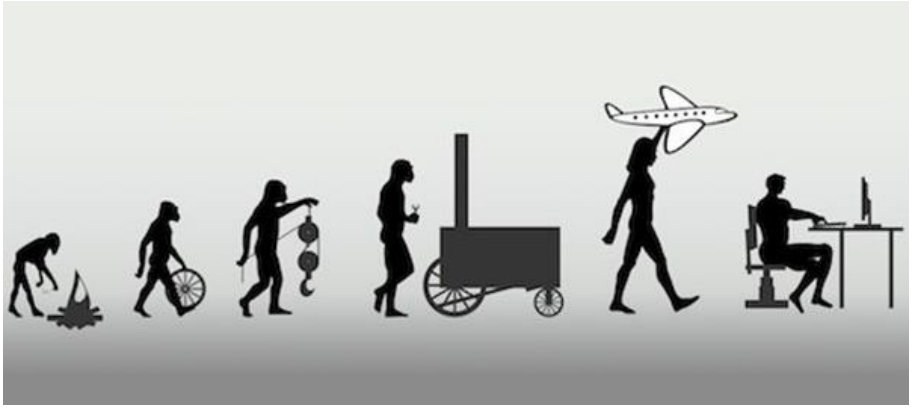

Figure 6: Evolution of Technology

4.1. Technology and the Darwinism Theory of Evolution

Several attempts have been made to develop a theory of evolution for computers in the years after Charles Darwin published his theory on the Origin of Species. The rationale given is that every given technology has several designers with different concepts, resulting in a large number of variations.

Any variants of all these variants are chosen for their superior performance and the minor differences are passed on to future designs. The gradual accumulation of such disparities gives rise to novel innovations, and the end result is referred to as a revolution.

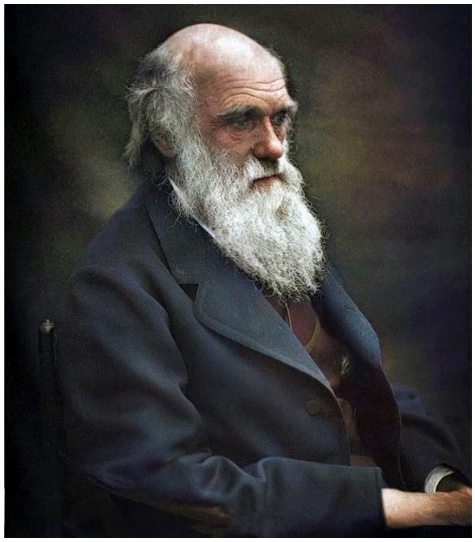

Figure 7: Charles Darwin

To begin, it is observed that all innovations serve a purpose; they all solve a problem. They can only do that by using what is already accessible in the world. To put it another way, they combine current operations, means, and methods - in other words, existing technologies - to complete the task.

As a result, new technologies are created by combining existing technologies. Although this is a step forward, it is not the end of the tale. Capturing and harnessing new phenomena may also result in the creation of novel technologies.

In a nutshell, technological evolution functions as follows: innovative technologies emerge from variations of existing ones, and these new technologies become potential components for the construction of new technologies. Some of these, in turn, become building blocks for the development of new technologies. The harnessing of novel phenomena, made possible by the convergence of existing technologies, is fuelling this. This mechanism, known as combinatorial evolution, has an intriguing consequence. Since new technologies emerge from old ones, we may argue that technology as a whole produces itself. Technology is autopoietic in systems terms. Of course, technology does not build itself from nothing. It creates itself through the agency of humans, just as a coral reef creates itself through the assistance of small organisms. (Coccia)

Autopoiesis tells us many things: that any technology stands atop a pyramid of ancestral ones that eventually made it possible, that all potential innovations will originate from those already in existence (though we don't know how), and that the importance of a novel technology lies not just in what it does, but also in what more technologies it will lead to. It also teaches us that the history of technology is an evolutionary tale of connected devices, processes, and phenomena capture, rather than a series of more-or-less separate discoveries.

To return to our original idea, a theory of evolution for technology can indeed be established. However, its core mechanism, in which objects create new things by combining themselves, varies somewhat from Darwin's. Biology is not devoid of combinatorial evolution. Certain primitive bacteria exchange and combine genes, and larger structures, such as the eukaryotic cell, appear sometimes as combinations of simpler structures. But, in biology, gradual change occurs through variation and selection laws, with combinations occurring but rarely. In the world of technology, the opposite is accurate. Darwinian variation and selection become active only after a technology has been developed. Combinatorial evolution rules supreme when it comes to the creation of new "species" of technology. (Devezas)

4.2. The Convergence of Technology

Technological convergence, also known as digital convergence, is the tendency for technologies that were originally unrelated to become more closely integrated and even unified as they develop and advance.

4.2.1. Elements of Technological Convergence

There are 5 elements of technological convergence, which are:

1. **Technology,** it is common for technologies that are viewed as very different to develop similar features with time that blur differences. In recent years, they may have similar features such as the ability to connect to Wi-Fi, play rich internet-based media and run apps.

2. **Media & Content,** a television and internet services were once viewed as separate but have begun to converge. It is likely that music, movies, video games and informational content will eventually converge to the point that they are no longer distinct formats.

3. **Services applications,** in the late 1990s, there was a large difference between business and consumer software and services. With time, this line has blurred. Technology tends to move from a large number of highly specific tools towards a small set of flexible tools with broad applications.

4. **Robots & Machines,** it is increasingly common for machines such as vehicles or appliances to have semi-autonomous features that technically make them robots.

5. V**irtual Reality/Augmented Reality,** can be viewed as the convergence of real life with digital entities such as simulations, games, and information environments.

4.3. Evolution of Technology throughout the History

Technology has advanced at an unprecedented rate over the years. New technology continues to play a critical role in all industries of the planet. To better understand where we are now, it is essential to first learn where it all began and how the journey has progressed to the fast-paced tech world of today.

- **3.3 million years ago: The first tools**

  The significance of technology begins even before the beginning of our own species. Sharp flakes of stone used as knives and larger unshaped stones used as hammers and anvils have been uncovered at Lake Turkana in Kenya that are believed to be made 3.3 million years ago.

- **1 million years ago: Fire**

  The humanity first used fire is still not definitively known but the evidence of burnt material can be found in many caves beginning about 1 million (and maybe even 1.5 million) years ago.

- **20,000 to 15,000 years ago: Neolithic Revolution**

  During the Neolithic Period several key technologies arose together. Humans moved from getting their food by foraging to getting it through agriculture. Clay was used for pottery and bricks. Clothing began to be made of woven fabrics.

- **4000 BCE: Sailing**

The first sailing ships were used on the Nile River. Since the Nile does not allow as much space for free sailing as the ocean, these ships also had oars for navigation.

- **1200 BCE: Iron**

  About this time, the production of iron became widespread as that metal supplanted bronze. Iron was much more abundant than copper and tin, the two metals that make up bronze, and thus put metal tools into more hands than ever before.

- **950: Windmill**

  Nearly 5,000 years after the first sailing ships, the wind was first used to operate a mill. The first windmills were in Persia. They were horizontal windmills in which the blades were set on a vertical shaft. Later, European windmills were of the vertical type. It has been speculated that the windmill may have been invented independently in Persia and in Europe.

- **1044: Compass**

  The first definitive mention of a magnetic compass dates from a Chinese book finished in 1044. It describes how soldiers found their way by using a fish-shaped piece of magnetized iron floating in a bowl of water when the sky was too cloudy to see the stars.

- **1250–1300: Mechanical clock**

  Hourglass and water clocks had been around for centuries, but the first mechanical clocks began to appear in Europe toward the end of the 13th century and were used in cathedrals to mark the time when services would be held.

- **1455: Printing**

Johannes Gutenberg completed the printing of the *Bible*, which was the first book printed in the West using movable type. Gutenberg's printing press led to an information explosion in Europe.

- **1765: Steam engine**

  James Watt improved the Newcomen steam engine by adding a condenser that turned the steam back into liquid water. This condenser was separate from the cylinder that moved the piston, which meant that the engine was much more efficient.

- **1804: Railways**

  English engineer Richard Trevithick improved James Watt's steam engine and used it for transport. He built the first railway locomotive at an ironworks in Wales.

- **1826/27: Photography**

  In the early 1820s, Nicéphore Niépce became interested in using a light-sensitive solution to make copies of lithographs onto glass, zinc, and finally a pewter plate. He then had the great idea to use his solution to make a copy of an image in a camera obscura. In 1826 or 1827, he made an eight-hour-long exposure of the courtyard of his house, the first known photograph.

- **1876: Telephone**

  Once it was possible to send information through a wire in the form of dots and dashes, the next step was actual voice communication. Alexander Graham Bell made the first telephone call, on March 10, 1876, , when he asked his assistant Tom Watson to come to him: "Mr Watson—come here—I want to see you."

- **1885: Automobile**

The internal-combustion engine improved, becoming smaller and more efficient. Karl Benz used a one-cylinder engine to power the first modern automobile, a three-wheeled car that he drove around a track.

- **1903: Airplane**

  On December 17 Orville Wright made the first airplane flight, of 120 feet, near Kitty Hawk, North Carolina. He and his brother Wilbur made four flights that day. On the last, Wilbur flew 852 feet.

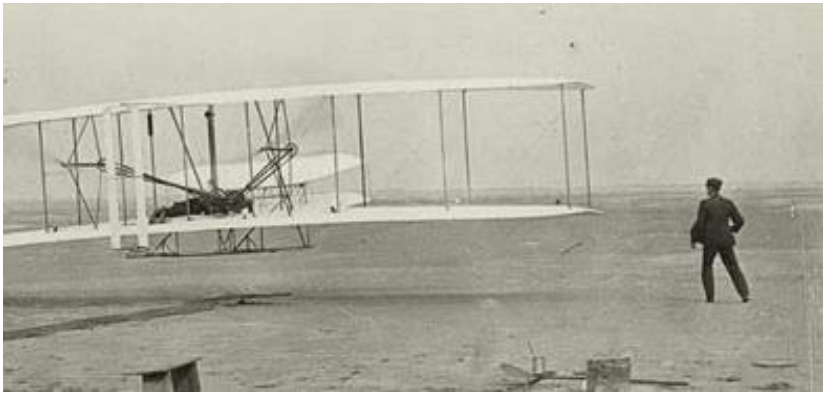

Figure 8: First Airplane by Wright Brothers

- **1937: Computer**

  Iowa State mathematician and physicist John Atanasoff designed the first electronic digital computer. It would use binary numbers, and its data would be stored in capacitors.

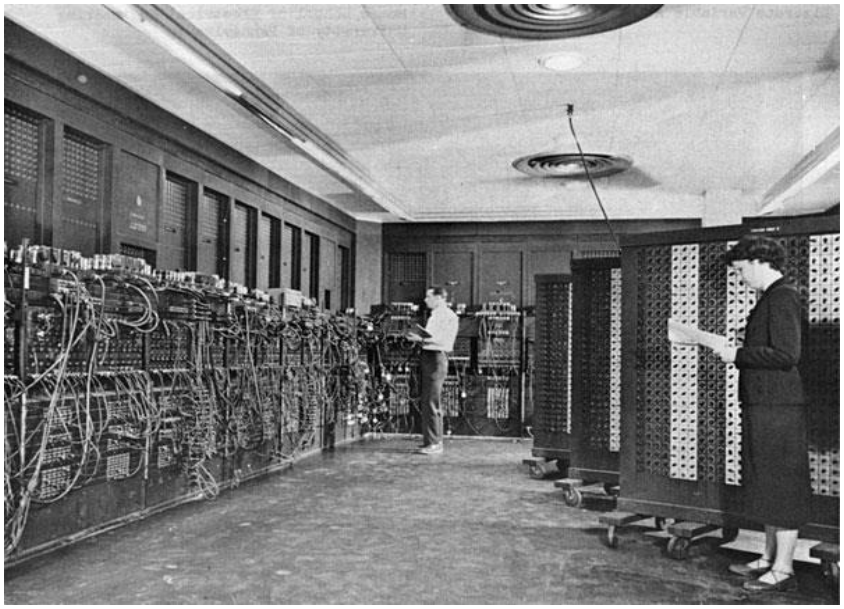

Figure 9: First Ever Computer

- **1942: Nuclear power**

  As part of the Manhattan Project to build the first atomic bomb, it was necessary to understand nuclear reactions in detail. On December 2, a team of physicists led by Enrico Fermi used uranium to produce the first self-sustaining chain reaction.

- **1974: Personal computer**

  The first computers that emerged after World War II were gigantic, but, with the evolution of technology, computers became both smaller and more powerful. Finally, they became small enough for home use. The first such personal computer was the Altair, which was soon supplanted in 1977 by the Apple II, the TRS-80, and the Commodore PET.

Figure 10: First Personal Computer

- **1974: Internet**

  Vinton Cerf and Robert Kahn produced the TCP/IP (Transmission Control Protocol/Internet Protocol), which describes how data can be broken down into smaller pieces called packets and how these packets can be transmitted to the right destination. TCP/IP became the basis for how data is transmitted over the Internet.

- **2012: CRISPR**

  American biochemist Jennifer Doudna and French microbiologist Emmanuelle Charpentier developed CRISPR-Cas9, a method for editing genes—that is, making changes to DNA sequences. Gene editing has the potential to treat many diseases but also opens up the ethical grey area of creating designer humans.

- **2017: Artificial intelligence**

  The team behind the AlphaGo artificial intelligence program announced that it had become the world's best go player. Go is a game with very simple rules but many possible positions. The previous year AlphaGo had defeated the great player Lee Sedol in a match 4–1. AlphaGo then played itself and, through continual improvement, was able to defeat the version

that had defeated Lee, 100–0. Through machine learning, AlphaGo had become better at the game than any human.

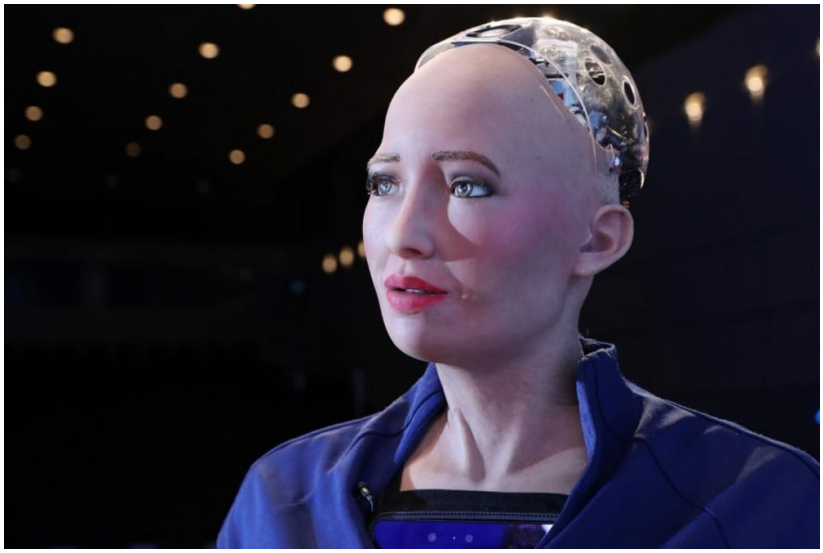

Figure 11: The First AI Robot - Sofia

5. Philosophy and History of Technium

Scientific inventions have become so complex and interwoven with our lives that humans have relatively less influence on how mechanical systems evolve. The advancement of technology cannot be halted. Consequently, when evaluating potential risks, a proactive method of trial and error and revision, rather than strict precaution, should be adopted.

5.1. Philosophy of Technium

The concept of "Technium" encapsulate the massive techno-social environment. The Technium, as opposed to human inventions such as radar or plastic polymer, encompasses all machines, processes, society, culture, and philosophies associated with technologies. The sheer complexity of interactions between the Technium's various layers and loops grants it a degree of autonomy. It develops its own dynamics as it evolves.

An autonomous system displays traits of self-repair, self-defence, self-maintenance, self-control and self-improvement. No modern system possesses both of these attributes, but certain technologies do. Aeroplan drones, for example, will self-steer and remain aloft for hours but cannot repair themselves. Communication networks can restore themselves, but they cannot replicate themselves. Computer viruses are capable of self-replication but not of self-improvement. The Technium is becoming more autonomous as inventions expand and become more adaptable.

For example, the vast global communications network incorporates 170 quadrillion computer chips (a quadrillion is 1015) wired together into one massive computing platform, with a connection density approaching that of synapses in the human brain. The majority of traffic flowing through the networks can be tracked by scientists, but some bits are lost or transformed during transmission.

The majority of these data mutations are due to factors such as hacking and computer error, although a tiny proportion isn’t — these variations are caused by device vagaries rather than human error. In the last decade, the movement of bits through the telephone network has been statistically similar to the fractal pattern found in self-organized systems. This indicates that it is developing its own behaviour.

Despite the fact that the Technium has no concept of self or conscious desires, it develops mechanical tendencies through its complex behaviour. Its millions of amplifying relationships and power circuits drive the Technium in specific directions. Some personal robots, for example, can navigate obstacles to seek power outlets and plug themselves in to recharge. These robots are similar to bacteria that migrate towards nutrients with no conscious awareness of their destination. As frontier technologies become more sophisticated, these 'wants' become more complicated and effective. Furthermore, the tendencies become less reliant on human designers and users.

Both technophobes and technophiles believe that the Technium is spinning out of control. They disagree only on what should be done about it: whether the Technium should be stopped, modified or embraced.

With the rise of genomics, robotics, informatics, and nanotechnology, there is growing concern that the Technium will take on a life of its own. Cautionary states and publics often invoke the precautionary principle, which states that every invention must be shown to be harmless before it can be adopted. This strategy appears to be unrealistic, infeasible, and unattainable. Every technology produces varying degrees of good, damage, and danger, and their evolution is unpredictable — none can ever be said to be decisively safe.

It is pointless to prohibit dangerous developments due to the autonomy of the Technium. Attempts to put a moratorium on them will only ensure that the emergent ones become much more resistant to human influence, demonstrating a form of natural selection. Instead, the focus should be on developing technology that is 'more convivial,' or more compatible with life. Every technology has the potential to be put to use in ways that encourage greater transparency, collaboration, flexibility, and openness across society.

One of the most troubling aspects of modern life tends to be uncontrollable "technological drift." To describe the seamless integration of humans and technology, the phrase 'socio-technical system' is more commonly used than 'social system.' The idea of the Technium, as well as the explanation of how it achieves autonomy, are novel and timely.

5.2. History of Technium

Looking back to the Palaeolithic period, we can see an evolutionary stage when human tools were in their infancy, when Technium was at its most primitive form. However, since technology predates humanity, appearing in apes and much earlier, we must look beyond our own origins to comprehend the true nature of technological growth. Technology is not only a human invention; it is also a result of life.

If we chart the varieties of life we have so far discovered on Earth, they fall into six broad categories. All organisms within each of these six groups, or kingdoms of life, share a similar biochemical blueprint. Three of these kingdoms are made up of one-celled species, which are microscopic in size. The remaining three are the biological kingdoms of life that we are familiar with: fungi, plants, and animals.

Every species in the six realms, that is, every organism alive today, from algae to zebra, is similarly evolved. Regardless of their sophistication and growth, all living creatures have developed from predecessors for the same period of time: four billion years. All have been monitored on continuous basis and have survived hundreds of millions of generations in an unbroken chain. Many of these species have learned to create structures, and those structures have allowed the creature to expand beyond its tissue.

Figure 12: Ancient Technology

The term "Technium" may also be referred as an extended person. It has been noted that clothes are people's extended skin, wheels are people's extended feet, and cameras and telescopes are people's extended eyes. Our technological creations are massive extrapolations of the bodies that our genes build. In this sense, technology can be viewed as an extension of our

body. It was easy to see the world in this way during the industrial era. Steam-powered shovels, locomotives, television, and engineer's levers and gears formed a spectacular exoskeleton that transformed man into Superman.

A closer examination shows the flaw in this analogy: animals' extended costumes are the product of their genes. They inherit the fundamental blueprints of what they make. Humans, on the other hand, do not. The blueprints for our shells emerge from our minds, which can spontaneously produce something that none of our forefathers ever created or imagined. If technology is a human extension, it is an extension of our minds rather than our genes.

As a result, technology serves as an expanded body for ideas. The evolution with the Technium—the organism of ideas—resembles the evolution of genetic organisms with small variations. Both systems evolve from the basic to the complex, from general to particular, from uniformity to diversity, from individualism to mutualism, from energy waste to quality, and from slow change to greater evolvability. The evolution in a species of technology follows a trend close to that of a genealogical tree of species evolution. Technium, on the other hand, expresses ideas rather than the functionality of genes.

6. Impact of Technium at Present and Future

A number of technological innovations have occurred since the beginning of humanity. And with a rise in these needs-based inventions, an important question prompts that, how did they help change the way people lived and how societies worked. As long as there have been people, there has been technology. On the whole, technology has been a powerful force in the development of civilization, all the more so as its link with science has been forged.

Today's world is built on the technology that humans have invented and advanced over thousands of years. The rate at which technology has advanced has made life almost indistinguishable from what life was like even a century ago. We are very much dependent on the technology we have.

Technium will only continue to advance, and because of how effective new technology is, it only means that it will continue to evolve at an even faster rate. The human race has been dependent on technology for its survival throughout its entire history, which means that the idea of stopping or slowing down is simply not a possibility. Technology must move forward and it will continue to evolve at a faster and faster rate to meet the challenges of today. From business to communications, healthcare to education; Technium has grown in every industry making itself one of the most important factors.

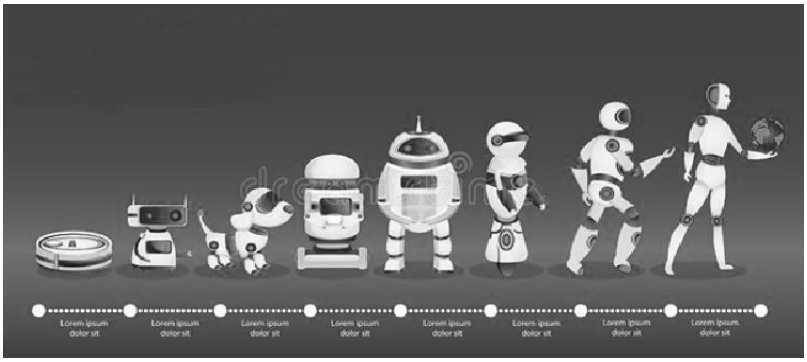

Figure 13: Evolution of Technology

6.1. Positive Impacts

Technology has always advanced with the purpose of making our lives better. Enlisted are a few advancements that affected the general public.

- **Business** – We live in a capitalist society, which means that a lot of the new advancements that are made in technology are made by businesses looking to improve their products/services or to improve their ability to market their products/services. New tech has also emerged over the years with the purpose of making business operations more efficient and effective as well.
  - Improving Strategy making process
  - Getting Accurate Statistics for analysis
  - Easier Communication
  - Smoother Trade
  - Efficient Advertising
- **Education** – From the way things are taught to the things being taught all has changed thanks to technology. The evolution of technology has given the ability to anyone and everyone to research any topic and learn.
  - Online courses
  - Web seminars
- **Communication** – People are more connected than ever, thanks in large part to rapid advancements in technology.
  - Data Retrieval and Information Sharing
  - Assisting People with Disabilities
- **Health Care –** With technology, we can help people who, in decades gone by, would have suffered pain, debilitating illness or death.
  - 3-D Printed implants and prosthetics
  - Smart Hospitals
  - Health Apps and Watches and Monitors

6.2. Negative Impacts

While with every advancement in human evolution there will be those who choose to use it for destruction and chaos of either society or themselves, the negative impacts of technology on an individual scale are still huge.

Figure 14: Negative Impacts of Technology

- **Psychological effects** – Overuse or dependence on technology may have adverse psychological effects, including:

    - **Isolation:** A 2017 study in young adults aged 19–32 years found that people with higher social media use were more than three times as likely to feel socially isolated than those who did not use social media as often.

    - **Depression and anxiety:** The authors of a 2016 systematic discussed the link between social networks and mental health issues, such as depression and anxiety. People who perceived that they had more negative social interactions online and who were more prone to social comparison experienced higher levels of depression and anxiety.

- **Physical health effects –** Technology use may increase the risk of physical issues as well, including:

    - **Eyestrain:** Technologies, such as handheld tablets, smartphones, and computers, can hold a person's attention for long periods. This may lead to eyestrain. Symptoms of digital eyestrain can include blurred vision and dry eyes. Eyestrain may also lead to pains in other areas of the body, such as the head, neck, or shoulders.

    - **Poor posture:** Many technologies promote a "down and forward" user position, meaning the person is hunched

forward and looking down at the screen. Over time, this may lead to musculoskeletal issues. This can put an unnecessary amount of pressure on the neck and spine.

- **Sleep problems:** Using technology too close to bedtime may cause issues with sleep. This effect has to do with the fact that blue light, such as the light from cell phones, e-readers, and computers, stimulates the brain.

6.3. Future of Technology

Technology has advanced at an unprecedented rate over the years. New technology continues to play a critical role in all industries of the planet. To better understand where we are now, it is essential to first learn where it all began and how the journey has progressed to the fast-paced tech world of today.

- **Clean Energy**

  Excessive consumption of fossil fuels has led our planet to the brink of catastrophic consequences. However, technology is helping us deal with this problem by developing clean energy. Development in the field of solar power technology has drastically reduced the cost of solar cells. Generation of electricity through wind turbines has also gained a lot of momentum in the recent years. So, in the near future, technology can help us do away with dependence on fossil fuels and embrace clean and green energy solutions.

- **Space Tourism**

  Companies such as Virgin Galactic, SpaceX and even Amazon's Blue Origin, want to make it a reality one day, and give us a (very expensive) seat aboard a spaceship to take us into orbit. Passengers on Amazon's New Shepard space shuttle will be taken 100km above sea level, before parachuting back to earth.

- **Virtual Reality**

  Augmented Reality, or AR, has some incredible potential. It's been around for a while now, in the form of various apps that can overlay information around you and is different from VR because it overlays information rather than simply put you in a virtual reality. Companies are experimenting with using both augmented reality and virtual reality devices in the workplace. They can be used in a variety of ways including visual representations of blueprints, virtual scale models of products in development or for simple things like virtual team meetings.

- **3D printed food**

  3D printing technology is coming along quickly and companies are already experimenting with printing food. 3D printing is taking off in other areas too. From creating aeroplane and vehicle parts, replacement joints such as hips, or pieces for a board game, it still has huge potential to change our lives in the coming years. The materials being used to print with are evolving too, and now include graphene that is "lighter than air" but 10 times stronger than steel.

- **Flying Cars**

  Amazon has already started delivering goods with the help of its drone fleet, and Google is working on building its own powerful drones. A couple of start-ups are also working on building flying cars. A flying car for all intents and purposes is a drone that is capable of carrying people. There are already a handful of flying vehicle proto-types: Terrafugia has TF-X; Pal-V has the Pal-V1; Indigenous Peoples' Technology and Education Center (I-TEC) has the Maverick LSA "Flying Car"; and lastly AeroMobil s.r.o. has the AeroMobil 3.0.

- **Artificial Intelligence**

  AI is all around us. It's in machines, robots and even our smartphones. Voice assistants such as Siri, Alexa and Google Assistant prove how far AI has already come, but it could eventually find its way into things like robot servants.

- **3D printed metal**

  3D printing has come on a fair bit in the last few years. Just recently, advancements in the technology have seen researchers producing 3D printed parts from metal and stainless steel. Some of these techniques are even producing parts that are stronger and more robust than traditionally made parts.

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