

Ideal Technology Concept & its Realization Opportunity using Nanotechnology

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ABSTRACT

Technology has affected society and its surroundings in a number of ways. In many societies, technology has helped to develop more advanced economies (including today's global economy) and has supported the rise of a leisure class people. The concept of ideal engine, ideal switch, ideal semiconductor devices like ideal diodes, transistors, etc. have been defined and taken as standards to improve the quality and performance of such practical devices or systems. It is found that, by keeping such hypothetical device or systems in mind, researchers have continuously improve the characteristics/properties of practical devices / systems to upgrade their performances. Hence ideal properties of a device or a system can be used to upgrade or improve its properties towards reaching 100% efficiency. By comparing the properties/characteristics of a practical device/system with its ideal counterpart, one can find out the possible modifications in that device /system towards reaching the objective of achieving such an ideal device. In this paper, we have developed the concept of Ideal technology by creating a model and identified its important characteristics. These characteristics are grouped under four categories namely input conditions, output conditions, system conditions and environmental conditions/social expectations. These characteristics are further discussed, analyzed and compared with present technologies. Based on the discussion, it is realized that many of the characteristics of ideal technology are achievable through discoveries and innovations in Nanotechnology. Finally, the characteristics of this ideal technology model are compared with nanotechnology developments and the possible way of realizing the nanotechnology as ideal technology are discussed.

Keywords: Ideal technology, Ideal technology model, Characteristics of ideal technology, Nanotechnology

1. INTRODUCTION

Technology is the making, modifying, using, and knowing of tools, machines, techniques, crafts, systems, and methods of organizing them in order to solving a problem, improving a pre-existing solution to a problem, achieving a goal, handling an applied input/output relation or perform a specific function. It can also refer to the collection of such tools, including machinery, modifications, arrangements and procedures. Technologies considerably affect human beings and other animal species' ability to control and adapt to their natural environments. Technology has affected society and its surroundings in a number of ways. In many societies, technology has helped to develop more advanced economies (including today's global economy) and has supported the rise of a leisure class people. The concept of ideal gas, ideal engine, ideal switch, ideal fuel, ideal semiconductor devices like ideal diodes, ideal transistors, ideal amplifiers etc. have been defined and taken as standards to improve the quality and performance of such practical devices or systems. It is found that, by keeping such hypothetical device or systems in mind, researchers have continuously improved the characteristics/properties of practical devices / systems to upgrade their performances. Hence ideal properties of a device or a system can be used to upgrade or improve its properties towards reaching 100% efficiency. By comparing the properties/characteristics of a practical device/system with its ideal counterpart, one can find out the possible modifications in that device /system towards reaching the objective of achieving such an ideal device [1]. The Characteristics of an ideal fuel are (1) The fuel should have high calorific value, (2) The fuel should have proper ignition temperature. (3) The rate of combustion should be balanced and moderate. (4) The content of non-volatile substances should be as low as possible. (5) There should be no poisonous or residue by-products on combustion. (6) The fuel should be easily available in plenty. (7) The fuel should be available at a low cost. (8) There should be convenience in transporting the fuel and should be easily storable [2]. An ideal gas is an hypothetical theoretical gas composed of many randomly moving particles that do not interact each other except when they collide each other elastically. The ideal gas concept is important and useful because it obeys the ideal gas law, a simplified equation of state, and is amenable to analysis under statistical mechanics. (1) The molecules of an ideal gas do not attract one another. (2) The molecules of an ideal gas repel one another. (3) The volume of the ideal gas molecules is negligible compared to the volume of the container. An ideal operational amplifier has properties like (1) Infinite input resistance, Zero output resistance, (3) Zero offset voltage, (4) Infinite bandwidth (5) Infinite common-mode rejection (6) Infinite open-loop voltage gain, and (7) Infinite Slew rate so that the output voltage changes occur simultaneously with the input voltage change. Similarly, ideal fabric is the fabric which satisfies the three conditions, good hand, good appearance of suit, and mechanical comfort for wear. In this paper, we have developed the concept of Ideal technology

by creating a model and identified its important characteristics. These characteristics are grouped under four categories namely input conditions, output conditions, system conditions and environmental conditions/social expectations. These characteristics are further discussed, analyzed and compared with present technologies. Based on the discussion, it is realized that many of the characteristics of ideal technology are achievable through discoveries and innovations in Nanotechnology. Finally, the characteristics of this ideal technology model are compared with nanotechnology developments and the possible way of realizing the nanotechnology as ideal technology are discussed.

2. IDEAL TECHNOLOGY

Technology is the branch of scientific knowledge that deals with the creation, application and use of technical means and their interrelation with human life, society, and the environment, drawing upon such subjects as engineering, applied science, pure science and industrial arts. Many technological processes generate unwanted by-products, which give rise to pollution, and deplete natural resources, to the detriment of Earth's environment. Implementations of new technology influence the culture and values of a society and often raises new ethical questions. For example, the rise of the notion of efficiency and effectiveness in terms of human productivity, a term originally applied only to machines is now became common traditional norms [3].

To improve any present systems in the society, it is normal practice that such systems have to be compared with an hypothetical, predicted system of that kind called "Ideal system". The word 'Ideal system' refers to the system which has ideal characteristics i.e., perfect in every way. It is what the mind pictures as being perfect. The concept of ideal engine, ideal switch, ideal voltage source, ideal current source, ideal semiconductor devices like ideal diodes, ideal transistors, amplifiers etc. have been defined and taken as standards to improve the quality and performance of such practical devices or systems. It is found that, by keeping such hypothetical devices or systems in mind, researchers have continuously been improving the characteristics/properties of practical devices / systems to upgrade their performances. Hence ideal technology model is essential to plan the improvement in the performance of any practical technology. The model of ideal business by considering it as a system is proposed by identifying its input conditions, output conditions, environmental/market conditions and system requirements are studied and a suitable practical online business model to realize ideal business model is identified and discussed [4]. Similarly, Ideal Education System model is also proposed by considering its various characteristics under Input conditions, Systems requirements, Output conditions and Environmental & social conditions. These characteristics are analyzed with an objective to achieve the goal and the possibility of realizing Ideal Education System through Online Education using E-education model is discussed [5]. Based on Ideal business model and ideal education model framework, in this paper we made an attempt to develop a conceptual ideal technology model by considering it as a system and identifying various characteristics of the system. Similarly, the concept of ideal technology can be predicted as a technology which can solve all basic needs of human beings and provide luxurious comfortable life without affecting the society and environment. Ideal technology should have characteristics in order to elevate the quality of life to unique level with perfect equality so that every human being in this universe should lead happy and comfortable life and realize the so called concept of heaven on earth.

3. IDEAL TECHNOLOGY MODEL

An ideal technology system should have characteristics to fulfill its objectives to solve all problems of human beings including both basic needs and advanced gadgets to support comfort living to realize their dreams. Based on various factors which decides the ideal technology system characteristics, a model consisting of input conditions, output conditions, environmental conditions and system requirements are derived by a qualitative data collection instrument namely focus group method [6, 7]. The block diagram of such a system is shown in Figure 1.

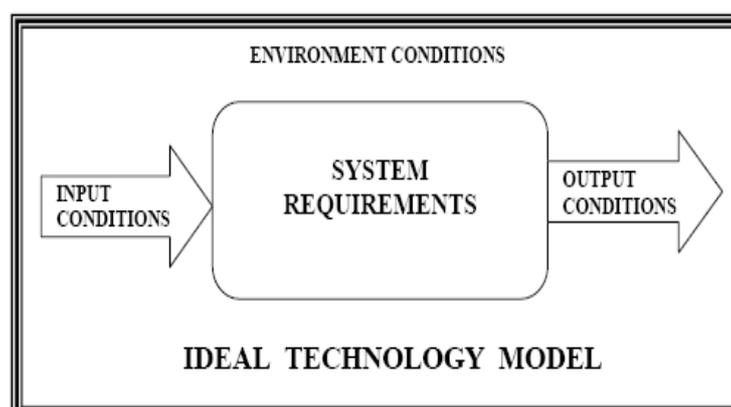


Figure 1 System model of classifications of Ideal Technology characteristics.

3.1 Input Conditions

1. Manipulate the fundamental nature of matter to provide solutions to basic and advanced problems of mankind.
2. In-expensive & self reliable in terms of resources to make it attractive to be used by people/countries of varied economical situations.
3. Ubiquitous so that the technology provide solutions and services at anytime, anywhere, any amount of time to the users.
4. Affordable to everybody so that it uses common materials available in nature and manipulate effectively to the need of human being at affordable cost.

3.2 Output Conditions

1. Solve basic needs like food, drinking water, renewable energy, clothing, shelter, health and clean environment.
2. Provide comfort life to the users by providing solutions to their desires.
3. Equality ; ideal technology provide equal opportunity and similar solutions to every user irrespective of their gender, religion, background, education, economic status, and country of origin.
4. Automation; ideal technology automate all processes in every type of industries to avoid human interference in work/control in order to provide expected output based on programming.
5. Immortality is the ultimate goal of ideal technology so that it can create an avenue for deathless situation or enhancement of human life span.

3.3 System Requirement

1. General purpose technology to support all fields and problems of human & living beings on the earth.
2. Self-directed & self controlled & self regulated so that the technology can control itself in order to achieve its goal.
3. Easy, simple, quick & user friendly to solve all type of problems and to provide quick ideal solution.
4. Scalable so that it is used for solving small and simple problem to large and complex problems of life.
5. Omni-potent to identify and solve problems and provide comfortability to human being and feeling him like God.
6. Exploring new opportunities to improve and explore comfortability and further leisure in life of people.
7. Infinite potential for further development of life in the universe.

3.4 Environment Conditions

1. Maintain clean environment through its processes and avoids foot print of processes while achieving specific function.
2. Infinite business opportunities by creating new products / services with ideal characteristics.
3. Adaptive to any situations to achieve stated goal.
4. No side effects so that it should be safe for users, and environment.

Any technology which has the above properties/characteristics is considered as ideal technology and the conventional technologies have serious drawbacks/limitations in terms of the above properties.

4. ANALYSIS OF IDEAL TECHNOLOGY CHARACTERISTICS

Ideal Technology characteristics can be explained based on their effectiveness in improving the qualities and comfortability of human life in the society. The characteristics mentioned in ideal technology model are depicted in figures 2 - 5 and further discussed below :

4.1 Input Conditions

1. Manipulate the fundamental nature of matter :

Ideal technology manipulated fundamental nature of matter. This include Four Interactive Forces Manipulation, and Unified Field Manipulation. The ideal technology is able to control the four interactive forces of Strong Force, Weak Force, Electromagnetism and Gravity all in one. Ideal technology allows user to control four fundamental forces of the universe, reaching nearly any effect they desire. As a result, the user can rearrange matter to create other configurations and can even transmute elements and manipulate space-time to a degree by using gravity to distort them. Hence, ideal technology helps to manipulate the fundamental nature of matter to provide solutions to basic and advanced problems of mankind.

2. In-expensive & self reliable in terms of resources :

Any technology should be cheap, simple, universal, self reliable in terms of resources so that can be used by anybody, anywhere with available basic resources. One of the examples of such technology is Appropriate technology which is an ideological movement (and its manifestations). Though the nuances of appropriate technology vary between fields and applications, it is generally recognized as encompassing technological choice and application that is small-scale, decentralized, labor-intensive, energy-efficient, environmentally sound, and locally controlled [8]. Schumacher and many modern-day proponents of appropriate technology also emphasize the technology as people-centered [9]. Appropriate technology is most commonly discussed in its relationship to economic development and as an alternative to transfers of capital-intensive technology from industrialized nations to developing countries [9,10]. Today appropriate technology is often developed using open source principles, which have led to open-source appropriate

technology (OSAT) and OSAT has been proposed as a new model of enabling innovation for sustainable development [11]. Such property of technology makes it attractive to be used by people/countries of varied economical situations.

3. Ubiquitous :

Ubiquitous, means being present everywhere simultaneously or existing everywhere at the same time. The very concept behind this kind of technology being everywhere and still being virtually inexistent or invisible. This technology is sometimes also referred to as pervasive computing - things that think, or calm technology. The aim of such technology is to establish an environment where people can always be on-the-go, and still carry information and power to solve their problems at their inconvenience, without being bound by the location of any particular technological device. The main underlying principle or rather thought behind Ubiquitous technology is to turn the virtual reality inside out [12, 15]. Virtual reality always attracts a common user into a technical system and makes him/her a part of a world, which is beyond mediation. On the other hand, this technology makes systems live and work in a world with people. Thus, Ubiquitous technology provide solutions and services at anytime, anywhere, any amount of time to the users.

4. Affordable to everybody :

Ideal technology should be so smart, so simple and so powerful it works for everybody. Development and maintenance of such technology should be simple, cost effective with less constraints for implementation. Innovative technology like smart phones and tablets are becoming more accessible as new models are being brought out at cheaper prices. For example, advent of technology made healthcare services more affordable than ever before. Hence ideal technology is affordable to everybody so that it uses common materials available in nature and manipulate effectively to the need of human being at affordable cost.

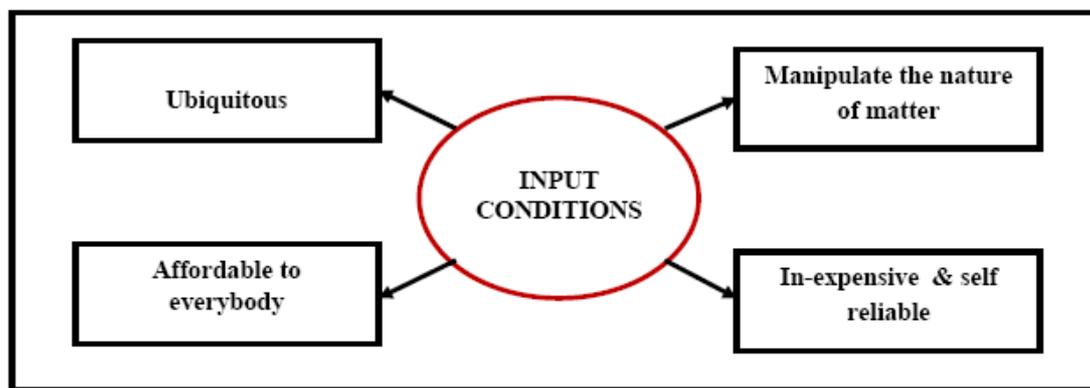


Figure 2 Input condition characteristics of Ideal technology

4.2 Output Conditions

1. Solve basic needs :

Science and technology are essential means of meeting society's needs for food, water, energy, health care, shelter, safety and alleviation of poverty. Technology is produced through the existence of the "scientific establishment", formed by the group of institutions, persons and resources directly involved in the production of new knowledge accordingly to certain "internal" rules and procedures. Basic human needs to lead comfortable life constitute a major worldwide shameful problem in the twenty first century. In contrast to the dazzling scientific advancement in fundamental and biomedical science there exists at the other end of the spectrum a formidable picture of unmet basic needs leading to serious health problems. Currently people in underdeveloped and developing countries are suffering from poor quality of life because of (1) Food shortage and malnutrition. (2) Unsafe drinking water. (3) Improper or absent sanitation system. (4) Poor or absent Health Care. (5) Overcrowding or shelter deprivation. (6) Primitive ineffective education. (7) Weak or absent social security. Those problems are localized in underdeveloped and developing countries in contrast to being nearly unknown in developed ones. The gap between people who enjoy such services and the people who are not is astronomically widening. Lack of scientific social and technologic development is recognized as the root causes of that disparity in the quality of life and living conditions. Hence ideal technology should have capability to solve basic needs like food, drinking water, renewable energy, clothing, shelter, health and clean environment.

2. Provide comfort :

Technological development offers new possibilities to make people's daily lives more healthy, safe, understandable, independent, fun and comfortable. New technologies provide us, for instance, with energy-friendly and sustainable solutions to improve the environment in which we live as well as tools for elderly people to live longer on their own. Furthermore, new technologies provided us with new means of communication and entertainment. Examples are smart phones, ambient intelligence and smart homes, online shopping and communities, 3D television and renewable energy technologies like hydrogen technology and biomass. In the historical accounts of engineers, comfort is generally presumed to be a definable human condition or attribute, with each new innovation bringing society closer to the

achievement of ideal indoor conditions. Starting from a different set of assumptions, social historians take comfort to be a malleable construct and social achievement. Ideal technology through its ingredients provide comfort life to the users by providing solutions to their desires.

3. Equality :

Technology provides equal opportunity to everybody in terms of identifying and en-cashing opportunities throughout the world. Thus ideal technology also should provide equal opportunity and similar solutions to every user irrespective of their gender, religion, background, education, economic status, and country of origin.

4. Automation :

Automation or automatic control, consists of using various control systems for operating equipment such as machinery in industries, boilers and heat treating ovens, processes in factories, switching in telephone networks, steering and stabilization of ships, controlling aircraft and other applications with minimal or reduced human intervention. Ideal technology automate all processes in every type of industries to avoid human interference in work/control in order to provide expected output based on programming.

5. Immortality :

Immortality is eternal life or the ability to live forever. Biological life have inherent limitations which medical interventions or engineering may or may not be able to overcome. Nature in its natural selection has developed potential biological immortality in some living species like jellyfish. Certain scientists, futurists, and philosophers, have theorized about the immortality of the human body, and advocate that human immortality is achievable in the first few decades of the 21st century, while other believe that life extension is a more achievable goal in the short term, with immortality awaiting further research breakthroughs into an indefinite future. It is predicted that newly developing technologies may be used to induce biological immortality in human beings. Human embryonic stem cells research created considerable excitement for the development of mass-producing replacement cells for the treatment of degenerative diseases involving the loss or dysfunction of cells, including those in osteoarthritis, macular degeneration, heart failure, diabetes, Parkinson's disease, and several other disorders. The preliminary report of the isolation of these cells marked the birth of the new area of research called regenerative medicine. This technology offers the theoretical potential of rejuvenating an entire human body back to a youthful state. Hence immortality is the ultimate goal of ideal technology so that it can create an avenue for deathless situation or enhancement of human life span.

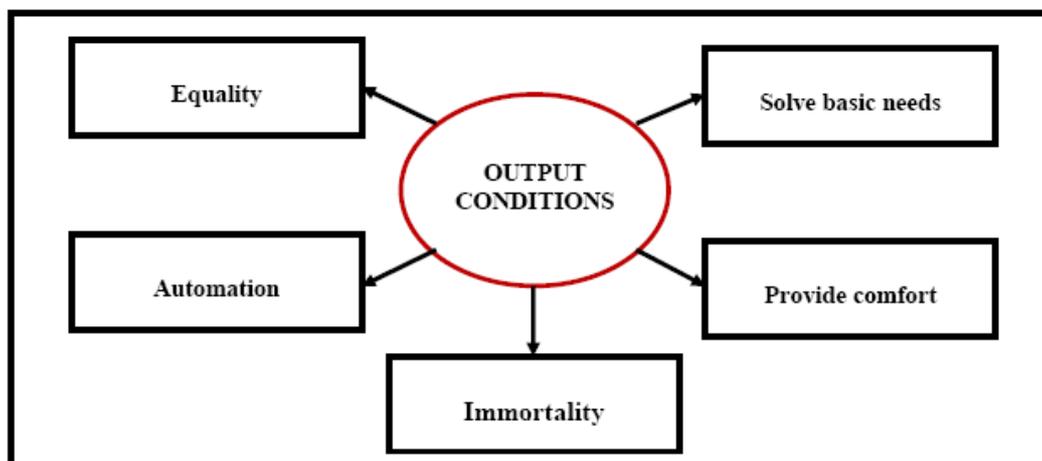


Figure 3 Output condition characteristics of Ideal technology

4.3 System Requirement

1. General purpose technology :

General-purpose technologies (GPT) are technologies that can affect an entire economy of the world. GPTs have the potential to drastically alter societies through their impact on pre-existing economic and social structures. Steam engine, railroad, interchangeable parts, electricity, electronics, material handling, mechanization, automation, the automobile, the computer, the Internet and the mobile phone are few examples for GPT. Thus, as GPT's spread throughout the economy, bringing about generalized productivity gains. Ideal technology should be general purpose technology in order to support all fields and problems of human & living beings on the earth.

2. Self-directed & self controlled & self regulated :

Ideal technology is expected to be self-directed, self-controlled and self-regulated so that the technology can control itself in order to achieve its goal. Changes in any parameters due to internal or environmental variations should be readjusted through feedbacks and automatic controls.

3. Easy, simple, quick & user friendly :

User-friendly describes a hardware device or software interface that is easy to handle. It is "friendly" to the user, meaning it is not difficult to learn or understand by an ordinary person. The common attributes of such user friendly

technology are (a) simple, a user-friendly interface is not overly complex, but instead is straightforward, providing quick access to common features or commands. (b) clean, a good user interface is well-organized, making it easy to locate different tools and options. (c) intuitive, in order to be user-friendly, an interface must make sense to the average user and should require minimal explanation for how to use it. (d) reliable, an unreliable product is not user-friendly, since it will cause undue frustration for the user. A user-friendly product is reliable and does not malfunction or crash. These features allow to solve all type of problems and to provide quick ideal solution.

4. Scalable :

Scalability is the ability of a system, network, or process to manage a growing amount of work in a capable manner or its enlarged ability to accommodate such growth. For example, it can refer to a systems capacity to increase its total output under an increased load when resources are added. It also refers to anything whose size can be increased. For example, a font is said to be scalable if it can be represented in different sizes. Scalability is the ability of a system based on technology it uses so that it is used for solving small and simple problem to large and complex problems in the society.

5. Omni-potent :

The noun omnipotence describes having an enormous amount of power, or even an infinite amount of power. Omni-potent technology has an ability to solve problems of many and multiple areas. Hence it can identify and solve problems and provide comfortability to human being and feeling him like God.

6. Exploring new opportunities :

The technological opportunity discovery (TOD) can be divided into two types: anticipating new technology and applying existing technology to solve basic and advanced problems. Ideal technology should focus on exploring new opportunities to improve and explore comfortability and further leisure in life of people.

7. Infinite potential for further development :

An ideal technology has ability to expand to all realm of the society and all branches of science. It should show its existence in solving problems of physical, chemical and biological areas. Through its innovative ability of improving quality of human life, it has infinite potential for further development of life in the universe.

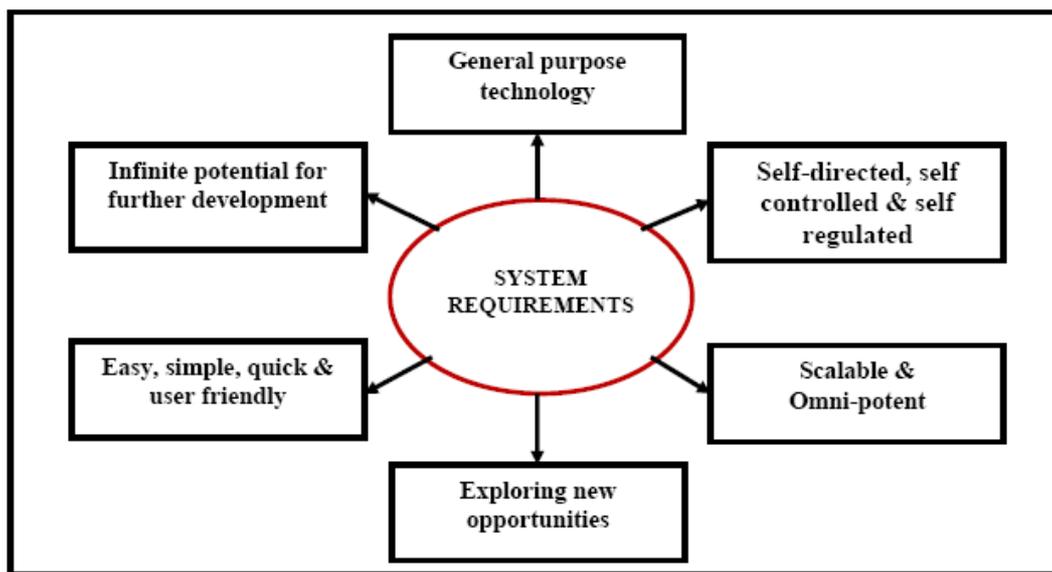


Figure 4 System requirement characteristics of Ideal technology

4.4 Environmental Conditions

1. Maintain clean environment :

Environmental technology or clean technology is the application of one or more processes of environmental science, green chemistry, model and conserve the natural environment and resources, environmental monitoring and electronic devices to monitor, and to curb the negative impacts of human involvement in environmental pollution. Clean technology includes recycling, renewable energy, green transportation, electric motors, lighting, grey water, information technology, and many other appliances that are now more energy efficient. It is a procedure to create energy in the form of electricity and fuels, with lower environmental footprint and minimise pollution. Thus ideal technology maintain clean environment through its processes and avoids foot print of processes while achieving specific function.

2. Infinite business opportunities :

New technology creates new business opportunities in many areas depending upon its ability to solve problems provide innovative solutions in different areas in the society. When considering the characteristics of ideal technology, it should

offer infinite business opportunities without any boundaries and constraints by creating new products / services with ideal characteristics.

3. Adaptive :

Another aim of this technology is to make the devices so advanced that they can sense the changes in the surrounding and environments and change themselves accordingly. This way, they become adaptive enough to function as per the necessary changes and preferences.

4. No side effects :

In addition to its intended benefits, every design is likely to have unintended side effects in its production and application. On the one hand, there may be unexpected benefits. For example, working conditions of the workers may become safer when materials are molded rather than stamped, and materials designed & developed for space vehicles may become useful in consumer products. On the other hand, substances or processes involved in production work may harm production workers or the public in general giving rise to side effects ; for example, sitting in front of a computer for long period may strain the eyes and lead to isolation from other employees. There may be enhanced opportunity and increased employment for the people involved in the new technology, which in turn decreases employment for others involved in the old technology. This may change the nature of the work people must do in their jobs. But ideal technology should be free from all such kind of side effects so that it should be safe for users, and environment.

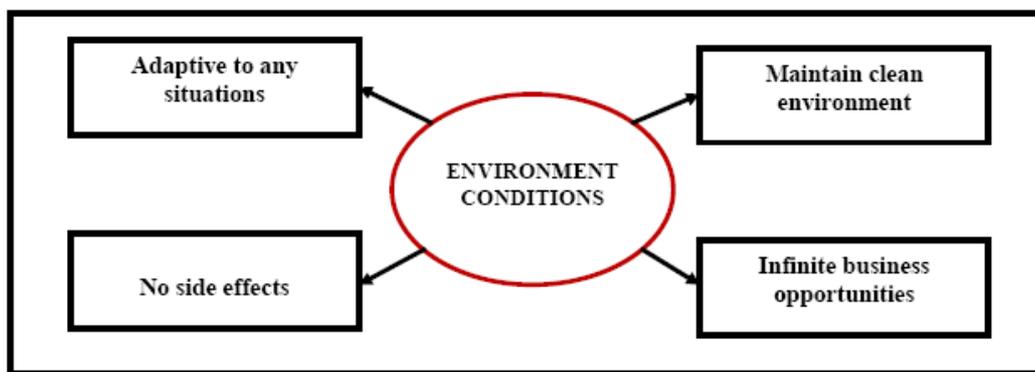


Figure 5 Environment characteristics of Ideal technology

5. CHALLENGES TO ACHIEVE IDEAL TECHNOLOGY

To realize the Ideal Technology in practice, we need to identify a general purpose technology which should manipulate the fundamental nature of matter. The technology should be microscopic and able to provide solutions to the problems and challenges of fundamental needs of human beings and also support the processes required to enhance the comfortability of the people. The products/services developed through such technology should have properties, at least close to Ideal technology properties. The presently developed technologies like agricultural technology, space technology, computer technology, electronics & communication technology, Automobile technology, bio-technology, laser technology are unable to show all the characteristics which are close to ideal technology characteristics mentioned above.

6. NANOTECHNOLOGY AS IDEAL TECHNOLOGY

The emerging nanotechnology is expected to solve both basic needs and comfort needs of human beings. The basic needs of human being are food, drinking water, energy, cloth, shelter, health and environment and the comfort needs are realizing the automation in every field, space travel and expanded life-span and so on. Nanotechnology is the manipulation of matter on an atomic, molecular, and supramolecular scale. The earliest, widespread description of nanotechnology [13, 14], referred to the particular technological goal of precisely manipulating atoms and molecules for fabrication of macroscale products, also now referred to as molecular nanotechnology. Some of the applications of nanotechnology initially thought are :

- Clean, secure, affordable energy;
- Stronger, lighter, **more** durable materials;
- Low-cost filters to provide clean drinking water;
- Medical devices and drugs to detect and treat diseases more effectively with fewer side effects;
- Lighting that uses a fraction of the energy associated with conventional systems;
- Sensors to detect and identify harmful chemical and biological agents; and
- Techniques to clean up harmful chemicals in the environment.

Nanotechnology is sometimes referred to as a general-purpose technology. That's because in its advanced form it will have significant impact on almost all industries and all areas of society. It will offer better built, longer lasting, cleaner,

safer, and smarter products for the home, for communications, for medicine, for transportation, for agriculture, and for industry in general [15].

(1) Food : Nanotechnology innovations in agriculture is expected to solve the problems in food sector and maximizes productivity in agriculture. There is an ever-increasing demand for food and adequate nutrition, while world grain harvest has fallen short for the last four years. Biodiversity is being destroyed worldwide with 9.4 hectares of forest being lost annually. Half of our world's forests and a quarter of our coral reefs are gone. The world population is currently at 6.4 billion and is estimated to swell to 8.9 billion by the year 2050. It is anticipated that 98% of this growth will be in poorer countries. It is also predicted that there will be 5 billion city dwellers by 2030 which will place heavy demands on the growth and distribution of food. Nanotechnology will provide solutions through precision farming using nanosensors, nano-pesticides, and inexpensive decentralized water purification. A more advanced nanotechnology solution will be plant gene therapy; creating pest resistant, high yield crops that require less water.

(2) Drinking Water : Nanotechnology has potential to provide efficient, cost effective and environmentally sustainable solutions for supplying portable water for human use and clean water for agricultural and industrial uses. Nanotechnology innovations in low cost water purification is expected to solve drinking water problem of the world. Water is one of the Earth's most precious natural resources. Most of it is saltwater. Fresh usable water is only 3% of the world's supply and two-thirds of that is frozen in glaciers, ice caps and icebergs. The remaining 1% is available for human consumption. Today 1.1 billion people don't have access to safe water and 2.4 billion lack sanitation facilities. 80% of developing world diseases are water-borne with an estimate of 3.4 million deaths, mostly children, in 1998 of water-related diseases. Demand for fresh water is increasing. Agriculture currently uses 70% of the world's water supply. To feed 2 billion more by the year 2030 there will be a 60% increase in demand on the water supply. Considering the current rates of consumption, population and development, some two-thirds of the world population will be affected by droughts by the year 2050. Nanotechnology will provide solution for this challenge through inexpensive decentralized water purification, detection on the molecular level of contaminants, and greatly improved filtration systems. This helps conversion of sea water into drinking water at very low cost.

(3) Renewable Energy : Nanotechnology innovations in renewable energy solves entire energy requirement of human beings for their basic needs and for the comfortable life. Balancing humankind's need for energy with the environmental cost to our planet is a major challenge. Demand for energy on earth is forecasted as increasing 50% by the year 2025 with most of these being fossil fuels. Currently over 1.6 billion humans have no access to electricity and 2.4 billion rely on plant material, vegetation, or agricultural waste as an energy and heating source. Our fossil fuel consumption is escalating and could become double by the year 2025. Meanwhile, Earth's glaciers are receding, the CO₂ concentrations in the atmosphere have nearly doubled, and world temperatures, recorded since 1861, were the hottest in three of the past five years. 1998 was the warmest of record, 2001 came in the second warmest and 2004 was the fourth warmest [22]. Nanotechnology will help to solve our need for energy solutions through more efficient lighting, fuel cells, hydrogen storage, solar cells, locally distributed power generation, and decentralized generation and storage by reinventing the power grid.

(4) Clothing : Nanotechnology based cloths are presently available in market. Making composite fabric with nano-sized particles or fibers allows improvement of fabric properties without a significant increase in weight, thickness, or stiffness as might have been the case with previously-used techniques. It supports creating fabrics that do not wrinkle, stain, or allow the growth of bacteria. Anti-microbial socks, underwear, and sporting apparel; wind and water proof jackets; wrinkle and stain resistant suits and casual wear; and swimsuits that protect against UVA and UVB rays are all products that are treated with nanocoatings or use nanotechnology in the manufacturing process. The advantages of nanotech fabrics are Water and stain resistant, Insulates against heat or chill, Dirt rinses off in rain, similar to property of the lotus plant, Reduces odors and bad smell [16].

(5) Shelter : Nanotechnology offers interesting new opportunities in the construction sector through the development of energy efficient, ultra high strength, extra durable, extremely lightweight construction materials. Preceded by the IT and software revolution, Nanotechnology and Science are expected to usher a new paradigm shift in all spheres of technology including infrastructure and construction. In a nutshell, Nanotechnology is today recognised as a revolutionary technology that can help address key needs relating to energy, environment, health, shelter and agriculture in developing countries. It has been estimated that \$ 1 trillion worth of products worldwide will incorporate nanotechnology in key functional components by the year 2015. To achieve this goal, the Govt. of India has launched an ambitious mission mode programme with a budgetary allocation of Rs. 1000 crore under which several major research initiatives have been initiated. Nano-modification of cement is an emerging field. Synthesis and assembly of materials in the nano-meter scale offers the possibility for the development of new cement additives such as novel super-plasticisers and nano particles. It is now possible to manipulate the fundamental structure of cement phases to control concrete properties, performance and durability. Nano-modification also provides crucial information for predicting the service life of concrete more accurately and insights on improving it further. Nanotechnology may have its biggest impact on the medical industry. Patients will drink fluids containing nanorobots programmed to attack and reconstruct the molecular structure of cancer cells and viruses. There's even speculation that nanorobots could slow or reverse the aging process, and life expectancy could increase significantly. Nanorobots could also be programmed to

perform delicate surgeries such nanosurgeons could work at a level a thousand times more precise than the sharpest scalpel. By working on such a small scale, a nanorobot could operate without leaving the scars that conventional surgery does. Additionally, nanorobots could change your physical appearance. They could be programmed to perform cosmetic surgery, rearranging the atoms of human body to change his ears, nose, eye color or any other physical feature he wish to alter.

(6) Human health : The important and major area of nanotechnology research is in human health. Humans are living longer lives. In the previous centuries, men and women expected to live to 48 and 51 years respectively. But life expectancy is now 74 and 80 years and could be significantly longer with anti-aging advancements currently being developed. At the same time, 30 new highly infectious diseases have been discovered in the last 20 years. These diseases account for 30% of the deaths worldwide and include HIV/AIDS, Ebola and the Avian Flu. HIV/AIDS, the most critical threat, has killed 22 million and infected 42 million. In 2003 roughly 5 million people became infected worldwide. AIDS according to a United Nations study is increasingly becoming global as it spreads rapidly to Eastern Europe and Asia. Cancer kills over 500,000 people and 1.5 million are diagnosed annually in the United States. According to the World Cancer Report, there could be a 50% increase to 15 million new cases in the year 2020 primarily attributed to an aging population worldwide. Recent nanotechnology research is making tremendous progress in the medical field. Some of the nanotechnology applications in the arena will be inexpensive and rapid diagnostics, new methods of drug delivery, and faster development of new drugs. Some longer term and even more powerful nanotechnology solutions will repair DNA and cellular damage and customize drug therapy. In the Expert Opinion essays below, longer-term applications of advanced nanotechnology to health and longevity are explored [23].

(7) Environment & Climate : There is an ever-increasing demand for natural resources and living space for humans, while toxics continue to build up in our water and soil. Biodiversity is being destroyed worldwide with 7 million hectares of forest being lost annually. Half of our world’s forests and a quarter of our coral reefs are gone. Biodiversity decreases each year, with increasing threats especially to the oceans. Damage to the atmosphere’s ozone layer has slowed but a hole still remains. Many believe that man-made greenhouse gases are causing disruption to the planet’s climate, a process popularly termed ‘global warming.’ Proposals to correct this are expensive and unlikely to be followed by developing nations who see economic advance as more urgent. Nanotechnology will provide solutions through precision pollution monitoring using nanosensors, lower energy needs due to lightweight strong materials, and reducing the use of harsh cleansers through the applications of nanocoatings to surfaces. A more advanced nanotechnology solution will be building our products with molecular-level precision through the use of productive nanosystems, resulting in virtually no chemical waste.

Table 1 : Comparison of nanotechnology with ideal technology model.

S. No.	Major Problems of human beings in the Society	Ideal technology solution	Nanotechnology solution
1	Nutritious food for everybody	Basic feature of Ideal technology	Possible to solve using nanotechnology in agriculture.
2	Clean drinking water for everybody	Basic feature of Ideal technology	Possible to solve using nanotechnology filters
3	Renewable energy at affordable cost	Basic feature of Ideal technology	Possible through nanotech solar cells & battery technology
4	Quality and long lasting cloth	Basic feature of Ideal technology	Possible to solve using nanotechnology in fabrics.
5	Affordable Shelter to every body	Essential feature of Ideal technology	Possible to solve using nanotechnology in construction.
6	Health care	Basic feature of Ideal technology	Possible to solve using nanotechnology in medicine.
7	Environment & climate	Essential feature of Ideal technology	Possible to solve using nanotechnology as clean technology.
8	Sustainable technology for every body	Essential feature of Ideal technology	Due to its fundamental nature, nanotechnology is sustainable for everybody and everywhere.
9	Comfort life	Luxurious feature of Ideal technology	Possible to solve using nanotechnology in customer products & ability to upgrade all other technologies.
10	Space travel	Luxurious feature of Ideal technology	Nanotechnology supports low cost & efficient space travel.
11	Life span expansion	Desirable feature of Ideal technology	Bio-medical applications of nanotechnology supports life span expansion.

(8) Sustainable transportation, & information communication technology for everybody: Nanotechnology will become a key enabling platform technology for next generation transportation systems to develop more efficient and lighter materials for automotive and aircraft systems, High performance tyres for automobiles, efficient and non-platinum based catalytic converters. Novel and more efficient fuel and power sources etc. There are currently many people who lack widespread access to communications, information, basic technology services and tech resources. This lack of access creates insurmountable barriers to education, democratization, and economic growth. The use of nanotechnology applications will drastically reduce the cost and increase the performance of memory, displays, processors, solar powered components, and embedded intelligence systems. It will also enable networks to be self-configuring. These improvements would create a pervasive computing environment that would promote greater global communication, cross-cultural understanding and cooperation [17, 18].

(9) Nano-factories : Nanofactories-manufacturing systems that work on the atomic & molecular scale-are gradually moving from science fiction to science fact and one day could be used to build all types of items such as drugs, semiconductor chips and even cell-sized robots that patrol the human body. The first step would be to develop nanoscopic machines, called assemblers, that scientists can program to manipulate atoms and molecules at their will. In order to make molecular manufacturing to be reality, one would need trillions of assemblers working together simultaneously. It is predicted that assemblers could first replicate themselves, and then build other assemblers. Each generation would build another, resulting in exponential growth until there are enough assemblers to produce objects. Trillions of assemblers and replicators could fill an area smaller than a cubic millimeter, and could still be too small for us to see with the naked eye. Assemblers and replicators could work together to automatically construct products, and could eventually replace all traditional labor methods and create a method of three dimensional material/device printer. This could vastly decrease manufacturing costs, thereby making consumer goods plentiful, cheaper and stronger. Eventually, such 3D printers allow us to replicate anything, including diamonds, water and food. Famine could be eradicated by machines that fabricate foods to feed the hungry [19, 20].

Table 2 : Comparison of ideal technology and Nanotechnology in terms of their characteristics.

S.No.	Ideal technology Characteristics	Conventional Technology	Nanotechnology
1	General purpose technology	Special purpose technology	General purpose due to its ability to provide solutions in many fields.
2	Self-directed & self controlled & self regulated	External control by human being is required in many cases.	Can be Self-directed & self controlled & self regulated by molecular programmed nano-machines & nano-factories.
3	Easy, simple, quick & user friendly	Most of the conventional technologies are simple, easy & user friendly.	Possible to get easy, simple & quick solutions to many problems.
4	Scalable	Not all	Scalable depending on application.
5	Omni-potent	Not applicable except mobile technology	Partially applicable for some areas.
6	Exploring new opportunities	Limited opportunities	Unlimited opportunities.
7	Infinite potential for further development	Finite potential	Infinite potential due to its general purpose nature and ability to solve fundamental and other problems of society.
8	Maintain clean environment	Failed drastically	This is major advantage of nanotechnology.
9	Infinite business opportunities	Limited business opportunity	Infinite business opportunities due to multiple field applications.
10	Adaptive nature	Partially possible	More or less possible
11	Manipulate the fundamental nature of matter	No	Yes due to atomic level & molecular level manipulation.
12	In-expensive & self reliable in terms of resources	No	Yes due to its fundamental nature.
13	Ubiquitous	Only few like mobile computing technology	Yes due to its fundamental general purpose nature.
14	Affordable to everybody	No	Yes in most cases due to its fundamental nature.
15	Solve basic needs	No	Yes by using only one technology.
16	Provide comfort	Partially	Yes due to its potential to solve real world problems to provide luxury to human life.
17	Equality	Partially	Yes irrespective of various affecting factors.
18	Automation	Partially	Possible in almost all application fields.
19	Immortality	No	Yes in long time span.
20	No side effects	No	Yes based on careful handling.

(10) Space-travel : The challenges facing by humanity on the earth are the result of our heavy demand on various resources and raw materials. Many of these materials can be found in space but the expense to extract them is a major barrier. In addition to cost, other obstacles to developing space are safety, reliability, and performance. According to the National Space Society there are four reasons why we need to pursue space exploration and colonization. These reasons—survival, growth, prosperity and curiosity—all point to the fact that we, as a species, want more room. Space exploration will give us a means to monitor the health of our planet, a source of resources and an outlet for our

imagination. Nanotechnology will create the ability for humans to operate in space more safely. Applications where nanotechnology will impact space exploration are propulsion fuels, coatings, structural materials, smart uniforms, electronics and life support environments. These will be more efficient, stronger, self-healing and lighter than what is currently available.

(11) Extended life span : There are two ways in which nanotechnology may be able to extend our lives. One is by helping to eradicate life-threatening diseases such as cancer, and the other is by repairing damage to our bodies at the cellular level--a nano version of the fountain of youth. The most exciting possibility exists in the potential for repairing our bodies at the cellular level. Techniques for building nanorobots are being developed that should make the repair of our cells possible. For example, as we age, DNA in our cells is damaged by radiation or chemicals in our bodies. Nanorobots would be able to repair the damaged DNA and allow our cells to function correctly. This ability to repair DNA and other defective components in our cells goes beyond keeping us healthy: it has the potential to restore our bodies to a more youthful condition. The extension of the human lifespan could be facilitated through the removal of a substance called lipofuscin from certain types of non-dividing cells, including the brain, heart, liver, kidneys and eyes. Lipofuscin is a metabolic end product that accumulates primarily within lysosomes (the garbage disposal organelles within cells). It's thought that when lipofuscin accumulates to certain levels, it begins to negatively impact cell function, which eventually manifests in many age related conditions. Aubrey de Grey et al. have proposed that soil bacterial enzymes might have the capacity for degrading lipofuscin. It is proposed that humans might live as long as 1,000 years under the appropriate rejuvenative therapies. In 30 or 40 years, we'll have microscopic machines traveling through our bodies, repairing damaged cells and organs, effectively wiping out diseases. The nanotechnology will also be used to back up our memories and personalities. And in 35 to 40 years, we literally will be immortal [21]. Table 1 compares the possible ideal technology solutions with nanotechnology solutions for solving major problems of human being in the society.

The system properties like - General purpose technology, Self-directed & self controlled & self regulated, Easy, simple, quick & user friendly, Scalable, Omni-potent, Exploring new opportunities, Infinite potential for further development ; the environmental conditions like - Maintain clean environment, Infinite business opportunities, Adaptive nature, and No side effects nature of ideal technology are also can be realizable using nanotechnology for various products/services. The input properties like - Manipulate the fundamental nature of matter, In-expensive & self reliable in terms of resources, Ubiquitous, Affordable to everybody ; the output conditions like – Solve basic needs, Provide comfort, Equality, Automation, Immortality of ideal technology model also realizable to certain extent using nanotechnology as shown in Table 2.

7. CONCLUSION

The various properties of Ideal technology are identified, classified and analysed in the form of a model. A suitable possible practical technology is identified to realize most of the properties of Ideal technology. The characteristics and opportunities of nanotechnology are identified and analysed and the possibility of realization of Ideal technology using nanotechnology. It is found that nanotechnology being a general purpose technology can provide solutions almost all basic and high level problems like hypothetical Ideal technology. Hence nanotechnology is future technology expected to solve all problems of human beings and elevate the human life to such a comfortable level towards ubiquitous and omnipotent like God.

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