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THE IMPACT OF THE DEVELOPMENT OF NANOTECHNOLOGY ON THE SPACE ECONOMY

Ayşe Meriç YAZICI*

Abstract

Since the existence of mankind, with the struggle for survival in nature the struggle with each other, the competition, the effort to make its presence felt until the last, has begun to take a quick step from locality to globality with the existence of reason and logic. This fast-paced movement has shaped the world of thought and imagination and designed the present and future with the traces of the past. It is an unwanted truth to see that the needs are infinite and the increasing dissatisfaction is actually the end of human being's own preparation. The effort of self- recognition, the increase of basic needs, the inadequacy of natural resources, and the uncontrollable ambitions have left their place to a very different image. The crazy projects developed by human beings in the 21st-century science and technology storm that we are in have led to the investigation of the structure of human genes, the creation of digital information society and the emergence of nanotechnology which will create a "revolution" in every area. These technologies will set the stage for the "age of the space economy" and bring our world to a very different dimension, perhaps transcending the human imagination world.

Keywords: Nanotechnology, Carbon Tube, Space Elevator, Space Economy, Space Mining.

1. INTRODUCTION

Medieval human beings are known as a period of suppressing the creativity and questioning of the brain. The period of enlightenment that started with the inclusion of Galileo, Leonardo da Vinci, Newton and Kepler, which completely changed the perceptions of the whole social, political, cultural and economic structure of Europe in the process of transition from centuries of belief depression to the years of reason and logic, social life has changed in a serious way.

In this period where human rights are important, progress in the field of science and technology has progressed rapidly. At the point where we come today, every field that developed itself is universally revealed by Works that will create very successful works for humanity in the future. Since consciously associating with the environment, humanity has tried to unravel the tiniest building blocks that make up the universe and the secrets of the eternal depths of space XXI. futurists who claim to have a wider and more comprehensive age than the industrial revolution of the twentieth century think of the extreme level of science and the space age.

With the understanding and widespread acceptance of this theory of science, it is necessary to find out the causes of the phenomena in nature, to find out their connections with each other, to generalize them, to theorize them, to predict the events after the help of this theoretical information, and when and how we should not ignore the fact that the history of science and technology is based on a common heritage and universal concept of humanity, the development process is based on positive information, and the history of written science is based on cultures such as Egypt, Mesopotamia, India, and China.

Science is very complex and each field has a different definition of its own. Scientific methods are phenomena that have evolved to help people to tell the truth and to understand the world. We can derive the knowledge from the real experiences through the rather conscious experience.

Science (Kaymakçı, 2013,24-25); it is a concept that each field has different definitions in terms of its own system. For scientists, for example, a processor a satisfying endeavor that they are to devote themselves to; provision of national security for the military; means of increasing the profitability of enterprises in terms of economy, for undeveloped countries, hoping to get rid of poverty; for historians, the factors that have developed modern society; for the socialists, to build the world on equality and justice; for the liberals, a gear of the industrial wheels; for the environment, a system that disrupts and repairs the ecosystems; for the

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artists, an opposing force trying to destroy the mystery that they trying to bring out. If we take a general framework of all these definitions, the broadest definition is science; is an activity of constant understanding and clarification that analyzes our expectations of existence and existence.

We use technology in all areas of everyday life. (Education, management, banking, agriculture, business, transportation etc.) We always say "we are following technology". But the point that can not be understood here is, what direction do we follow or which direction should we follow? When we say technology, the meaning understood by all of us is concentrated only at a certain point. This point is the hardware of the technology. However, software is also the theoretical dimension of technology. These two concepts need to be examined within the framework of the theoretical dimensions of technology (İşman, 2012,207-208).

A whole new level of 3D and 4D prints, which will have a major impact on society, the economy, the ruling the business world and the global communication environment of the public, is now showing a new technological horizon. Here, the programmable issue, defined as 4D edition, will have economic, environmental, geopolitical and strategic effects of 3D printing, while offering new and unprecedented capabilities in transforming the digital world of the virtual world into a physical object of the material world (Campbell, 2014,1)

The information revolution is happening today when the technology changes every 50- 60 years. Within 60 years, mankind has gone to a manufacturing method for designing materials at the size of a millimeter to create new molecules at an atomic level and has met with nanotechnology.

2. DEFINITION OF NANOTECHNOLOGY

The nano is a unit of measure, derived from the Greek word "dwarf" meaning Nanos. One is a billionaire, one millionaire is millions and one micron is one.

The nanometer is a measure of 10 to9 meters in size.it is known that the size of atoms is about 0.1 nanometers, about one nanometer for a biological cell diameter, about 2.5 nanometers for a DNA molecule, and about 100.000 nanometers for a hair cell. If we define it in the simplest way, if we accept a nanoscale baseball ball, the world is one meter in size.

Nanotechnology is the design and characterization of materials, systems, and devices by controlling their shape and dimensions at the nanoscale. In other words, it is the art and science of creating useful and different materials by manipulating atoms and molecules one by one and rearranging them by changing the sequence of atoms that make up the molecules. It's a kind of alchemy. For example, by playing with the order of the atoms in the glass molecules and the molecules inside, folding the glass and putting it into the grave and turning it into a new material.

As another example, one of the basic substances in the environment is carbon, and it is the basic building block of all beings. It consists of a carbon atom in coal. The diamond is also made up of carbon atoms. The only difference between these two substances that come from the same atom is that the carbon atoms in the molecules that bring the coal and apple to the square are connected to each other by a different sequence. According to nanotechnology, if we can arrange the arrangement

of the atoms within these coal molecules and the arrangement of the atoms inside the diamond molecules, we can turn the coal into a diamond. This is the simplest definition of nanotechnology.

The American Foresight Institute's definition of nanotechnology is the name given to an emerging group of technologies for controlling the structure of matter to produce new materials and devices with useful and unique properties (Ramsden, 2011).

Examples of the use of nanotechnology in the early periods of medieval churches are church windows. Gold nanoparticles produce glass ruby color. These church windows, the first example of nanotechnology, were able to control the size and shape of nanoparticles by medieval artists and use two metals, gold, and silver, to produce other metals. Similarly, nowadays, scientists have found that engineers only take small quantities of a nanoparticle precisely positioned to change the physical properties of a material (Deal, 2012).

Norio Taniguchi from Tokyo University of science is the first to use nanotechnology. "Nanotechnology, in general, is the process of an atomic atom or molecule processing, separation, association and degradation", published in a 1974 paper. Prior to the emergence of the nanotechnology term, Richard Feynman, who expressed his opinion as an idea, began the nano- level thoughts with his speech "There is More Below" in 1959. Feynman emphasized in his speech that new tools are needed to be able to control atoms and molecules. He also stated that weaknesses such as Van der Waals would increase the importance of gravity reduction at the atomic level (Keiper, 2013,18-19).

Another idea of nanotechnology is K. Eric Drexler, in 1986 he tried to prove that nanorobots could from the atoms of matter we wanted in the "Creation Engines: The Approach of Nanotechnology" and Nano

Systems: Molecular Mechanisms, Production and Calculation" books and tried to reveal the effects of these technologies. The invention that enables the development of nanotechnology is the discovery of the Scanning Tunneling Microscope. This microscope can change the positions of atoms. In 1986, it found buckyball (large cell) from the class of fullerenes (compounds made by carbon atoms). A molecule is so named because it resembles a soccer ball. Subsequently, in 1991, carbon nanotubes were found by Sumio Iijima. As a result of the US investment in nanotechnology in 2000, nanotechnology research began in many countries of the world. Economists describe nanotechnology as a new industry and information revolution that strikes the 21 st century. In a few years, the level of development of the countries will be indicative of the work that the country has done in nanotechnology and the products it produces.

Today, nanotechnology is used in many fields such as computer and data storage, production, health and medicine, energy and environment, transportation, national security, material science, biotechnology and agriculture, aviation, space research.

2.1. Carbon Nanotubes

In 1991, a Japanese researcher, Nanio, discovered by Sumio Iijima, is a nanometer consisting of atoms such as carbon. A nanotube consists of one or more continuous cylindrical crusts of graphite plates. Each shell is made up of carbon atoms coming from a hexagonal network without any edges. A nanotube is thought of as a microcrystal in the form of a graphite tube and has hexagonal pentagons at both ends. The intermediate layer weight is typical of 0.34 nanometers and turbostratic graphite. The position of each layer there is not correlated to another (Ebbesen, 1996,26-27).

Outer diameter is small, hollow, long, thin and much stronger than steel (200 times more). A process is being developed to make carbon nanotubes simpler, safer and less costly in research.

NASA has licensed its patented technology to produce these high- quality "single-walled carbon nanotubes" in Idaho, Idaho Space Materials (ISM) in Boise, Idaho. Carbon nanotubes based on the creation process are used by researchers and companies working on products that can affect almost every aspect of life, such as ceramics and polymers and new materials. Polymers are also found in the foods we eat or in plastic, for example in proteins and starches". ISM believes that carbon nanotubes will be a building block for a better world. This will enable people to live a better life with a wide range of uses, such as medical advances, fuel cells, video displays, solar batteries, and other applications.

Many years later, the manipulation of Casimir forces has suggested that spacecraft can lead to a repulsive system for interstellar travel, and this will be achieved by the development of carbon nanotubes. The main idea is that if the vacuum can take advantage of the fact that it is a reservoir of energy, zero-point energy will have space travelers access to an unlimited source of energy in the coming years. What is needed for this is a kind of propulsion system that collects from the energy vacuum. The space elevators that will be constructed with carbon nanotubes that will carry a human, cargo, satellites, and possibly space vehicles to earth orbit, which NASA continues to operate, will also be provided through the use of this technology.

2.2. Space Elevator

Designed by Constantin Tsiolkovsky, considered to be the pioneer of Russian rocket science, this immense structure is well known to be the most magnificent work of the 21 st century in 2050 (Dinçer, 2003,45).

The design will consist of a marine anchor floating on one end and a carbon nanotube ribbon connected to another geosynchronous (GEO) satellite. It will be connected to the orbit of the earth from the Earth's surface with ropes to be physically connected at an altitude of 36.000 km. This cable to be made from graphene and diamond nano yarns should be resistant to tons of loads. Today, it is estimated to cost around $ 100 pounds using the space elevator, while costing about $ 50.000 per pound to haul freight. The application of carbon composite nanotube cabling only when applied to the elevator model may have a great influence on the quality of life in the world.

The Earth's rotation will be exploited around the equator to remove the loads that are far from the Earth's surface. Possible numbers are 10 and will have the capacity to carry more loads than 20 tones per day (Skip and Penny and Swan, 2012,15-16).

In this elevator where space tourism will be started from May of 2068, the internal structure consisting of capsules has a capacity of 30 people in total. He will be able to travel to space tourism for less than $ 1000. It is expected that this giant structure, which is expected to be made 10 times in total, will be finished by the year 2099. The practicality of this mega- structure includes some threats against the economy. It is necessary to take into consideration the threats such as meteorites, lightning strikes, remnants of previous space studies, low orbit objects (LEO), inhibition of carbon emissions, storms, intense electromagnetic fields, radiation, damage caused by small meteorites and aircraft crashes. If one of the ropes is broken, there are two possibilities. The first one will fall quickly, which is a high possibility, and the other is to make at least 8 rounds around the world (Smitherman, 2000,24-25).

3. THE EFFECT OF SPACE MINING ON THE SPACE ECONOMY

The rapid growth of the human population, the reduction of natural resources and the growth of the economy are now unable to meet the demands of people all over the world. According to the Global Footprint Network (https://www.footprintnetwork.org/our-work/ecological.footprint/), 2 worlds will be needed for the living resources to be used in 2050 and 1.7 worlds will be needed for the need for natural resources.

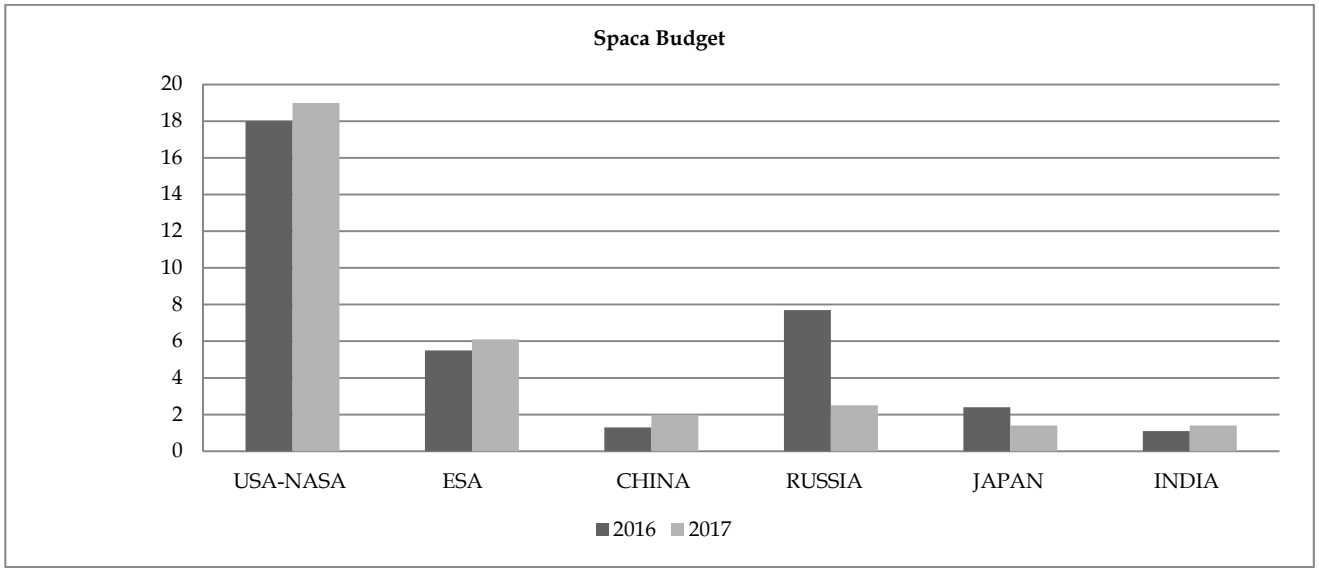
Today, asteroid mining is very important in this sense. Asteroids are primitive materials that are rich in resources from the creation of our solar system, financial and life-critical sources. It is estimated that there are approximately 60 million asteroids in our solar system known between Mars and Jupiter. The first asteroid displayed by NASA's spacecraft was 200 years ago. As the asteroid belt grows and thickens every year, these asteroids seem to be getting closer to the world. These are called "near world asteroids" (Geniş Açı Dergisi, 2017).

According to a study at Caltech University in 2012 (Keck Institute for Space Studies, 2012), the cost of catching an orbiting an asteroid of about 500 tons and a diameter of 7 meters is about $ 2.6 billion. It is about 175 times the annual global platinum output of a single Platinum Rich asteroid constitutes 1.5 times the known world reserve.

Another asteroid, the Dionysus asteroid, has an estimated profit value of $ 2.62 trillion. The composition in the asteroid is nickel, iron, cobalt, and water. Considering the world's regular return between September 3, 2023, and May 19, 2059, it was observed that the asteroid progressed at a speed of about 1.5 km and a speed of about 8.2 km/s. This fact makes it a difficult target for any research mission. Near- Earth asteroids hold an estimated 2 trillion water. This water can also be used for life support functions and to be refined into rocket propulsion (https://www.planetaryresources.com/missions/arkyd-301/).

Planetary Resources and Deep Space Exploration the Luxembourg government also participated is this space mining, funding $ 223 million. Projects to be carried out by Luximpulse, the official space program of Luxembourg, have taken an important step in space mining. With the billion dollars invested by many countries in the space economy, the share of economic contribution of space mining is high.

The budgets of the space economy according to the countries are according to the space report of 2016- 2017; (The Space Report).



Graph 1 : Space Report 2016-2017

This statistic is the dollar-denominated total budget of the leading countries with the highest government spending on space programs between the years 2016- 2017, up to 2026 by the space economy. Global government spending rose from $ 72.7 billion in 2016 to $ 76.2 billion. Government spending accounts for 19.9 % of the global area economy. This is a 20.3 % decline in 2016. We can link this to the ongoing growth of commercial growth. On the other 20 % in the local currency due to budget cuts. Japan and India have invested more than $ 1 billion in space programs and have taken their place among countries that have invested $ 3.5 billion in an unmanned space travel.

3.1. Space Law

The first steps were taken with the work of the space law "Space Committee for the Peaceful Uses of Outer Space (UNCOPUS)". Space law with these studies; that no nation could be found in space and in the celestial bodies of the earth in the absence of land, the free access of nations to space, and that all nations could freely conduct scientific research in space. A collective use regime was established on the basis of the freedom of use and the principle of equality of states, similar to the open sea regime in space, with the 1966 "Treaty of the Principles of State Activities for the Exploration and Use of the Moon and Sky Fields (Outer Space Treaty)". In addition, space including the Moon and other celestial objects, which are considered to be the common property of mankind, sovereignty claims, use occupation or other means have been left out of national sovereignty. (Outer Space Treaty, provide II) (Bozkurt, 2013,14-14).

The Committee on the Use of the Outer Space for Peaceful Purposes (1959), in its form for the development of the International Space Law, has developed a number of scientific researches, including freedom of exploration, responsibility for damage caused by space objects, spacecraft and astronaut safety, weapons control, space activities and environment and outdoor use of natural resources and the resolution of disputes. The aim of the agreement emphasizes the importance of promoting international cooperation and emphasizes the commitment to increase to the prosperity of all countries and humanity (Listner, 2011,62).

It is an indication that the moon and other celestial bodies are left to a community and that the right of property in the space where the right of space ownership is to be avoided is still open to debate. In comparison, a draft treaty regulating the activities of the objects at that time was prepared in 1979 for the world states. According to this draft, known as the Moon Agreement, the jurisdiction of space activities would be left to the international community and the right of property would be prevented. This draft has not been accepted by the USA, Russia, China, Japan, and India. Kazakhstan, Lebanon, Mexico, Pakistan, Peru, the Philippines, Uruguay, Chile, Morocco, Belgium, the Netherlands, Austria, and Australia are among the countries that accept this agreement. According to the Outer Space Treaty, which entered into force on October 10, 1967, space explorations must be done by ignoring the interest of all the countries of the world. Accordingly, countries will be free to use exploration and mines, but will not have the right to occupy and territory in space and the right to sovereignty. It also limits the use of space mines for peaceful purposes and the use of space for military activity by countries.

4. CONCLUSION

From the past to the present day, human beings have innovated for their own needs, designed tools, and utensils, and thus have taken the steps of technology. Over time, these developments have enabled us and new generations to live in a different world. There is no doubt that this different world has a share of computer and information technology.

The reality of quantum theories and the fact that an unbelievable world is waiting for us in the lower world has taken its place in our lives today. "Nanotechnology", which we call the technology revolution, needs to see us in the forefront of a technology adventure.

Many countries have invested billion dollars in this adventure shows how serious it is to be the development of a country will be measured by the investments and products produced by that country's nanotechnology.

The world is among the global technological revolution, depending on developments in the fields of nanotechnology, biotechnology, materials and information technology. It is no doubt that significant changes will take place in social and social areas until 2020. Examples of these developments include cheap solar energy, rural wireless communications, quantum cryptography, wearable computers, improved diagnostic and surgical methods, green production and hybrid vehicles.

One of the oldest dreams of mankind continues to be carried out with various and ambitious projects aiming to go out and prospect for the future. In this context, the European Space Policy is making various legislative and legal regulations with a very radical and comprehensive policy. It is also a condition that should not be overlooked that competition policy will increase due to the contribution of space policy.

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