Nanotechnology in Daily Life

Zeynep Şevval Kara

Astronautical Engineering

110210163

Buğrahan Adalı

Electronics and Communication Engineering

040210228

Betül Çaylak

Urban and Regional Planning

020210249

English 201A

Dilek Öztürk Yağcı

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Thesis statement: Nanotechnology, which is the creation and manipulation of minimal materials and devices, transforms human life through various innovations, mainly in food-agriculture, electronics, and medicine.

I. Food And Agriculture

A. Food

1. Food Packaging and Protection

a. Food packaging with nanomaterials (Liu, et al., 2020, p.1716)

b. Food protection

2. Food Improvement and Quality Control

a. Nano additives

b. Food monitoring and safety

B. Agriculture

1. Plant Health and Productivity

a. Nano fertilizers

b. Plant protection products:(Mittal, et al., 2020, p.21)

2. Soil Health and Environment

a. Soil improvement

b. Environmental and Health Impact: (Khan, et al., 2022, p.4)

II. Electronics

A. Electronic Devices

1. Nano Transistors

a. The use of nano transistor technologies

b. The benefits of nano transistors for smaller and more powerful devices

2. Nano Electronic Components

a. The use of nano-sized components in electronic devices (Salem & Abu-Lebdeh, 2012, p.223, Chapter 9)

b. Its role in the development of faster and more efficient electronic devices

B. Computer Technologies

1. Nano Chip Design

a. Features and advantages of nano-sized chip design (Parekh et al., 2020, p.1863)

b. The use of nano chip for higher processor speed and lower power

2. Display Technologies

a. Screens developed with nano materials (Ishida et al., 2023, p.28)

b. The impact of nanotechnology in the production of thinner, brighter and energy efficient screens

III. Medicine

A. Nanotechnology And Drug Development

1. Nano drug carriers

a. Use of nanosized drug carriers

b. Nanocarriers that facilitate the delivery of drugs to targeted areas (Patra et al., 2018, p. 4)

2. Drug Delivery Systems

a. Features of nanosized drug delivery systems

b. Nanosystems that provide controlled and long-term release of drugs

B. Medical Imaging And Diagnoses

1. Nano-Sized Contrast Agents

a. The role of nanosized contrast agents in medical imaging (Thurman & Serkova, 2013, p. 2)

b. Nano-agents that increase the sensitivity of imaging techniques

2. Medical Devices Developed with Nanotechnology

a. Some medical devices developed with nanotechnology

b. Use of advanced medical diagnostic and monitoring devices (Pallotta et al., 2018, pp. 3-4)

With the rapid progress of technology today, nanotechnology has started to affect people’s daily lives in many areas. These effects mostly appear in aspects that make human life easier and lead to major changes in various areas. Nanotechnology provides faster, more practical, and more accurate results than the ones provided by human hands. Moreover, nanotechnology can be adapted and used along with other technologies in many fields, such as the environment, energy materials, and manufacturing. Nanotechnology, which is the creation and manipulation of minimal materials and devices, transforms human life through various innovations, mainly in medicine, food-agriculture, and electronics.

The influence of nanotechnology in the field of food and agriculture is undeniably substantial, considering it is widely and increasingly used in the field over the last years. To begin with, nanotechnology has revolutionized food field by enhancing its packaging, protection and improvement along with its quality control. For instance, food packaging can benefit from the application of nanoparticles to strengthen its mechanical strength, improve its gas barrier, repel more water, and have antibacterial and scavenging capabilities. Also, as Liu, et al. states, it is discovered that fruits and vegetables has their shelf life effectively sustained and the quality of the products has been maintained during storage with the utilization of nanotechnology into preservation strategies (2020, p.1716). It is evident that usage of nanotechnology in the food packaging and protection industry is very beneficial since nanotechnology enhances self-life considerably. In addition, the effects of nano additives on food improvement, and food monitoring on quality control is indisputable. Nano-additives, derived from nanotechnology, are used in food production to enhance qualities like flavour and texture, reduce fat, and preserve nutrients, thereby improving nutritional quality and shelf life. Additionally, nanomaterials are employed in food quality testing methods, offering advantages like ultra-sensitivity and selectivity, and are used in various devices to detect contaminants, revolutionizing the speed and accuracy of food regulatory agencies. Thus, nanotechnology in the form of nano additives and food monitoring methods are exceptionally advantageous for food improvement and quality control. The effect of nanotechnology in the field of agriculture also cannot be taken lightly, knowing it has an immense impact on plant health, productivity, soil health and environment. To begin with, Nanotechnology has revolutionized agriculture by creating nanoparticles (NPs) for plant protection, nano-fertilizers for targeted nutrient delivery, enabling plant gene transformations for desirable traits, implementing nano sensors for early disease detection, and using nano devices for crop genetic manipulation, all contributing to enhanced plant health and productivity. As Mittal, et al. states, in order to diminish the environmental stress and election of high yielder plant features, sensitive sensors based on nano biotechnology can track chemical signals in real time, and it is used to protect the plants with the help of NPs (2020, p.21). Clearly, nanotechnology is revolutionizing agriculture by improving plant health and productivity through targeted nutrient delivery, early disease detection, and precise genetic manipulation. Also, nanotechnology enhances agriculture via nano-bio-fertilizers, and nanomaterials, improving crop production, soil quality, and plant nutrient availability. According to Khan, et al., one of the best methods for improving plant productivity, resource efficiency, and pollution control has been found to be the use of NFs (2022, p.4). Evidently, nanotechnology, through the use of nano-bio-fertilizers and nanomaterials, is playing a crucial role in improving crop production, soil quality, and plant nutrient availability, thereby enhancing resource efficiency and pollution control in agriculture. Moreover, it is obvious that nanotechnology is a valuable tool in order to improve agriculture. All things considered, nanotechnology has a significant role in food and agriculture industry based on its revolutionary effects on food packaging, protection, improvement, and control, plant health, and productivity, soil health and, environment. It is very clear that, if used correctly, nanotechnology has the potential to change and improve many systems in the field of food and agriculture.

Secondly, nanotechnology brings positive developments in the field of electronics with the innovations it offers to human life. Initially, at the beginning of these developments in nanotechnology, there are developments in the field of electronic devices, such as energy efficiency and the production of high-performance electronic devices. For example, with the developments of the twenty-first century, nanotransistors have an important position in the scientific arena. The development of nanotransistors is important for the formation of smaller devices, with which the efficiency of the device can be increased. In this view, nanocomposites obtained by distributing ceramic and clay materials into a polymer matrix can increase the demand for commercial battery materials by providing mechanical properties and an electrolyte-electrode interface with higher ion transfer when compared with mainstream polymers. Salem et al. state that nanocomposites are obtained by dispersing ceramic and layered clay-type materials into the polymer matrix, indicating that new hybrid electrolytes can increase the demand for commercial battery materials by providing a higher ion transfer number, up to ten times higher ionic conductivity, mechanical properties, and electrolyte-electrode interface compared to the host polymer. (2012, p.223). This research output reveals clear information about the potential of polymer nanocomposites to improve their electrical properties. Nanotechnology makes many contributions in the field of computer technology. At the beginning of these contributions, thanks to the use of nano-sized transistors, computers increased their efficiency in areas such as memory and energy. Also, it is claimed by Parekh et al. that the "Single Electron Transistor" (SET), which is one of the advantages of the advancing technology, is more efficient compared to the traditional MOSFET technology. The MOSFET presents a number of disadvantages, such as heat generation and power loss when transmitting, but the SET does not accommodate these inefficiencies. The SET is found in many places in human life, such as microwave detectors, logic designs, electrometers, and memory. (2020, p.1863). The fact that SET has such wide areas of use is an indication of how much nanotechnology affects human life and how much it is involved in it. Nanotechnology has also spread to an influential field in display technologies. Along with the development of nanotechnology, active matrix (AM) has pioneered the development of nanoLED displays by attracting the attention of prominent brands in display technologies. These technological breakthroughs have mobilized many companies that want to offer more advanced imaging devices. Ishida et al. highlight that in recent years, nanotechnology has paved the way for the development of active-matrix (AM) nanoLED displays. Many brands, such as TCL and Samsung, have started to produce advanced imagers using these developments. (2023, p.28). These innovations are not limited to image quality alone but also indicate that we are entering a new era in different areas, such as the introduction of thinner screens and, in addition, increasing energy efficiency. All things considered, although nanotechnology is still not involved in every part of life, it is developing and spreading further. In the sense of electronics, that is, it shows its effect on important points such as imaging technologies or nanoscale transistors and chips.

Thirdly, the impact of nanotechnology on medicine is huge as it is directly used in many areas of medicine. To begin with, Nano drug carriers and Drug Delivery Systems are the most important of these possibilities for advances in medicine. For example, nano drug carriers help reach the desired area easily and reliably. In this regard, the methods by which nanomaterials are used for medical purposes and the nanomaterials that facilitate transportation to the region can be mentioned. Nanomaterials are used to facilitate the transport of drugs, increase their effectiveness, and sometimes as an imaging method. Also, it is claimed by Patra et. al. that the use of nanomaterials as drug delivery systems and targeting of drugs falls into two main categories: active and passive methods. In the active method, molecules are bound to the drug delivery system, and these molecules bind to the receptor in the target, allowing the drug to be specifically targeted. In the passive method, the drug carrier complex is directed to the target site depending on factors such as body temperature, acid-base level, and shape. Drug delivery methods realized through nanotechnology are generally focused on cancer (2018, p. 4). Surely, if the combination of nanomaterials and technology in medicine continues to improve, it may even be used as a treatment method for diseases such as cancer rather than just imaging cancer and delivering drugs. In addition, the systems technology of drug delivery systems with nanotechnology is effective in terms of the functioning of the systems. For instance, the properties of nanoscale pharmaceutical delivery systems may be beneficial or may cause some problems. Despite the positive features of early diagnosis and follow-up of the disease, there are doubtful approaches about their toxicity in the long term. Also, thanks to nanosystems that enable controlled and prolonged release of drugs, planned and constant releases can be made. The systems will be useful if safe studies are carried out by going through gradual studies and considering the pros and cons of these systems. Second, Medical Imaging and Diagnostics are one of the most obvious and useful impacts of nanotechnology in the medical field. To begin with, Nanoscaled Contrast Agents and Medical Devices Developed with Nanotechnology are two indicators that nanotechnology has advanced considerably in the field of healthcare. For example, Nano-agents, which increase the sensitivity of visualization techniques, are very common in the medical field, especially in disease diagnosis, thanks to their magnetic susceptibility. Also, It is claimed by Thurman & Serkova, new techniques can help measure kidney function. For example, they can assess renal blood flow and glomerular filtration rate. Methods called 'molecular imaging' are used to detect specific molecules in the body without causing harm. In this technique, tiny structures called nanoparticles are employed. These can easily penetrate most tissues, be imaged using standard radiological methods, and take on the task of finding specific molecules (2013, p. 2). It is clear that as contrast agents continue to evolve, especially in the field of radiology and then in treatment and drug delivery, many more problems will be solved. In addition, Medical Devices Developed with Nanotechnology is one of the most significant areas of use of nanotechnology in daily life. For instance, a research experiment by Pallotta et al. observed that nanotechnologies are now increasingly being used in the development of medical devices. Today, nanotechnologies are increasingly used in the development of medical devices. In 2014 alone, 230 nanomaterial-supported products were created in the medical field. Silver, zirconium, steel, magnesium, silicon, titanium, hydroxyapatite or its derivatives, iron, and iridium were most commonly used in the construction of these products. If the purposes of these devices are listed; to create pseudo-biological systems that imitate the biological adaptability of the material, to create absorbable biological substances, to create materials that can release active drugs (2018, pp. 3-4). And also, some medical devices developed with nanotechnology are actively used in many fields such as diagnosis and treatment in cancer, targeting cancer cells directly in chemotherapy, diabetes, dental treatment, nano tubes when brain capillaries are blocked, and Parkinson's disease. Although the use of nanotechnologies in the field of medical imaging provides great convenience in the field of medicine, research should continue, and harmful aspects should be avoided. All things considered, nanomaterials are a useful technology in the field of medicine for many of the issues as mentioned earlier, in short, for the diagnosis and treatment of diseases. Nevertheless, pros and cons should always be considered.

In conclusion, the development and manipulation of tiny materials and devices, which is nanotechnology, improves human existence through a variety of advancements, mostly in the areas of electronics, food and agriculture, and medicine. These effects can be summarized as follows; considering its transformative impact on food packaging, protection, enhancement, and regulation, as well as plant and soil health, nanotechnology, when properly utilized, holds the potential to revolutionize and enhance numerous systems within the food and agriculture industry.  In the context of electronics, nanotechnology expresses its impact on significant elements like imaging technologies, chips, and transistors at the nanoscale. In the field of health, nanotechnology is widely used in the diagnosis of many diseases, their treatment after diagnosis, imaging during the diagnosis phase, and drug delivery. Research continues to be conducted on new advances in the field of medicine.  Therefore, this situation shows that people’s future will be greatly affected by nanotechnology, and if nanotechnology is to be used for the benefit of human life, it is crucial to understand its effects.

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