iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: XI Month of publication: November 2023

DOI: https://doi.org/10.22214/ijraset.2023.56762

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

# Implications of Nanotechnology

Kirti Vishwakarma[1],Om Prakash Vishwakarma[2]
[1, 2]Department of Physics, Gyan Ganga College of Excellence, Jabalpur, M.P., India

***Abstract: A wide range of scientific, technological, and research fields are included in the word "nanotechnology." It can be defined as working with little objects in its most fundamental form. The study, creation, modification, production, and control of materials through physical or chemical techniques at resolutions on the order of one billionth of a metre in size. We find it necessary to have a basic understanding of nanotechnology because of its potential for a wide range of applications. The possibilities, excitement, and responsibilities that come with working in the quickly evolving field of nanotechnology are aptly summed up in the conclusion. It encourages the responsible and proactive use of technology while considering its effects on society and ethics. An overview of nanotechnology is given in this article, along with a discussion of its potential/ social effects on human life in the near future.***
***Keywords: - Nanotechnology, Nanoscale, Buckyball, Green Nanotechnology, Fullerenes and Carbon Nanotubes.***

## I. INTRODUCTION

Using the special features that develop at the nanoscale between one and one hundred nanometers nanotechnology does, in fact, entail controlling matter at this size. One of the main causes of unique physical and chemical features is the quantum size effect, which is brought about by tiny particles having more surface area than volume. Wide-ranging effects of nanotechnology can be seen in many different sectors. Below is a summary of some of the most important things

1) *Size and Scale:* Nanotechnology functions at the atomic and molecular scale, with a range of 1-100 nanometers. The fact that a nanometer is roughly a billionth of a metre emphasises how minuscule nanoscale materials are.
2) *Properties at the Nanoscale:* Compared to their bulk counterparts, materials at the nanoscale frequently display distinctive physical and chemical properties. The quantum size effect, which affects material behaviour, is brought about by an increase in surface area relative to volume.
3) *Applications:* Because of their minuscule size, nanotechnology is used to build systems, gadgets, and structures with unique features and capabilities. A wide range of industries are affected, including computing, electronics, space science, medicine, and military applications. To exploit particular features, scientists design and fabricate nanodevices by adjusting their size and shape at the nanoscale.
4) *Wide Range of Applications:*
a) *Medical:* Nanotechnology holds promise for use in molecular imaging, medication delivery, and diagnostics. • Electronics: By utilising nanoscale materials in electronic components, gadgets can become more compact and effective.
b) *Military Applications*: Advanced materials, sensors, and other military technologies can be developed using nanotechnology.
c) *Computing*: The development of quicker and more potent computers may be aided by nanoscale components.
d) *Space Science*: Satellite technology and space exploration are two areas where nanotechnology may find use.

## II. HISTORICAL BACKGROUND

1) *The 1959 Talk by Richard Feynman:* Ri chard Feynman, a physicist, initially presented the idea of nanotechnology in a lecture titled "There's Plenty of Room at the Bottom."Feynman discussed the prospect of influencing matter at the atomic and molecular levels, speculating that the entirety of the Encyclopaedia Britannica may be printed on the tip of a pin. This talk was given on December 29, 1959, at an American Physical Society meeting at Caltech.
2) *Coining of the Term "Nanotechnology" (1974)*: In a 1974 study, Professor Norio Taniguchi of Tokyo Science University provided an official definition of the term. According to Taniguchi's definition, the main activities of nanotechnology include materials processing, separation, consolidation, and deformation at the scale of a single atom or molecule.
3) *Early Restraints and Innovations (1980s):* Although scientists had been working with nanoparticles for decades, their inability to see their structure limited their usefulness. The invention of the scanning electron microscope in the 1980s was a major advancement that allowed researchers to see and work with materials at the nanoscale.

4) *Buckminsterfullerene discovery (1985):* This discovery in 1985 led to a large amount of attention and funding in nanotechnology research. Buckminsterfullerene, also known as fullerene or Buckyball, is a football-shaped molecule made up of 60 carbon atoms.
5) *Fullerenes and Carbon Nanotubes:* A fullerene is any molecule made completely of carbon, which frequently takes the shape of a hollow sphere, ellipsoid, or tube. The cylindrical form of a fullerene is referred to as a carbon nanotube, while the spherical form is called a Buckyball.
6) *Further Developments:* Ever since the fullerenes were discovered, the topic of nanotechnology has been the subject of continuous research and development, with applications extending across diverse industries and scientific disciplines.

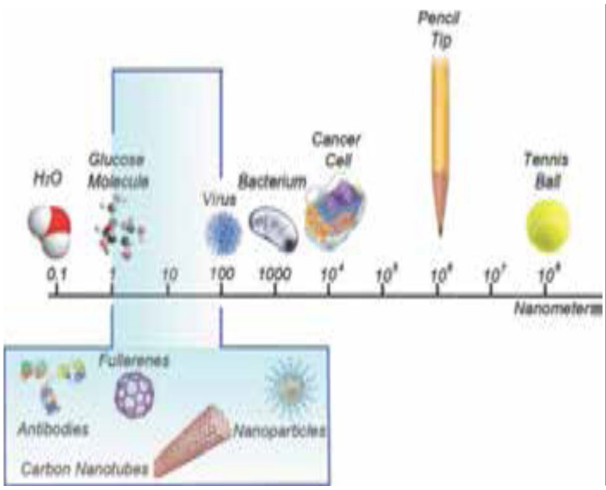



Fig. 1 Scale of different things

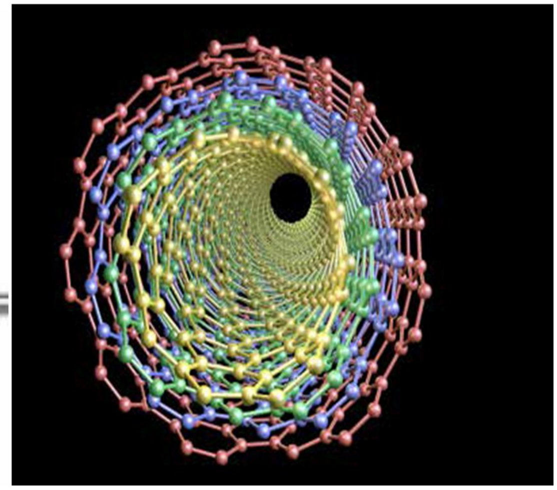


Fig. 2 Carbon nanotube

## III. APPLICATIONS

### A. Medicine and Drug Delivery

Precision and Efficiency: Using nanotechnology in medicine has the potential to provide more accurate and efficient care. Because microscopic nanotools are so precise, patients can avoid invasive and dangerous surgical procedures.

Precision in Treatment: Advanced laboratory tests and highly technical computers can provide detailed images of the body's systems, helping identify the cause of diseases and suggesting appropriate treatments. Nanotechnology allows for precise treatment, doing away with the need for trial-and-error drug prescriptions.

1) *Medical Malpractice Reduction:* Using nanotechnology in medicine may help lower the incidence of medical malpractice. Reducing the element of guessing in medicine prescriptions can result in more precise treatments and lower the possibility of adverse drug reactions.
2) *Medication Delivery in Chemotherapy:* Difficulties with Conventional Chemotherapy: The inaccuracies in conventional chemotherapy techniques frequently lead to detrimental side effects since the drugs are not precisely delivered to the targeted cells.
3) *Nanoparticle-Based Drug Delivery:* Harvard researchers have created a brand-new strategy for drug delivery by utilising nanotechnology. Specialised RNA strands with a diameter of approximately 10 nm are affixed to nanoparticles containing a chemotherapeutic agent. Because cancer cells are drawn to these RNA strands, the nanoparticles can attach to them and release the medication.
4) *Potential for Less Side Effects:* By increasing the precision of drug delivery, nanotechnology offers a more targeted and less toxic approach to cancer treatment. This directed method of drug delivery has the potential to treat cancer patients more effectively while producing fewer harmful side effects than conventional chemotherapy.
5) *Advanced Medical Equipment:* Disease Detection and Prevention: With the help of nanotechnology, highly sophisticated medical equipment can improve possible disease early detection and prevention. Early detection enables more effective treatments, which enhances general quality of life and may lengthen life expectancy.

In conclusion, the use of nanotechnology in medicine, especially for drug administration, has enormous potential to increase treatment accuracy and efficiency while lowering the unfavourable side effects of traditional medicines. This has important ramifications for patient welfare and the future of healthcare.

### *B. Green Nanotechnology*

The application of nanotechnology to improve the environmental sustainability of processes that result in negative externalities is known as "green nanotechnology." It also refers to the application of nanotechnology-related products to improve sustainability. It involves creating environmentally friendly nanoproducts as well as utilizing them to promote sustainability. The development of clean technologies "to minimize potential risks to human health and the environment associated with the manufacture and use of nanotechnology products, and to encourage replacement of existing products with new nano-products that are more environmentally friendly throughout their lifecycle" is what is meant to be understood by the term "green nanotechnology." The two main objectives of green nanotechnology are to create nanomaterials and products that do not damage the environment or human health, as well as to create nanoproducts that address environmental issues. It makes use of current green chemistry and green engineering techniques to create nano-materials and nano-products that don't include any hazardous elements, are made at low temperatures with minimal energy consumption, whenever possible, and incorporate lifecycle thinking into every step of the design and engineering process.

### *C. Energy Sector*

Nanotechnology has the potential to completely transform the energy sector by making it possible to create goods that produce, absorb, and store energy more efficiently. Nanotechnology can be used to develop smaller, more efficient devices, such as fuel cells, solar cells, and batteries.

### *D. Quantum Computing*

#### *1) Basics of Quantum Computing*

Unlike classical computers, quantum computers use quantum bits (qubits), which are able to represent both "0" and "1" at the same time. They are made of billions of customised atoms and function through nanotechnology. Quantum computers are far faster than classical computers because they can execute several calculations at once.

#### *2) Creation of Quantum Computers*

a) *Transforming Electronic Products:* Nanotechnology has the power to transform electronic products, encompassing the creation of quantum computers, nano transistors, and nano diodes. Quantum computers function by using atoms to perform calculations in groups of qubits within a tightly regulated and secluded environment. This means that atoms in a quantum computer act as both the processor and memory.
b) *Comparative Advantage:* Due to their capacity for parallel computation, quantum computers may be able to outperform classical computers in some difficult tasks. A major development in computing technology is the creation and manipulation of quantum computers through the use of nanotechnology.

In conclusions, the impact of nanotechnology goes beyond the field of medical to include the energy industry and the creation of cutting-edge computing technologies like quantum computers. These developments have the power to drastically increase the capabilities of current technologies and change a number of sectors.

### *E. Reactivity and Material Strength*

#### *1) Nanoparticle Reactivity:*

Because of their enormous surface area-to-volume ratio, nanoparticles are more reactive than bigger particles. Due to their increased reactivity, studies have indicated that some pollutants, including iron, can be cleaned up by groundwater nanoparticles more successfully than other ones. Carbon nanoparticles, in particular, are incredibly strong. This strength can be used in applications like the production of bulletproof vests composed of carbon nanotubes.

## IV. SOCIAL IMPACT

In addition to the environmental and health hazards linked to first-generation nanomaterials, nanotechnology has a greater social influence and presents more significant social concerns. According to social scientists, societal concerns related to nanotechnology should be recognized and evaluated in addition to their "downstream" dangers and effects. Instead, the difficulties should be taken into account during "upstream" research and decision-making to guarantee that technology advancements serve social goals. Public participation should be a part of technology assessment and governance, according to a number of social scientists and civil society organizations, analyzing the stakeholder's perspective is also crucial to determining the extent of the risk attached to nanotechnology and products related to it.

For the millions of people in developing nations without access to basic amenities like clean water, dependable energy, medical care, and education, nanotechnologies may provide new options. Among the benefits of nanotechnology, according to the 2004 UN Task Force on Science, Technology, and Innovation, are low labor, low maintenance costs, high productivity, and minimal material and energy requirements in production. However, there are many worries expressed that the alleged advantages of nanotechnology will not be dispersed equally and that any advantages (technical and/or economic) will solely go to wealthy countries.

## V. UNFAVOURABLE CONSEQUENCES OF NANOTECHNOLOGY

1) *Employment:* One significant drawback is the possible influence on customary jobs in agriculture, manufacturing, and the industrial domain. Human labour may be replaced by nanotech machinery and technologies, which would lessen the significance of labour in actual work.
2) *Atomic Weapons' Easy Accessibility*: With the development of nanotechnology, worries have been expressed over the weapons' easier accessibility. Weapons made using nanotechnology have the potential to be more lethal and powerful, and there is a chance that illegal people or criminal organisations will be able to access them.
3) *Health Hazards:* Because of their small size, nanoparticles can cause deadly diseases and present health dangers for inhalation. Lung injury can arise from brief exposures to air containing nanoparticles.
4) *High Cost:* The molecular structure and processing of nanotech goods add to the high cost, making these technologies less accessible to the general public. At now, nanotechnology is one of the most expensive technologies, and its cost is rising.

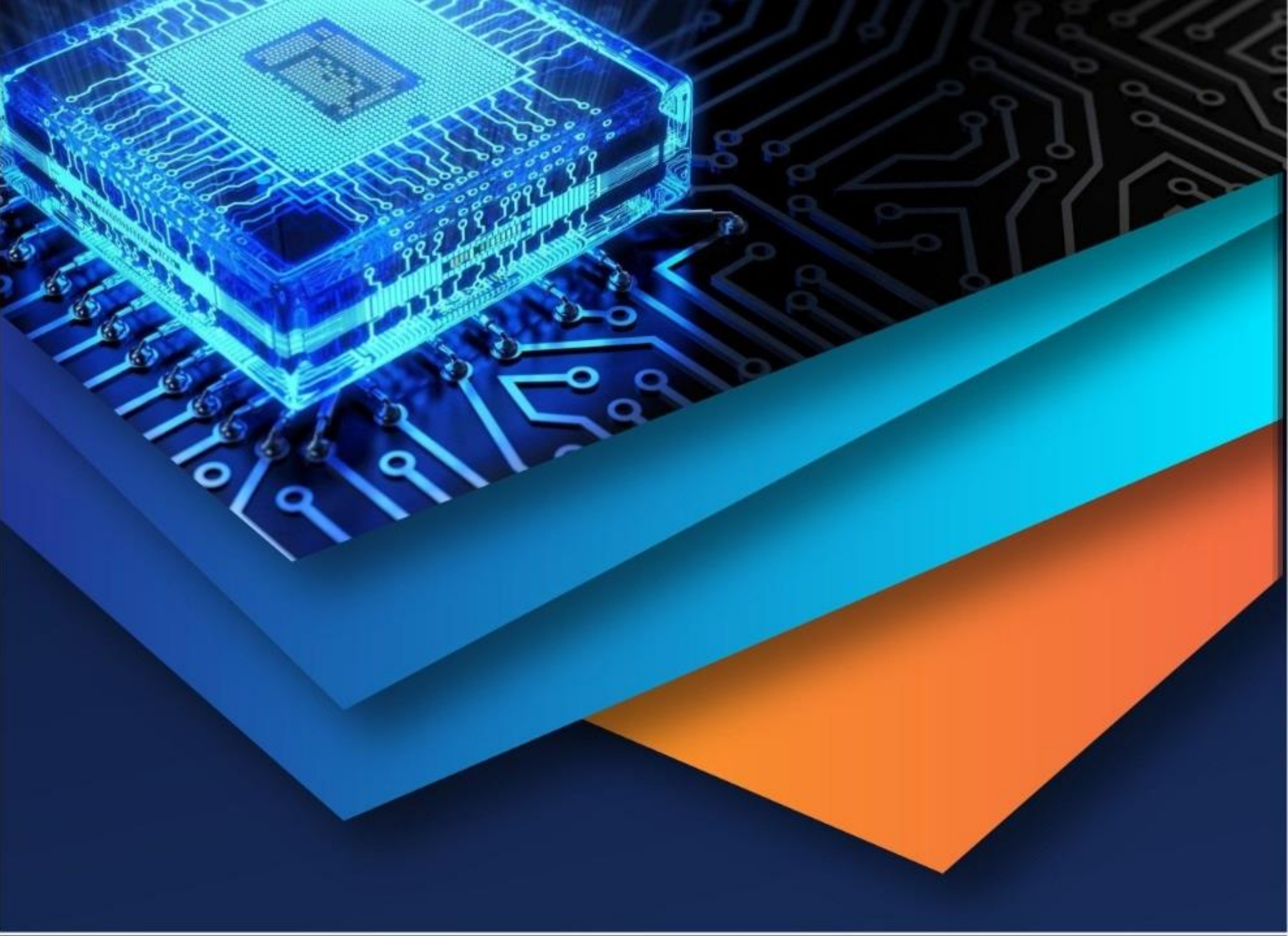
## VI. CONCLUSION

In conclusion, even though nanotechnology has a lot of potential, it's critical to take into account and deal with any potential negative effects, such as socioeconomic implications, increasing accessibility to strong technologies, health hazards, and financial obstacles brought on by nanotechnology's high cost. These worries emphasise the necessity of responsible nanotechnology development and control. It presents the current developments and the potential for future breakthroughs, highlighting the accuracy and control that scientists and engineers currently possess at the atomic and molecular levels. The need for preparedness and responsible use of nanotechnology is an important one, recognising the necessity of carefully weighing its risks in addition to its enormous potential benefits.

The fact that nanotechnology has the potential to impact almost every person on the world in the next years is indicative of the field's revolutionary nature. Indeed, nanotechnology has the potential to rank among the greatest technological advances in Earth's history as long as funding, research, and applications keep increasing. Conclusion well sums up the possibility, excitement, and responsibility that come with working in the rapidly developing field of nanotechnology. It promotes using technology wisely and proactively while taking society's and ethics' ramifications into account. Longer-term worries are about how new technologies will affect society as a whole and if they will eventually lead to a post-scarcity economy or worsen the income gap between wealthy and developing countries. The impact of nanotechnology on trade, security, human health, the environment, food systems, and even the notion of "human" has not been thoroughly studied or politicized.

## REFERENCES

[1] P. Charles, Jr. Poole, J. frank, Owens, Introduction to Nanotechnology, John Wiley & sons,In, 2003.
[2] Paulo Ferreira, Michael F. Ashby, Nanomaterials, Nanotechnologies and Design- An introduction for Engineers and Architects, Publication 2009.
[3] Edward L. Wolf, Nanophysics & Nanotechnology-An introduction to modern concepts in Nanoscience.
[4] P.K. Sharma., An introduction to nanotechnology and its analysis, 2015
[5] N. Alain, An introduction to nanoscience and nanotechnology, Wiley, 2006
[6] http://en.wikipedia.org/wiki/implications_of_nanotechnology, 1st ed.
[7] http://nanogloss.com/nanotechnology/advantages -and-disadvantages of nanotechnology.
[8] http://www.wtec.org/loyola/nano/IWGN.Research. Directions/Chapter01.pdf, 13.




10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

ISI


# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY