Chapter 2
Impacts of Nanotechnology

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ABSTRACT

This chapter presents an overview of positive and negative nanotechnology impacts discussed on a broader plane. Nanotechnology's central tenet is the utilization of sub-micrometer-sized particles for use in a wide variety of disciplines, including medicine, cosmetics, agriculture, and the food industry. Nanotechnology's advantages include better agricultural production, quality in pharmaceuticals, targeted drug delivery, and sensor applications. In order to move forward with its growth, it is crucial to correctly recognize the potential benefits and unintentional threats of nanomaterials to our surroundings. Nanotechnology is more complex, more focused, and a balanced interpretation of risks and benefits is very important to analyze.

It's quite easier to enlist nanotechnology technical uses but how its applications covers energy and health related issues along with information processing is quite interesting. It is noteworthy that windows for new possibilities and opportunities in this field must be meet up by individuals, major factor is environment shaping both as producer and a consumer. Nanotechnology covers fields such as bio-chemistry, computer, materials-science along with ethical to mental, legal to environmental aspects. That's why for long-term survival needs meetup, vision and technological development importance for its promotion in terms of realization is need of era. Because of the small size of nanotechnology, it may be possible to automate tasks that were previously impossible due to physical limits, lowering the amount of work, land,

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and maintenance that humans are necessary to perform. Environmental, health, and safety concerns are among the potential risks, as are transitional impacts such as the replacement of established sectors as nanotechnology products become more prevalent, which privacy advocates are concerned about. These could be especially relevant if nanoparticles' possible harmful effects are disregarded. Just with prior knowledge of its physics and chemistry we can't achieve without having insight that how its physical behavior affects its chemical behavior for having nanotechnological revolution. That's why it has been referred as invisible, slippery and ubiquitous. The question of whether nanotechnology warrants specific government regulation is a contentious one. The Environmental Protection Agency (EPA) in the United States and the Health and Consumer Protection Directorate (HCPD) of the European Commission have both opened investigations into the risks posed by nanoparticles. No man-made nanoparticles can be included in organic nanomaterials that have been given the seal of approval.

BACKGROUND OF NANOTECHNOLOGY

Structural development and application with basic, new and valuable functional properties on basis of structural size within range 1-100 nanometers constitute nanotechnology by involving creation (manipulation or discovery) of structural materials at atomic/molecular/supermolecular atomic scale level (Mansoori & Soelaiman, 2005). Nanotechnology development phase still continues as it starts from 1960's with biotechnological evolution in 1980's by allowing unlimited characteristic applications discovery making it 21st century technology including manufacturing industry, human health in terms of nanomedicine development, energy conversion by protecting environment to act as economic driving force (Sheeparamatti, Sheeparamatti, & Kadadevaramath, 2007). US national science foundation (NSF) worldwide estimated that by end of year 2015, about products of worth 1 trillion US dollars that are incorporating nanotechnology as a key component using manpower of about 2 million workers (Hulla, Sahu, & Hayes, 2015; Roco, Mirkin, & Hersam, 2010; Williams & Alivisatos, 2013). Research and development industry investment exceeds about 6 billion US dollars by 2006 keeping in view global risk management factor by holding potential applications to solve technical, economical, ecological and social problems (Kay & Shapira, 2009). National research and development programs during last few years have a tendency to revolutionized digitally involving cognitive sciences owing to funding by agencies by regulating impacts on human health and environment as well (Roco, 2011).

Defining the Term "Impact"

As nanotechnology is continuously investigated by considering public-private as well as commercial research institutions but technological innovation is another question. For technological adoption a scenario needs to be developed but for impact factor calculation, what will be the probability of adoption of that scenario is important. From this we can formulate into a relation as:

Actual impact=Theoretical + Probability of adoption

For making a decision being rational regarding innovation adoption decision has to be made on basis of J-value termed as Judgement value introduced to world by Thomas while considering adoption of safety procedures in nuclear industry (Bhushan, 2017; Malik, Muhammad, & Waheed, 2023; Rickerby