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Nanotechnology in Food and Agriculture: An Outlook towards Ethical & Safety Issues alongside a brief Resonance on Indian Scenario

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Abstract

As technologies emerge from society, it can be reconciled as social phenomenon. Technologies are in place and encouraged by society through social valuing, public funding and intellectual property policies. They are implemented in and disseminated through society and also sometimes prohibited and / or resisted or rejected by society. Nanotechnology is no way an exception to this. It holds the promise to exceed the advances achieved in recent decades even in biotechnology. Its applications are expected to have dramatic impacts possibly in improving agriculture as well. It also represents the latest, and in many ways most far-reaching, high technology implications on real food and agriculture. Two major uses of nanotechnology in the food industry include creating sensory value and using amine-based nano- sensors on a packaging substrate to ensure food preservation, safety, and bio-security.

Nanotechnology is the atomically processed antithesis to locally controlled, ecologically sustainable food systems. It eventually transforms the farm into an automated extension of the high technology factory production line, using patented products that will inevitably concentrate corporate control. It also introduces serious issues related to new risks for human health and the environment. Yet in the absence of public debate, or oversight from regulators, unlabelled foods manufactured using nanotechnologies have possibly entered the market. However, in the absence of mandatory product labelling anywhere in the world, it will not be authentic to tell how many commercial food products now contain nano ingredients. As per the recent study by the Helmut Kaiser Consultancy Group there are now over 300 nano food products available on the market worldwide. It also estimates that the global nano food market was worth US$5.3 billion in 2005 and will rise to US$20.4 billion by 2010. It predicts that nanotechnology will be used in 40 per cent of the food industries by 2015.

The current global population is nearly 6 billion with 50 per cent living in Asia and a large proportion of those living in developing countries face food shortages. For developing countries the drive is to develop drought and pest resistant crops, which also maximize yield. In developed countries, the food industry is driven by consumerism for fresher and healthier foodstuffs. This is a booming business, likely the food industry in the UK is developing with an annual growth rate of 5.2 per cent and the demand for fresh food has also increased by 10 per cent in the last few years. However, the application of nanotechnology to the agricultural and food industries was first analyzed by a United States Department of Agriculture roadmap published in September 2003.

At present the USA leads with a 4 year, 3.7 billion USD investments through its National Nanotechnology Initiative (NNI). The USA is followed by Japan and the European Union, which have both committed substantial funds (750 million and 1.2 billion, including individual country contributions, respectively per

year). The level of funding in developing countries may be comparatively lower; however this has not lessened the impact of some countries on the global stage. For example, China's share of academic publications in nanoscale science and engineering topics rose from 7.5 per cent in 1995 to 18.3 per cent in 2004, taking the country from fifth to second in the world. Others such as India, South Korea, Iran, and Thailand are also catching up with a focus on applications specific to the economic growth and needs of their countries. Iran for example has a focused programme in nanotechnology for the agricultural and food industry. A study from the Helmuth Kaiser Consultancy suggests that with more than 50 per cent of the world population, the largest market for Nanofood in 2010 will be Asia lead by China.
The nanotechnology as a means of boosting agricultural productivity in the country, the Indian government is looking ahead as in a report released in April, 2008, the Planning Commission of India recommends nanotechnology research and development (R&D) should become one of six areas for investment. The commission also recommends policies to and carries out financial planning for government departments to make it a part of India's eleventh five-year plan, for 2007–2012.

Apart from its very bright future impact we need to look into its ethical and safety issues even if it is the fact that too often, discussions about the social and ethical issues surrounding new technologies are treated as afterthoughts, or worse still, as potential roadblocks to innovation. The ethical discussions are relegated to the end of scientific conferences, outsourced to social scientists, or generally marginalized in the policymaking process. Nanotechnology has tremendous potential to contribute to human flourishing in socially just and environmentally sustainable ways. However, nanotechnology is unlikely to realize its full potential unless its associated social and ethical issues are adequately attended. The purpose of this paper is also to raise the salience of social and ethical issues within ongoing responsible development discourses and efforts by:

- in the responsible development of technology identify the crucial roles of ethics;
- dispelling common misconceptions about the social and ethical issues associated with emerging nanotechnologies;
- providing a typology of the social and ethical issues and identifying several specific issues within each type; and
- emphasizing how social and ethical issues intersect with governmental functions and responsibilities.

Technological advances have always been offering both upsides and downsides. Consequently it is important, in the development of nanotechnology, to consider how various forms of nano-materials will be disposed off and treated at the end of their use and how the regulatory system will treat with the handling of such materials at various stages of their life cycle. If nanotechnology is to succeed in asia-pacific countries, the governments of these nations must have an open policy discussion that is informed by a clear understanding of the science and how products are moving from laboratories and farms to factories and stores and into people’s homes and environment. This paper is an attempt to have an insight to the key aspects of these transformations, highlighting current research in the agrifood industry and what future impacts these may have alongside its ethical, safety and regulatory issues.