



## Opportunity and uncertainty: the technical, social and commercial challenges presented by nanotechnology

### Introduction

This paper provides a commentary on key issues that emerged from a workshop for businesses to discuss a range of uncertainties and opportunities relating to nanotechnology convened by Insight Investment, the Royal Society and the Nanotechnology Industries Association (NIA) in November 2006. It should be read in conjunction with a longer paper prepared for the workshop entitled '*An Uncertain Business, The technical, social and commercial challenges presented by nanotechnology*' which outlines in detail the issues and uncertainties surrounding the development of nanotechnology, available by [clicking here](#).

### Background

Commercialising innovations from nanotechnologies presents huge opportunities for business. But at the same time – while the evidence of harm is currently limited – there is real uncertainty over the potential environmental, health and safety (EHS) risks of some nanoscale materials, particularly the impact of manufactured free nanoparticles and nanotubes. The development of nanotechnologies also gives rise to a variety of social and ethical issues – both in relation to their governance and the societal impacts of specific applications. See our article "Nanotechnology" by [clicking here](#), page 10 – 11 of our Autumn 2004 Bulletin for a detailed explanation of nanotechnology and the risks associated with its development.

### What is nanotechnology?

The Royal Society defines nanoscience as the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale; and nanotechnologies as the design, characterisation, production and application of structures, devices and systems by controlling shape and size at the nanometre scale. A nanometre (nm) is one thousand millionth of a metre. The 'nanoscale' is usually defined as being at the scale of 100nm down to the size of atoms (approximately 0.2nm).

As the Royal Society points out, in some senses, nanoscience and nanotechnologies are not new. Chemists have been making polymers, which are large molecules made up of nanoscale sub-units, for many decades and nanotechnologies have been used to create the tiny features on computer chips for the past 20 years. However, advances in the tools that now allow atoms and molecules to be examined and probed with great precision have enabled the expansion and development of nanoscience and nanotechnologies.

All businesses with an interest in this area will need strategies for dealing with these uncertainties. However, it is still early days in the development of nanotechnologies, and the environment in which they are and will continue to be commercialised is not yet fixed. There are numerous societal and environmental benefits expected to be brought by nanotechnological innovation. At present, the public seems to view nanotechnologies broadly favourably – a Eurobarometer survey of June 2006 suggests that Europeans feel optimistic about its contribution to society – and the majority of NGOs have not made it a campaigning issue as yet.

At present, the debate around nanotechnology encourages businesses, scientists, academics, NGOs and others to work together to address and reduce the various areas of uncertainty surrounding nanotechnologies. But time is running out, and the window of opportunity to secure nanotechnological innovation through responsible delivery and a balanced stakeholder dialogue will not be open indefinitely.

## Exploring business opportunity and uncertainty

On 7 November 2006, three organisations with a strong interest in the responsible and successful development of nanotechnology-based products – The Royal Society, Insight Investment and the NIA – came together to explore these issues with business and stimulate companies to focus more fully on a broad spectrum of questions which affect the development of nanotechnologies.

The three organisations began this process by convening a business-focused workshop and commissioning a briefing paper: *An Uncertain Business, The technical, social and commercial challenges presented by nanotechnology*.

The workshop, hosted by the Royal Society, brought together seventeen European companies with a commercial interest in nanotechnology – from food and chemicals manufacturers to retailers of healthcare and fashion.

The event sought to build on the work of the initial report from the Royal Society and Royal Academy of Engineering published in 2004, which was commissioned by the UK Government to consider current scientific knowledge in the field and whether nanotechnology could raise EHS, ethical or social issues which are not covered by current regulation (see [www.nanotec.org.uk/finalReport.htm](http://www.nanotec.org.uk/finalReport.htm)) fund managers' investment decision-making and engagement processes.

This event had three aims:

- to highlight the particular technical, social and commercial issues surrounding the development of nanotechnologies.
- to stimulate discussion and interaction among companies working up and down the supply chain on these topics.
- to explore ways in which companies individually, or business collectively, could better understand and respond to the challenges posed by the issues.

## The nature of nanotechnology risks

The seminar explored the technical, social and commercial areas of uncertainty surrounding the development and commercialisation of nanotechnologies and posed related questions for businesses to consider.

**1. Technical uncertainties:** issues concerning our understanding of the technology and how it behaves; our ability to develop, manufacture, control and measure it, and ultimately to accurately predict its behaviours.

Technical uncertainties, relating to potential EHS impacts, arise because we are at an early stage in our understanding of the behaviour and effect of (principally) free nanoparticles. Materials at the nanoscale can behave very differently from the same chemical in a bulk form. At this stage, there is little data on the hazard they present or their safety: little is known, for example, about how nanomaterials enter the body, how they are metabolised, their toxicity and their impact on the environment and other species. The Royal Society has highlighted the pressing need for fundamental risk research in this area and a rigorous assessment of benefits, risks and uncertainties.

Workshop participants were challenged to consider the commercial imperative for directed research and the role of business in controlling their exposure to risks in this area.

**2. Social uncertainties:** this group of uncertainties stem from society's view of the technology, based on complex factors including: the perceived benefits compared to the perceived risks; the uses to which the technologies are put, their impact on people and the environment; regulation and governance; and previous experience of new technologies

Companies need to consider the social and perceptual uncertainties surrounding nanotechnologies as carefully as they consider the technical uncertainties. A backlash of negative opinion from consumers, governments and civil society – as happened to genetically modified crops – could prove incalculably damaging to the success of all types of nanotechnology.

**3. Commercial uncertainties:** these uncertainties arise as companies begin to commercialise nanotechnology-based products. At that point, they need to consider the risks arising from the shape of future standards and regulation, and whether supporting only minimal regulation is necessarily the best approach; the potential for litigation (there are many lessons which may be learned from the business approach to asbestos, for example) and the impact of complex intellectual property regimes on the development of less commercial but highly beneficial applications

These issues are also critical for investors who will be affected by the impact on company valuation if these risks are handled badly, especially if the products form a large part of the company's current or future business, or if it has a valuable public brand. Similarly, lenders and insurers will be scrutinising the technical, social and commercial risks posed by nanotechnologies to allow them to assess risk, while the costs of capital and insurance policies may rise if these uncertainties are not adequately addressed.

With respect to this set of uncertainties, participants were challenged to consider the effectiveness of their approach to research, risk assessment, regulation and other commercial aspects of nanotechnology development.

### **The importance of interconnections**

None of these risks and uncertainties can be considered in isolation. The commercial uncertainties for businesses working with nanotechnologies arise out of the technical and social risks associated with them. Regulatory uncertainty, for example, may leave companies potentially liable for damages in the event that products are discovered to present EHS problems, which in turn may affect a company's ability to get adequate insurance coverage; or large scale brand owners and retailers may find themselves exposed to widespread public criticism if uncertainties further down the value chain affect public perception of nanotechnologies as a whole.

## **The business response to uncertainties**

The participants at the workshop began to shape priorities for a business response to these issues. The important questions were distilled to three key areas:

### **1. A new approach to responding to technical, social and commercial risk is needed**

Participants stressed the importance of a new approach to understanding and responding to the three types of risk. Lessons from asbestos and genetically modified crops must be learned and incorporated into businesses response to the development of nanotechnologies. This may involve new partnerships, a coordinated approach to responsible nanotechnology research and development, and clarity about where responsibilities lie.

### **2. Businesses should be more active in shaping the debates on regulatory systems, standards and definitions**

There was concern about how the existing systems of regulation and risk assessment can cope with nano-risk and what role business should play in their development. A number of initiatives are currently underway in this area internationally, but progress was slow and business needs are often not taken into account. Participants felt that business should be fully involved in the processes of agreeing common definitions, standards and regulatory approaches. In light of current uncertainties, the proposal to develop a business focused 'code of conduct' on the responsible development of nanotechnology was welcomed.

### **3. The importance of coordinated engagement and communication**

Participants stressed the importance of effective and balanced communication about nanotechnologies. A starting point would be communication up and down the value chain between consumer focused companies, manufacturers and researchers. Dialogue between business and NGOs, consumers, government and the public was also considered an essential part of the process of responsible development, to understand aspirations and concerns for nanotechnology.

## Next steps identified at the workshop

### Responsible Nanotech Forum?

The coordination of an effective response to the technical, social and commercial issues surrounding nanotechnologies was considered essential. The participants debated whether a new 'Forum' or 'Centre' may be an appropriate vehicle for this, convened by an 'honest broker' – an independent group who would be at arms length from all the stakeholders, yet have the respect and authority required to engage widely and coordinate a range of activities. Most importantly participants stressed that it should focus on actions to address uncertainties, rather than simply being a talking shop.

### Responsible Nanotechnology Code?

The development of a voluntary code of conduct for businesses engaged in nanotechnology was widely agreed to be an important next step. It was felt the code should be principles based rather than standards based and would be developed through a process of engagement between a group of European businesses and a wide range of stakeholders, including NGOs, government and consumer groups.

### A strategic approach to communication and engagement about nanotechnology?

The group felt that there was a need for strategic coordination on communication and engagement activities on nanotechnology. This could enable business to understand and address social risks more effectively. It would also provide a clear means to demonstrate to stakeholders, including investors and regulators, a responsible business approach to nanotechnology development.

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