

Impact Assessment of Biotechnology and Nanotechnology

Drawing from the strength of prior OECD work, the new OECD Working Party on Biotechnology, Nanotechnology and Converging Technologies (BNCT) aims to develop an impact assessment methodology that allows the simultaneous analysis of nanotechnology and biotechnology and the impacts of policies concerning them.

The Working Party anticipates to use the consolidated Impact Assessment of Biotechnology and Nanotechnology to understand more fully the growth dynamics of industrial sectors involving and affected by the two technologies, with a view to characterizing the development towards converging technologies.

For some time, analysts have predicted that biotechnology and nanotechnology would enable broad new areas of scientific research and innovation, revolutionise industrial processes, and deepen economic value chains. After many years of sustained investment by countries in these areas, many national policy makers seek better ways to measure impact of these fields. However, validation of predictions and assertions is hampered by the interdisciplinary nature of these fields and their broad diffusion as tools within other scientific areas. Growing technological convergence across these domains further confounds clear assessment of impact that policymakers are interested in.

The new OECD BNCT will build and improve on prior efforts to collate information on science, technology and innovation policies on national and supranational levels, with a view to conducting a consolidated impact assessment of biotechnology and nanotechnology; special emphasis will be given to the inclusive study of both technologies in their entirety, providing an overview to former impact assessments that had to focus on different sub-disciplines and levels of detail due to the rapidly advancing knowledge base and commercialization of the two technological fields. The OECD BNCT has convened a skilled expert group drawn from OECD member countries, **the Task Force on Measurement and Impact**; this group has identified a number of initial challenges and opportunities that will guide their work moving forward.

Threshold Questions The most important initial decisions to take before embarking on a complex Impact Assessment are:

- What are the object and the objective of the Impact Assessment, and
- Which data and information sources, and which indicators should the Impact Assessment be based upon?

The term 'Impact Assessment' can describe the assessment of socio-economic effects of an innovation, but also the effectiveness of innovation policies; while the object and assessment process differ, the two procedures of Impact Assessment are mutually supportive, sharing quantitative and qualitative indicators.

Impact Assessment consists of a range of different approaches and methodologies, which are themselves based on different macro- or micro-economic models. These models can focus on monetary measures, causality, specific impacts and outcomes, and/or the measurement of (change in) performance.

Impact Assessment of Converging Technologies

Impact Assessment of any modern technology is a complex procedure; each important step -- such as the agreement of definitions, the weighted consideration of socio-economic contexts, and the identification of causality factors -- can introduce a systematic error. Nevertheless, the combined Impact Assessment of both Biotechnology and Nanotechnology allows a reduction in apparent complexity: the use of consolidated indicators, methodologies and objectives provides a means to compare the dynamics of each technology. These shared indicators help separate unique antecedents to each technology from shared and/or mutual precursors, which could enable a better characterization of the observed development towards converging technologies in qualitative and quantitative terms.

In addition, biotechnology, by some accounts, outdates nanotechnology by 40 years. This differential provides policy makers and economists an untapped opportunity to assess the impact of policies concerned with both technologies in a comparative manner, in which some cultural and socio-economic factors could be regarded as constant, and identical indicators could be considered benchmarks of time-dependent impact, and thereby help to solve the causality problem that is inherent to each Impact Assessment.

BNCT Roadmap

Over the next two years, the BNCT's Task Force on Measurement and Impact (TFMI) will have to (i) agree on definitions and terminologies used in the Impact Assessment of Biotechnology and Nanotechnology (ii) develop a methodology (i.e. underlying economic model, focus and indicators), taking into consideration a wide range of policy elements, and (iii) establish an inventory of national and supranational policies concerned with biotechnology and nanotechnology. So far, the following elements have been identified as critical for this analysis:

- Science policies that might be based on technology-push (e.g. ring-fenced R&D funding mechanisms), or on market-pull (e.g. responsive-mode R&D funding, for example in conjunction with Great Challenges),
- Technology-transfer constraints, based on the scalability of innovations,
- Intellectual Property issues (e.g. the timely recognition of a novel technologies),
- Public perception of novel technologies,
- Concerns about the potential impact of novel technologies on the environment and human health,
- Ethical issues arising from novel technologies (and especially from the convergence of technologies),
- Lack of international standards,
- Difficulties of novel technologies to enter established value-chains (e.g. the problem of missing infrastructures and knowledge clusters, especially for disruptive technologies),
- Challenges to commercialization of novel technologies (based – in part – on the bullets above),
- Human resource constraints (e.g. trained workforces), and
- Cultural, historic and socio-economic factors.

The resulting report will provide recommendations on objects, objectives and methodologies of impact assessments on biotechnology, nanotechnology and converging technologies.