Statistics & Indicators of Biotechnology and Nanotechnology

Biotechnology and nanotechnology are both disciplines of science and technology in their own right and providers of increasingly widely adopted tools to other fields of science and technology and to each other. This complex pattern of deployment signifies a growing convergence of traditional disciplines of science and engineering, and poses a formidable challenge to the creation and measurement of reliable indicators of the technologies' development and impact.

The OECD Working Parties on Biotechnology (OECD WPB) and Nanotechnology (OECD WPN) have for several years set, measured and published indicators and statistics for biotechnology and nanotechnology [1,2,3]. With the creation of the new **OECD Working Party on Biotechnology, Nanotechnology and Converging Technologies** (BNCT) in January 2015, the OECD now aims to re-confirm indicators and measurement methodology for these multidisciplinary and partially over-lapping technologies with a view to establishing exclusively accurate and relevant datasets.

Indicators

Indicators are pointers that allow policy makers and analysts to identify and monitor emerging trends within the frame of specific national or supranational markets or economic connectivity. In this context, such metrics must be based on high-quality statistics and robust analytical principles, in order to provide relevant cornerstone, on which policy decision makers can develop and monitor new policies and assess already implemented policies.

It will be critical to guarantee comparability of inidcators both to traditionally measured statistics and within the context of current national and supranational developments focused on a specific subject. To this effect, indicators – and especially new 'experimental' indicators – must be identified on the basis of their policy relevance, analytical soundness, statistical quality and measurability.

Biotechnology meets Nanotechnology

Since the coining of the term 'nanotechnology' to describe a multifaceted set of sciences and technologies centered on the understanding and control of matter on the nanometer scale, biotechnology has been quoted a its 'closest bigger sister' in the family of 'enabling' technologies, yet little effort has been made to compare the two technologies within the context of progress, policies, outcomes and impact.

The OECD's track record in building data infrastructures to support the causal link between actors, outcomes and impacts provides an ideal framework to establish a set of reliable indicators that are relevant for both bio- and nanotechnologies, and to thus highlight parallels and divergence in the progress of both the technologies and the policy leverages concerning them.

[1] *OECD Biotechnology Statistics 2009*, OECD (2009), http://www.oecd.org/sti/sci-tech/42833898.pdf
[2] *Nanotechnology: An Overview based on Indicators and Statistics*, OECD (2009), http://www.oecd.org/sti/inno/43179651.pdf
[3] *OECD Indicators*, http://www.oecd.org/sti/biotech/keybiotechnologyindicators.htm

The OECD BNCT aims to review indicators hitherto used in biotechnology and nanotechnology statistics with a view to assess and highlight the potential and the limits of certain metrics, to develop and stress-test new 'experimental' indicators, and to ultimately establish a consolidated set of indicators for both multidisciplinary technologies.

The Approach

The centerpiece of the BNCT's work on Statistics & Indicators in Biotechnology and Nanotechnology is the Technology-Value-Chain, which enables a link between individual metrics, irrespective of the industrial sector and regional market it is incorporated within.

Over the next two years, the BNCT's Task Force on Measurement and Impact will take the following steps to establish statistics and indicators in biotechnology and nanotechnology:

- identify key features of both biotechnology and nanotechnology with a focus on those that are of common interest to OECD member and partner countries,
- review traditional indicators and statistics used to measure biotechnology and/or nanotechnology,
- develop new 'experimental' indicators that are equally measureable for biotechnology and nanotechnology,
- establish a core set of consolidated indicators for biotechnology and nanotechnology according to the criteria that the indicators should be:
    - transparent and easy to interpret and (i.e. users should be able to assess the significance),
    - measureable internationally (to provide a basis for comparisons across countries), and over-time (to identify trends),
    - lend itself to being adapted to different national contexts, and analyzed at different levels of detail or aggregation,
    - analytically sound and benefit from a consensus about their validity, and
    - based on data that are available or that can be made available at a reasonable cost, and that are of known quality and undergoing regular updates.

The core set of consolidated indicators will be stress-tested through data acquisition during its development and validation process; the results will be published in the BNCT's Report on Statistics & Indicators in Biotechnology and Nanotechnology (expected January 2017).

Towards Converging Technologies

It is envisaged that data acquired for a set of indicators that is equally applicable to and comparable between a number of technologies, such as biotechnology and nanotechnology (and including their contributing disciplines of biology, chemistry, physics and engineering) will outline quantifiable descriptors of the so-called trend towards 'converging technologies'; this trend is increasingly felt by those involved with science and technologies, but has until now been too intangible to characterize.