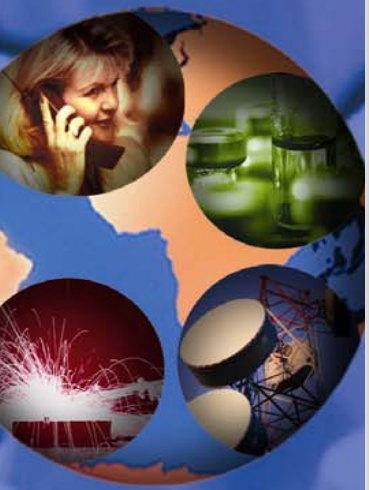
Science, Innovation and Electronic Information Division



Division des Sciences, de l'Innovation et de l'Information Électronique

Biotechnology impact indicators: From measures of activities, linkages and outcomes to impact indicators

OECD Biotechnology Outputs and Impacts Workshop

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Biotechnology impact indicators

- **Preliminary remarks**
- **Overview of biotechnology indicators and international comparability**
- **Is biotechnology important?**
- **Impact indicators**
  - What is meant by impacts
  - Indicators of economic impacts
- **Statistical requirements**
- **Concluding remarks**

Biotechnology impact indicators

- **Preliminary remarks**
  - Technology is not evolving randomly in every directions. It follows trajectories opened by critical discovery (e.g. steam, electricity, transistor, semi processor, TCP/IP, DNA and PCR)
  - In a linear model, innovation comes first and technology adoption is a diffusion process.
  - From technology adoption to emerging technologies
  - Emerging technologies: a set of techniques and tools that creates new capabilities for innovation.

Biotechnology impact indicators

- **Overview of biotechnology indicators and international comparability**
  - Industrial biotechnology activities
    - **Quantitative indicators: number of firms, Revenue, R&D, exports, employment, capital raising, IP protection, product development**
    - **Qualitative indicators: training and recruitment, firms history, innovative behaviour, regulatory activities, collaborative arrangements, IP protection, benefits and obstacles.**
  - Government biotechnology activities
    - **Quantitative: R&D expenditures and performance, R&D personnel**
  - Other
    - **Patents, citations, GM crops acreage**

Biotechnology impact indicators

- **Overview of biotechnology indicators and international comparability**
  - OECD
    - **Accepted statistical definition**
    - **Model survey and model questions**
    - **Framework and guidelines**
    - **Statistical compendia**
    - **On-going work on public sector biotechnology activities.**

Biotechnology impact indicators

- **Is biotechnology important ?**
  - Total of $1,5 billion for biotechnology R&D, 12% of total industrial R&D, two digit growth rate since 1987 (aerospace $900 million) (automobile $600 million)
  - But, biotechnology revenue is only 0,15% of total industry operating revenue and, biotechnology employment is only 0,07% of active population
  - Not very much in terms of wealth effect, perhaps more to be seen in substitution effects.

Biotechnology impact indicators

- **Impact indicators**
  - Emerging and enabling technologies: a stream of innovations resulting from a combination of S&T discovery and changes in socioeconomic conditions that allow for the emergence of a different technological system, having large impacts on economic inputs, organizations, structures and institutions.
  - Impacts are the consequences of S&T activities for the economic, social, political and environmental system, and to science.
  - Biotechnology also bring consequences on health and, on ethics and culture

Biotechnology impact indicators

- **Macroeconomic impacts**
  - Changes in productivity via innovative products and processes
  - Economic growth
  - Changes in industrial structure
  - Changes in trade structure
  - Changes in labour market

Biotechnology impact indicators

- **Microeconomic impacts**
  - Business creation, growth, death, merger and, change of activity
  - Change in prices and costs structures
  - Impacts on competitiveness
  - Changes in competitiveness conditions (market framework)
  - Substitution of inputs

Biotechnology impact indicators

- **Statistical requirements**
  - Increase progressively the coverage of sectors surveyed
  - Link existing biotechnology surveys to other production surveys
  - Changes to commodity classification to build data on trade
  - Analysis on trends and indicator development

Biotechnology impact indicators

- **Concluding remarks**
  - The use of biotechnology will trigger important substitution of economic inputs, from non-renewable to renewable (from biomass)
  - In this substitution process, some economic actors and sectors will flourish and others will perish, generating social costs
  - From a policy perspective, minimizing costs and maximizing benefits requires monitoring
  - Statistical challenge is four fold: coverage, classifications, linkages and analysis.

Biotechnology impact indicators

- Thank you

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