

## TOWARDS A MEASUREMENT AGENDA FOR INNOVATION

*Towards a Measurement Agenda for Innovation* builds on the OECD's half-century of indicator development and the challenge presented by the broad horizontal focus of the OECD Innovation Strategy. It identifies five broad areas in which international action is needed: develop innovation metrics that can be linked to aggregate measures of economic performance; invest in a high-quality and comprehensive statistical infrastructure to analyse innovation at the firm-level; promote metrics of innovation in the public sector and for public policy evaluation; find new and interdisciplinary approaches to capture knowledge creation and flows; promote the measurement of innovation for social goals and of social impacts of innovation. These five key areas of action, if endorsed, would be the basis for a forward-looking, longer-term, international measurement agenda for innovation. The development and implementation of such an agenda imply a relatively long time frame. It calls for the efforts of the statistical community but also the engagement of policy makers to define user needs and of researchers to use the data, analyse impacts and feed into the development of appropriate metrics and data infrastructures. It also requires the engagement of organisations, businesses, universities and the public sector, because the statistical system can only collect what it is feasible to measure inside organisations.

## Measuring innovation: looking ahead

*Measuring Innovation* presents new measures and new ways of looking at traditional indicators. It builds on the OECD's half-century of indicator development to try to reflect adequately the diversity of innovation actors and processes and the linkages among them. It moves forward the Blue Sky measurement agenda on science, technology and innovation indicators (see Box 1) and draws on measures of education, entrepreneurship, economic, environmental and social outcomes, and the framework conditions that support or inhibit innovation. Its goal is to mirror the broad, horizontal focus of the OECD Innovation Strategy.

This is a challenge. For example, does basic education play a role in shaping the skills of future innovators? If so, how do we measure how well it does so? What measures can we use to capture the range of skills innovators need? Can we in fact define such skills? How does innovation relate to entrepreneurship and how do we define this? Entrepreneurship is already difficult to measure, but not all entrepreneurial activity consists of launching new ideas on the market, it might also include, for example, opening a new outlet or deciding to become a freelance writer.

Innovation is clearly part of a business strategy based on turning ideas into value. It generally means improved goods, services or processes. It sustains growth. Yet other forms of innovation respond to broader challenges. For example, encouraging interdisciplinary research, often viewed as a source of major breakthroughs, implies developing networks of researchers across disciplines and countries. What are the returns to innovation when different actors in different places create new knowledge? Who appropriates the returns? How can we measure the transmission mechanisms of new knowledge and their impacts on economic development? Finally, while innovation drives and sustains growth and helps tackle global challenges, it also affects society. What does a sustained rate of innovation imply for demand for labour and skills? What is its effect on the workplace, on communities and social habits? In sum, the current measurement framework, with its focus on the role of innovation in economic performance, falls short in terms of measuring the social impacts of innovation. This raises hard questions and calls for a rethinking of what constitutes an appropriate framework for measuring innovation.

In the shorter term, the challenge is to render statistical systems more flexible and responsive to the introduction of new and fast-evolving concepts. Ways of doing this include experimenting with satellite accounts, exploiting the potential of existing microdata, adding questions to existing surveys, adding topic-specific modules to main survey vehicles every  $n$  years or developing short turnaround surveys to meet special needs. Experimental and flexible approaches can progress at different speeds according to countries' specific priorities and resources. This will require co-ordination to prevent geographically fragmented research efforts over the long term and ensure that the results of successful experimentation in a limited number of countries are taken up by the international community. In the longer term, the challenge for the statistical community is to redesign surveys to address the relevant unit of innovation analysis. Should data be collected at the level of research laboratories to address questions about basic research? Is the enterprise group a more relevant unit of analysis than the enterprise when looking at innovation activity? Should innovation surveys use the establishment as the unit to look at the diffusion of new process technologies? Another challenge is to restructure data collection to maximise data-linking opportunities for research and the analysis of impacts. This also means finding ways of providing researchers with access to microdata while respecting confidentiality requirements.

The development and implementation of such an agenda imply a relatively long time frame. It calls for the efforts of the statistical community but also the engagement of policy makers to define user needs and of researchers to use the data, analyse impacts and feed into the development of appropriate metrics and data infrastructures. It also requires the engagement of organisations, businesses, universities and the public sector, because the statistical system can only collect what it is feasible to measure inside organisations.

### Box 1 • Key messages from the OECD Blue Sky Forum

1. Research on innovation in the broad sense is currently fragmented. There is need for a general framework of analysis and greater coordination of research efforts. The goal is to understand the entire story of innovation, from inputs to economic and social impacts.
2. Indicator and related econometric research must move forward from innovation inputs and activities to include the outputs and impacts of innovation.
3. New methods of analysis are necessary to understand innovation processes, which will require improved data access, data linkages and the adoption of interdisciplinary approaches to data.
4. A marked improvement in the policy relevance of innovation research is required in order to create a science of science policy.

Source: OECD (2007), *Science, Technology and Innovation Indicators in a Changing World. Responding to Policy Needs*, OECD, Paris.

The work undertaken as part of the OECD Innovation Strategy has engaged the international community and has helped to move the measurement agenda forward. *Measuring Innovation* presents some “experimental” indicators and highlights some of the gaps in the current measurement framework, as well as some of the initiatives under way to address such gaps. A number of recommendations have emerged from this work and are presented below. In addition, Box 2 provides a summary of the key actions needed to take the measurement agenda forward.

### Broader innovation matters for growth

The increasing recognition of innovation as a driver of economic growth and structural change has drawn greater attention to its nature, role and determinants. Innovation entails investment aimed at producing new knowledge. It is the result of a range of complementary intangible assets – not only R&D but also software, human capital and new organisational structures. In itself, innovation is not an objective. It needs to be placed in the broader context of its contribution to aggregate economic performance. The ability to explain productivity differences is what drives and informs policies designed by ministers of finance or of the economy.

#### Action 1

#### *Improve the measurement of broader innovation and its link to macroeconomic performance*

Science, technology and innovation (STI) surveys need to be redesigned to take a broader view of innovation. Survey and administrative data need to be aligned with aggregate economic measures and become a visible part of the System of National Accounts (SNA). The goal is to help recognise the important role of STI policies in promoting economic growth.

The business, statistical and research communities are encouraged to work to:

- Measure and value intangible assets;
- Revisit the measurement framework for innovation to identify and prioritise areas for survey design and re-design; and
- Align survey and administrative data with economic aggregates to enable productivity analysis.

### Going beyond targets and aggregates: understanding why and how innovation happens in firms

Targeting levels of spending on certain dimensions of innovation activity, such as R&D, has been a widely used policy tool in recent years. Spending on R&D is well measured, but it is important to know how to reach the target and what that target means in terms of innovation outcomes and impacts. R&D surveys can provide information about some of the inputs to innovation but give little information on the outputs of these processes. They tend to be more useful for measuring technology-based activities, which are only a subset of what is included in the broader concept of innovation, and they are often more relevant for manufacturing than for services. Similarly, patent data are useful for understanding certain innovation-related strategies, but they cannot measure the full extent of innovative activities and suffer from some well-known limitations. “Innovation surveys” were therefore developed to increase knowledge about innovation in firms with a view to developing effective innovation policies. They collect information about types of innovation, reasons for innovating (or not), collaboration and linkages among firms or public research organisations, and flows of knowledge, as well as quantitative data on sales from product innovations and spending on a range of assets beyond R&D.

However, knowing, for example, that 60% of a country’s firms have introduced some type of innovation does not help to understand why and how innovation happened, what its impacts are on the economy and how it can be encouraged. Indicators should not simply provide a level and *Measuring Innovation* explores the potential of firm-level data tell a story about how that level was achieved. Using microdata from innovation surveys, it shows that firms introduce new products on the market without necessarily performing R&D. It shows that firms adopt complementary strategies. Terms such as “technological” or “non-technological” innovation or “open” innovation are simplifications and potentially misleading. Most innovative firms introduce both product and process innovations and also marketing or organisational innovations. They are part of the broader conditions and infrastructure of their national innovation system, which are often provided by government agencies. This is true of firms in both manufacturing and services. New empirical analysis based on these data and presented in *The OECD Innovation Strategy : Getting a Head Start on Tomorrow*, shows how different “modes” (complementary strategies) of innovation are positively correlated with economic performance. Chapter 1 presents the use of some of these indicators to highlight the nature of innovation today.

### Action 2

#### *Invest in a high-quality and comprehensive data infrastructure to measure the determinants and impacts of innovation*

Sound evidence-based policy advice calls for a comprehensive, high-quality data infrastructure, including at the sub-national level. Its backbone is a reliable business register. It is important to be able to link different data sets and exploit the potential of administrative records. This can improve understanding and reduce respondent burden. For example, the ability to link innovation survey data to business practice surveys, ICT surveys or administrative databases on firm-level capital investment, earnings, value added and employment can substantially improve empirical research on the impacts of innovation. This can also reduce respondent burden if questions do not have to be repeated in the innovation survey.

However, there is no point to a first-class data infrastructure if it is not available to the research community. It is researchers who formulate relevant research questions and analyse the data. Of course, this requires measures to ensure data confidentiality in order to protect respondents and to avoid any real or perceived conflict of interest on the part of researchers.

Governments and the statistical and the research communities are encouraged to focus on:

- Improving business registers;
- Exploring the statistical potential of administrative records;
- Establishing a data infrastructure which exploits linkages across data sets and over time;
- Improving the data infrastructure at the sub-national level; and
- Improving the research community's access to this infrastructure while ensuring data confidentiality.

### **Going beyond traditional actors: addressing the role of government in innovation**

Governments, including central and local government and various agencies, provide services to people and to businesses. They also define the boundaries within which innovation takes place through regulation of domestic activity and trade, and they play a major role in fostering innovation. Yet while universities and firms are covered by conventional indicators, current measures do not fully take account of the roles of individuals, consumers and government in the innovation process. There are several compelling reasons for developing metrics and definitions for innovation in the public sector and measures of policy efforts to foster innovation. There is a need to account for the use of public funds for innovation, improve learning outcomes and the quality of the provision of education or other public services.

### Action 3

#### *Recognise the role of innovation in the public sector and promote its measurement*

Internationally agreed concepts and comparable metrics for studying innovation in the public sector do not yet exist. A framework for the measurement of public-sector innovation that is analogous to, but appropriately different from, the one used for business innovation (OECD/Eurostat [2005], *Oslo Manual*) would provide a basis for a more innovative approach to public activities and services and allow for comparisons and benchmarking. Because the concept of "public sector" encompasses very different organisational units (*e.g.* the public administration, the health sector, the education sector), it may be necessary to develop new concepts, such as innovation in education, and different metrics to encompass the public welfare aspects of innovation.

Governments and the statistical and research communities are encouraged to develop a measurement framework for innovation in the public sector that:

- Examines the extent to which concepts and metrics used in the context of business innovation can be used and adapted;
- Considers whether basic concepts and tools are relevant in light of the specificities of the public sector, in particular its complexity and heterogeneity, and its organisational and incentive structures; and
- Recognises that the public sector has multiple objectives, including innovation for social goals, which may require radically new thinking about what innovation is and how it takes place in that context.

Evaluation – typically of institutions, programmes and instruments, but recently more comprehensively of the overall "policy mix" or (public funding) "systems" – is essential to improve STI governance and to enhance the effectiveness and efficiency of innovation policies. New metrics are needed to support innovation policy making. Chapter 4 presents some "experimental" indicators on the mix of direct and indirect public support to R&D, as well as measures of public funding "modes" (*e.g.* institutional versus project funding). Work is needed to improve the international comparability of these indicators and to develop metrics for broader innovation (beyond R&D).

The policy, research and statistical communities are encouraged to:

- Promote the development of indicators that capture the nature, direction and intensity of policy actions for innovation at national and regional levels. This will make it possible to study the linkages between them and innovation performance and the relevance of policies in different innovation system contexts.

### Capturing knowledge interactions

Workplaces can provide a fertile environment for interactions leading to innovation if effective management can ensure that the talents of individuals are being tapped. New measures are needed of the skills required and of ways in which the workplace promotes and makes use of such skills.

The production of new knowledge is often a collective process involving a significant number of individuals and organisations which requires communication and co-ordination. Knowledge produced in such a complex but structured way may have public good aspects. Such interactions or “networks” may be usefully tracked as part of the innovation measurement framework. Networks can be a means for “collective intelligence”, and policies that seek to influence the rate and orientation of innovation have to take networks into account. For instance, technology transfer between universities and industries implies two-way communication. The mobility of the highly skilled implies knowledge flows across disciplines, sectors and borders. A “clever” and linked use of bibliometric, patent and other administrative data can help reveal how these multidisciplinary, transnational networks are evolving. However, while science and innovation activities increasingly rely on dispersed networks of actors, they sometimes tend to cluster in certain places or around certain institutions (e.g. a leading university or a research laboratory of a multinational corporation). To analyse the changing landscape of science, technology and innovation is likely to require new units of analysis with different geographical scope.

Finally, rapidly developing enabling technologies such as information and communication technologies (ICT), biotechnologies, and nanotechnologies draw on interdisciplinary research and tend to be “general purpose technologies” that can be used across a broad range of industries. A consistent measurement framework across technologies would make it possible to compare their impacts.

#### Action 4

##### *Promote the design of new statistical methods and interdisciplinary approaches to data collection*

The design of innovation policy should take into account the characteristics of technologies, people and locations, as well as the linkages and flows among them. New methods of analysis are needed to understand innovative behaviour, its determinants and its impacts at the level of the individual, the firm and the organisation.

The statistical and research communities should consider:

- Developing interdisciplinary approaches to data collection and new units of data collection;
- Improving the measurement of innovative activity in complex business structures, organisations and networks;
- Promoting the measurement of the skills required in innovative workplaces; and
- Promoting joint measurement of emerging and enabling technologies.

### Going beyond economic goals: innovation for social goals and social impacts of innovation

Innovation may be part of a policy framework that addresses societal issues that go beyond day-to-day business innovation. This may require a concept of “policy-driven” innovation which can also respond to social challenges or address social needs. Some innovations that generate income for firms may, of course, reduce environmental impacts and improve social well-being. However, the current measurement framework focuses on the role of innovation in economic performance and has limited capacity to measure innovations that help address social goals, such as those associated with an ageing population or climate change.

Moreover, the current framework does not cover the social impacts of innovation. For example, to analyse the effects of policies that “foster innovative workplaces”, it is necessary to measure both the adoption of innovative practices by companies and the impact of these practices on workers. It would be possible to do so, for example, through linked employer-employee surveys.

#### Action 5

##### *Promote the measurement of innovation for social goals and of social impacts of innovation*

It is important to promote the development of concepts and measures of innovation that reveal their impact on well-being or their contributions to achieving social goals.

The statistical and research communities are encouraged to work towards:

- Developing concepts and measures of innovations that address social needs; and
- Devising measurement tools that bridge the economic and social impacts of innovation activities.

### Box 2 • A measurement agenda for innovation: Key actions

#### **1. Improve the measurement of broader innovation and its link to macroeconomic performance**

Science, technology and innovation surveys need to be redesigned to take a broader view of innovation and improved measurements are needed to link science, technology and innovation policies to economic growth. Key actions:

- Measure and value intangible assets;
- Revisit the measurement framework for innovation to identify and prioritise areas for survey design and re-design; and
- Align survey and administrative data with economic aggregates.

#### **2. Invest in a high-quality and comprehensive data infrastructure to measure the determinants and impacts of innovation**

Sound policy advice needs to rely on a high-quality and comprehensive data infrastructure, including at the sub-national level. The backbone of such infrastructure is a high quality business register. The ability to link different data sets and exploit the potential of administrative records will improve understanding and reduce respondent burden. Key actions:

- Improve business registers;
- Exploit the statistical potential of administrative records;
- Improve the data infrastructure at the sub-national level; and
- Establish a data infrastructure which combines data linkages with good researcher access to the data, while protecting business and individual confidentiality.

#### **3. Recognise the role of innovation in the public sector and promote its measurement**

There is a need to account for the use of public funds, measure the efficiency of producing and delivering public policies and services, and improve learning outcomes and the quality of the provision of public services via innovation. Key actions:

- Develop a measurement framework for innovation in the public sector for the delivery of public services, health and education; and
- Devise indicators that capture the nature, direction and intensity of public support for innovation, at national and sub-national levels.

#### **4. Promote the design of new statistical methods and interdisciplinary approaches to data collection**

Design of policies for innovation needs to take into account the characteristics of technologies, people and locations, as well as the linkages and flows among them. New methods of analysis that are interdisciplinary in nature are necessary to understand innovative behaviour, its determinants and its impacts at the level of the individual, the firm and the organisation. Key actions:

- Develop interdisciplinary approaches to data collection and new units of data collection;
- Improve the measurement of innovative activity in complex business structures, organisations and networks;
- Promote the measurement of the skills required in innovative workplaces; and
- Promote the joint measurement of emerging and enabling technologies.

#### **5. Promote the measurement of innovation for social goals and of social impacts of innovation**

The current measurement framework fails to measure the social impacts of innovation. The development of measures that provide an assessment of the impacts of innovation on well-being, or their contributions to achieving social goals, needs to be promoted. Key actions:

- Develop measures of innovation that address social needs; and
- Devise measurement tools that bridge the economic and social impacts of innovation activities.

## References

OECD (2007), *Science, Technology and Innovation Indicators in a Changing World. Responding to Policy Needs*, a selection of papers presented at the OECD Blue Sky II Forum in September 2006, OECD, Paris.

OECD (2010), *The OECD Innovation Strategy: Getting a Head Start on Tomorrow*, OECD, Paris.

OECD and Eurostat (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3<sup>rd</sup> edition, OECD, Paris.