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*Institute for Economic
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ScISTIP

DST-NRF Centre of Excellence in
Scientometrics and Science,
Technology and Innovation Policy

STI Policies New Perspectives

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Science and Technology

- Science and technology *activities*
 - Occur in all sectors of the Frascati Manual 7th edition
 - Business enterprise, Government, Higher education, Private non-Profit
 - Include the formal generation of knowledge (R&D) and related scientific activities (data bases, geological surveys, granting councils, IP management, statistical offices, ...)
- Science and technology *policies*
 - Direct support for R&D
 - Grants and contracts, support for human resource development, technology ...
 - Indirect
 - Tax benefits, investment in infrastructure (super computers, high speed broadband networks, facilities for space research and astronomy, support technology transfer and for participating in international networks ...)

Science and technology policies

- Indirect (con't)
 - Support transfers among sectors
 - Government support for R&D in higher education and research institutes, as well as business contracting with universities and research institutes
 - Business support for R&D in higher education and research institutes as well as government organisations
 - Support for a better understanding of how the system works
 - NFS Science of Science and Innovation Policy (SciSIP)
 - Public understanding of science
 - Managing global value chains
 - ...

Innovation – What is it?

- For statistical purposes, the definition of innovation is taken from the Oslo Manual (OECD/Eurostat 2005). www.oecd.org/sti/innovation/
- The Oslo Manual deals with the business sector and has done for 25 years
- An **innovation** is the *implementation* of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD/Eurostat 2005, para. 146)
- A common feature of an innovation is that it must have been *implemented*. A new or improved product is *implemented* when it is introduced on the market. New processes, marketing methods or organizational methods are implemented when they are brought into actual use in the firm's operations (OECD/Eurostat 2005, para. 150)
- Innovation can happen in any sector (OECD/Eurostat 2005, para. 27 and 28)

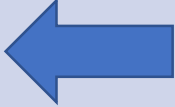



Innovation - Activities

- These include
 - Capital expenditure on machinery, equipment and software
 - Training and learning by doing related to innovation
 - Purchase of knowledge
 - R&D
 - Other
 - An innovation activity is different from the activity of innovation
- Innovation does not happen in isolation, even if measurement is limited to the business sector

Innovation Systems

- **Actors** (firms, government departments, institutions of education and research, ...) *engaged in*
- **Activities** (Capital expenditure on machinery, equipment and software, Training and learning by doing related to innovation, Purchase of knowledge, R&D, other) *having*
- **Linkages** (grants, contracts, mobile staff, collaboration, audit...) *resulting in*
- Short term **outcomes** (jobs and growth) and longer term **impacts** (wellbeing? ...) subject to **framework conditions**

Innovation Policy – An overview

	Innovative Firms	Non-Innovative Firms	Total Firms
R&D Performers	Larger firms converting knowledge to value	Human Bio start ups 	Total R&D performers
Non-R&D Performers	 Smaller firms learning by Doing, Using and Interacting (DUI)	  No R&D and no innovation	Total Non-R&D performers
Total	Total innovative firms	Total non-innovative firms	Total firms

Innovation Policy – Some data

Company characteristics	All Companies	Product or Process innovation	No. of innovative companies
	(000)	Per cent	(000)
All	1,220.1	14.3	174.5
With R&D	57.1	64.2	36.7
No R&D	1,163.0	11.8	137.2
Source: NSF 16-308			

Emerging trends*

- Demography
- Natural resources and energy
- Climate change and environment
- Globalisation
- Role of governments
- Economy, jobs and productivity
- Society
- Health, inequality and well-being

*OECD Science, Technology and Innovation Outlook 2016

Innovation policies

- Reflect the thematic **priorities** of the country*
 - Digital Economy and Society
 - Sustainable economy and energy
 - Innovative workplace
 - Healthy living
 - Intelligent mobility
 - Civil security
- **Governance (indicative of priority)**
 - Whole of government
 - Groups of Ministries
 - Single Ministry or sub department

* *The New High-Tech Strategy - Innovations for Germany*, as an example

Developing the policy - 1

- Direct policies
 - R&D related or not?
 - Human resource development
 - Technology focus? – Aerospace, ICT, Bio, Materials, ATTO, ...
 - Regional focus?
 - International cooperation
 - ...
- Goals
 - Global challenges
 - Economic development
 - Technological development
 - Regional development
 - Sustainability
 - Inclusiveness
 - Dialogue and participation
 - ...

Developing the policy - 2

- Framework conditions
 - Regulation
 - Environmental
 - Health and safety
 - Trade and cooperation
 - Immigration
 -
 - Norms
 - Internationally agreed standards, de facto standards
 - History, culture (risk aversion, ...), education
 - Corruption, violence, disease, inequality,

Implementing and monitoring policy

- Implementation
 - Dialogue and transparency
 - Existing instruments
 - Legislation leading to regulations to support the policy
 - Incentives
 - *Requires*
- Monitoring
 - Surveys
 - Case studies
 - *Leading to*
- Evaluation
 - Were the policy objectives achieved? *Leading to*
- Policy learning

Innovation does not happen in isolation

- Oslo Manual deals with innovation in the business sector
- Innovation in the business sector is influenced by linkages with the public sector (government, health, education)
- Innovation can also happen in these sectors requiring a new perspective on innovation policy
- Can innovation in the public sector be measured and what does innovation policy look like?
 - Deal with the market by changing ‘introduced on the market’ to ‘made available to potential users’ (Gault 2012)
 - From a policy perspective, the linkages in the system become more important
 - Institutions in all economic sectors can innovate, but also, their activities can influence innovation in all other sectors. This leads to responses to the Mazzocato question – *what role does the public sector play in business sector innovation.*
 - Business, public sector and households sectors are all related

Innovation in all sectors of the economy

- Policy development, monitoring and evaluation of implemented policy require statistical measurement
- The source of definitions, for statistical purposes, of economic sectors is the System of National Accounts (SNA 2008). The Oslo and Frascati Manuals use SNA definitions and language
- A start in dealing with innovation in all sectors was a proposal to change ‘on the market’ in the Oslo definition to ‘made available to potential users’ (Gault 2012)
- Next came generalised definitions applicable in all sectors (Gault 2016). Using a *systems approach* to classify *actors, activities, linkages, outcomes and impacts* all influenced by *framework conditions* leading to a system-wide understanding of innovation

New Perspectives

- Response to the Mazzucato question?
- A system-wide view for policy
- Actors and activities
 - Consistent measurement of the activity of actors in each sector – with little change to what is measured in the business sector
- Linkages
 - Innovation in any sector requiring input from other sectors
 - Innovation in any sector providing output (outcomes, impacts) that influences innovation or other activities (entrepreneurship) in other sectors
- Outcomes and Impacts
 - Resulting from linkages across sectors

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