Innovation surveys and indicators: an international perspective and emerging issues

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Outline and introduction

- OECD involvement in innovation measurement: surveys and indicators
- Methodological and conceptual work
- Data collection and indicators
- Analytical work: microdata
- Ongoing work: business R&D and innovation survey (re)design, public sector innovation

Methodological work

- **Long tradition of manuals and guidelines for the measurement of S&T activities**
- **Frascati (R&D): since 1960s, now 6th edition (2002)**
- **Oslo (innovation): since early 90s, now 3rd edition (2005)**
- **Others: patents, HRST (Canberra), economic globalisation, information society, biotech**

Oslo Manual

- Co-managed with Eurostat since the 2nd edition (1997), developed and reviewed through peer process (NESTI + ESTAT WP STI)
- Provides conceptual background for analysis of innovation in firms
- Built on economic framework (elements from Schumpeter, systems of innovation approach), subject approach, creation and diffusion of knowledge
- Provides definitions and recommendations for developing surveys, but not a template or list of indicators
- Latest revision: expansion to non-technological innovation (org + mkt), innovation linkages, annex on developing countries

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Harmonised data collection: the Community Innovation Survey (CIS)

- **Run since reference year 1992, now biannually**
- **Used by all EU Member States + some Candidate / Associated countries**
- **Guided by:**
  - Oslo Manual (2005)
  - EC Regulation 1450/2004 → list of mandatory/voluntary indicators (around 50/50 in CIS-2010)
  - Business survey questionnaire + methodology
- **Harmonised questionnaire (incl. ad-hoc modules) which is then implemented nationally with some modifications**
- **Methodological guidelines + aggregations/tabulations**

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Use of CIS indicators

- **National reports**
- **Eurostat reports**
- **EU Innovation Union Scoreboard - IUS (ex-EIS):**
  - http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2010
- **OECD reports: STI Scoreboard (forthc. 2011), Innovation Strategy (2010)**
- **Growing use but still less widely used than R&D statistics → some concerns about quality, policy relevance, international comparability (outside EU)**

Innovation surveys outside Europe

- **Increasing use in OECD and developing countries: around 80 countries world-wide have carried some type of innovation survey, mainly following Oslo Manual framework**
- **3 broad types:**
  - Close to CIS design with some adaptations: China, Japan, Korea, Russia, South Africa
  - Joint R&D/innovation surveys close to CIS: Brazil, Chile, Israel, Mexico, United States* (BRDIS)
  - Broader surveys (business strategies/operations): Australia, Canada, New Zealand, Switzerland

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Some examples

- **Australia (Business Characteristics Survey 2008-09): modular approach with sections on business structure and operations, financing, innovation, markets & competition, skills, ICTs**
- **Canada (Survey of Innovation and Business Strategy 2009): strategic decisions, innovation activities, operational tactics + involvement in global value chains**

Challenges

- **Differences in:**
  - scope and type of survey: stand-alone, joint R&D/innov, module within broader survey
  - Target population: industries, firm size threshold
  - length of observation period (2-3 years)
  - Reference period
  - Scope of certain variables: *e.g.* collaboration, expenditure
- **Methodological problems remain, even for CIS countries:**
  - Data quality due to low response rates, widespread use of imputation, qualitative/subjective measures
  - Voluntary/mandatory variables (ad-hoc modules)

An example: innovation expenditure

- Current model CIS (and similar surveys): levels are collected for 4 activities (only for product innovation), binary (Y/N) for other activities (*e.g.* training)
- Switzerland (2008): 5-level scale by type of innovation (product/process) and expenditure category (research, development, design and preparations, subsequent investments, ICT). + levels for 3 categories over 3-yr period
- Canada (2009): expenditure on process innovations, expenditure on product innovations, expenditure on marketing innovations (as a share of total marketing expenditures).
- Japan (J-NIS 2003): total value for innovation expenditure (related to product / process) and shares for certain activities (similar to CIS).
- Australia (2008-09): only a binary variable (Y/N) is used for 8 activities relating to all 4 types of innovations (product, process, marketing, organisational).
- New Zealand (2009): values for 4 categories relating to product development & related activities (R&D, design, marketing and market research, other) + Y/N to list of 10 activities (and whether to support innovation)

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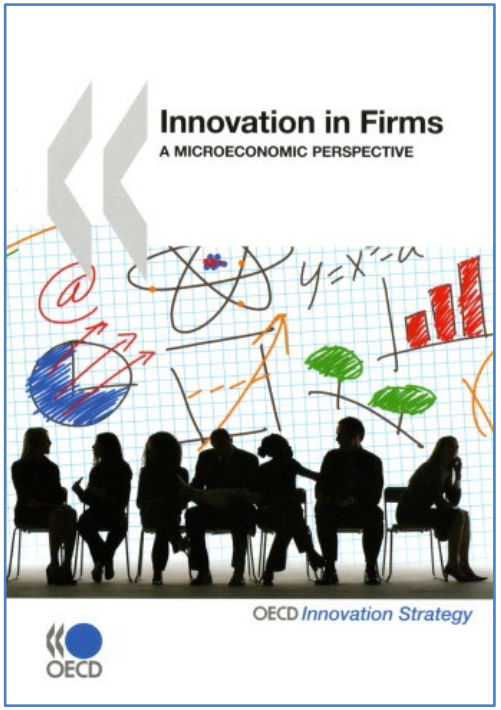
OECD Innovation Microdata Project

- **Rationale and approach: restrictions on accessing microdata → decentralised approach with OECD coordinating and country leads, develop common routines (STATA/SAS)**
- **Participants and organisation: over 20 countries, around 50 researchers**
- **3 modules: (1) indicators; (2) mixed modes and non-tech innovation; (3) innovation and productivity (econometric analysis)**
- **2 phases: 2007-09 and 2009-11**
- **Data used for *OECD Innovation Strategy* reports, in particular "Measuring Innovation: A New Perspective" (2010)**



Microdata Project 1: indicators

- **3 main objectives:**
  - International comparability: CIS / others → construct indicators using similar scope (industries, firm size), map variables to CIS
  - Develop new indicators and taxonomies
  - Exploit new breakdowns for existing indicators

Indicators (1)

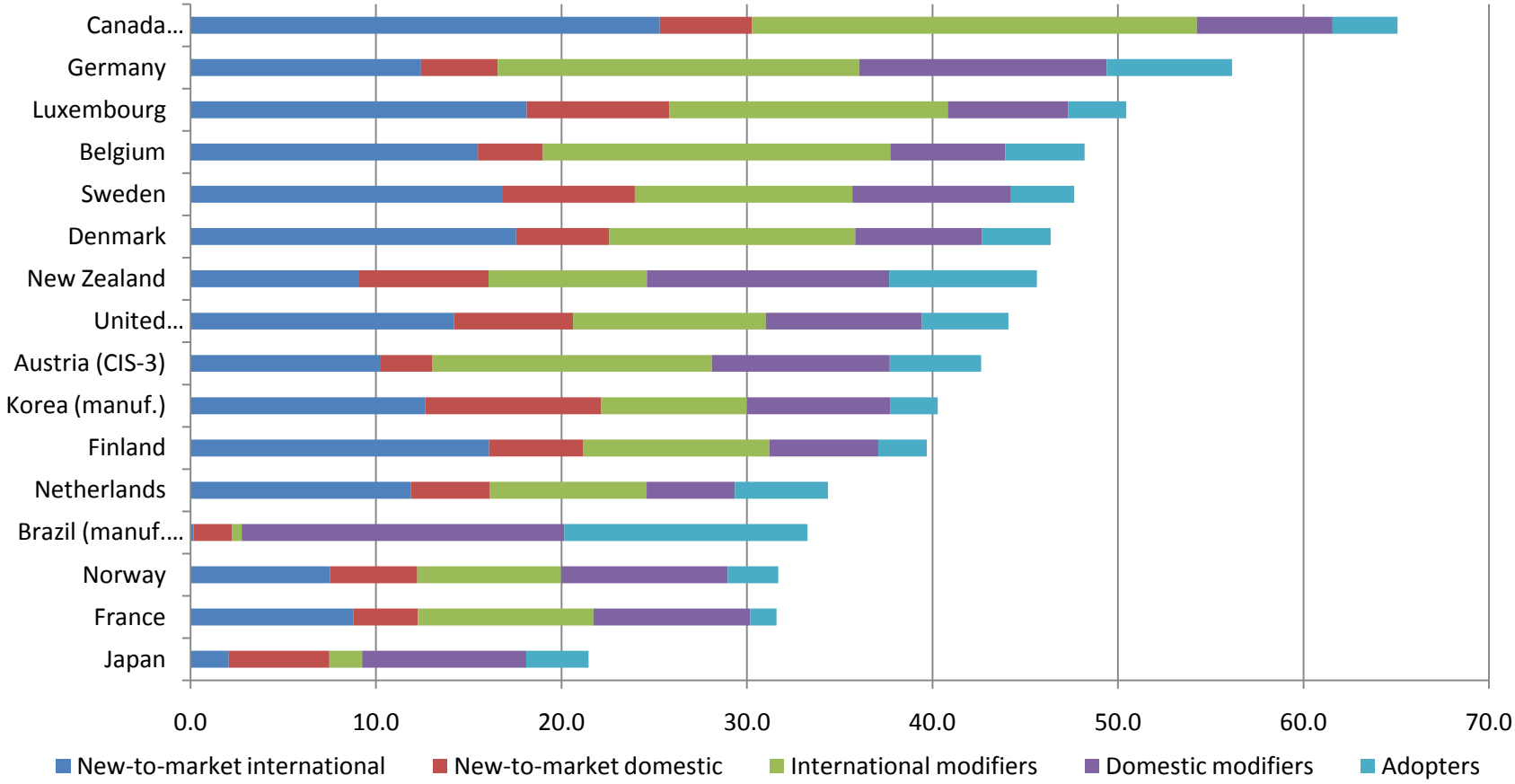
- Selected 20 “basic” indicators usually constructed with a single variable in survey
- Similar to indicators tabulated for CIS: product / process innovators, new-to-market process innovators, marketing / organisational, R&D performance, expenditures (as % of turnover), public support, collaboration, patents
- Map variables for non-CIS countries

Indicators (2)

- **More 'complex' indicators and new taxonomies (combining several questions)**
- **Output-based modes (PP):**
  - Combine degree of novelty (new-to-market) with international orientation (domestic-only/foreign)
- **Open innovation:**
  - Sourcing (extramural R&D, other external knowledge)
  - Joint innovation: product/process innovations with others
- **Complementarities:**
  - PP only, MO only, both
- **Breakdowns: R&D status/intensity, SMEs (single/group)**

Indicators: some examples

Output-based innovation modes, 2002-04 (as a % of all firms)

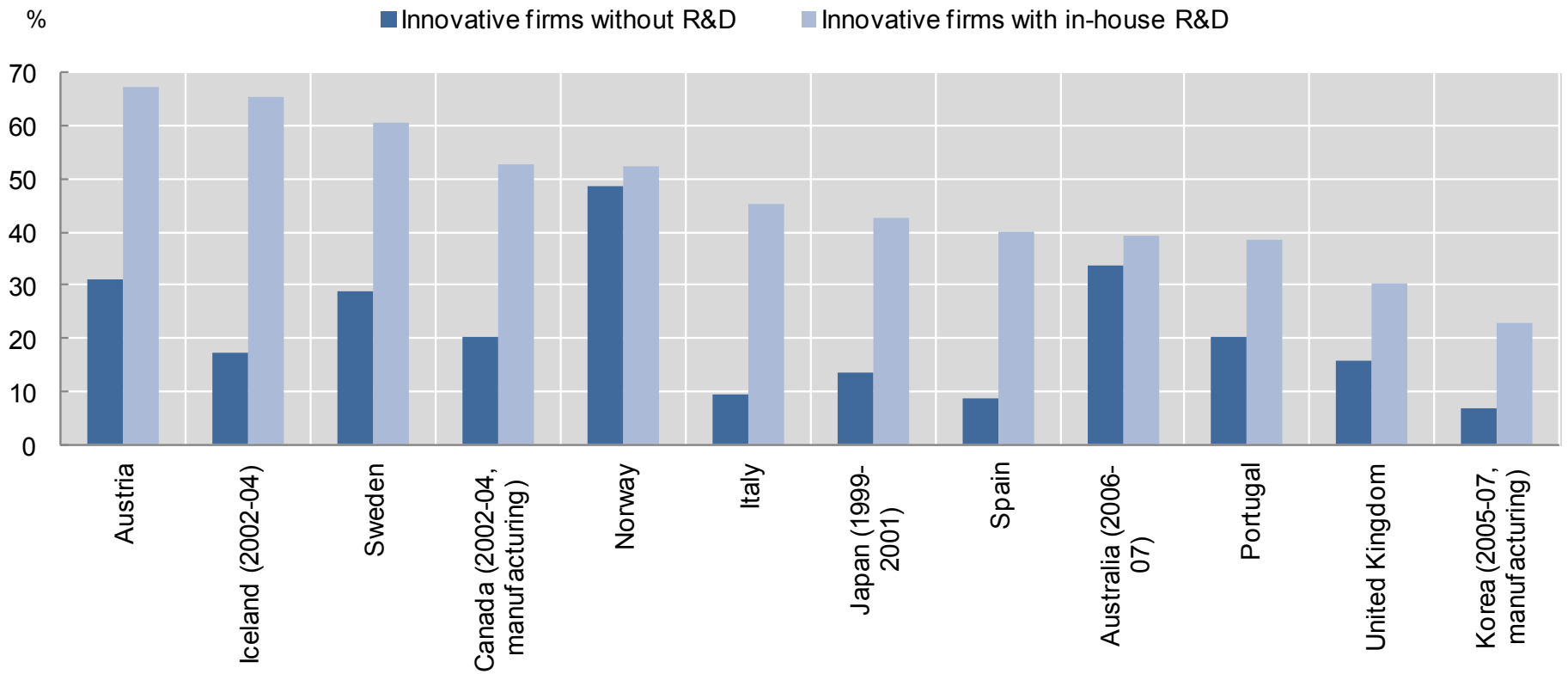


Note: for New Zealand: 2004-05, for Japan: 1999-2001, for Brazil: 2003-05, for Austria 1998-2000.
Source: OECD (2009), *Innovation in Firms: a microeconomic perspective*, OECD, Paris.

Innovation is not only about R&D...

New to market product innovators with and without R&D, 2004-06 (or latest)

As a percentage of innovative firms by R&D status



Source: OECD (2010), *Measuring Innovation: A New Perspective*, OECD, Paris.

Microdata project 2: innovation modes

- **Rationale: limited analysis of "non-tech" forms of innovation, understand complementarities between the 4 types (Prod, Proc, Mkt, Org) → identify different firm strategies**
- **Approach: include various variables relating to innovation outputs (*e.g.* new-to-market product innovation) and inputs (*e.g.* R&D activities) as well as different types of innovation.**
- **Around 17 variables were used in analysis for 9 countries (CIS + others)**

Mixed-modes

- **Exploratory factor analysis used to reduce set of binary variables into different concepts (factors) which relate to combinations of innovation inputs/outputs**
- **Factor solutions computed for all countries which are then identified and interpreted as *firm strategies***
- **Cluster analysis is then conducted based on these factors to identify groups of firms with similar values across all factors**
- **Factor scores for each firm used as variables in regressions to predict firm-level (labour) productivity**

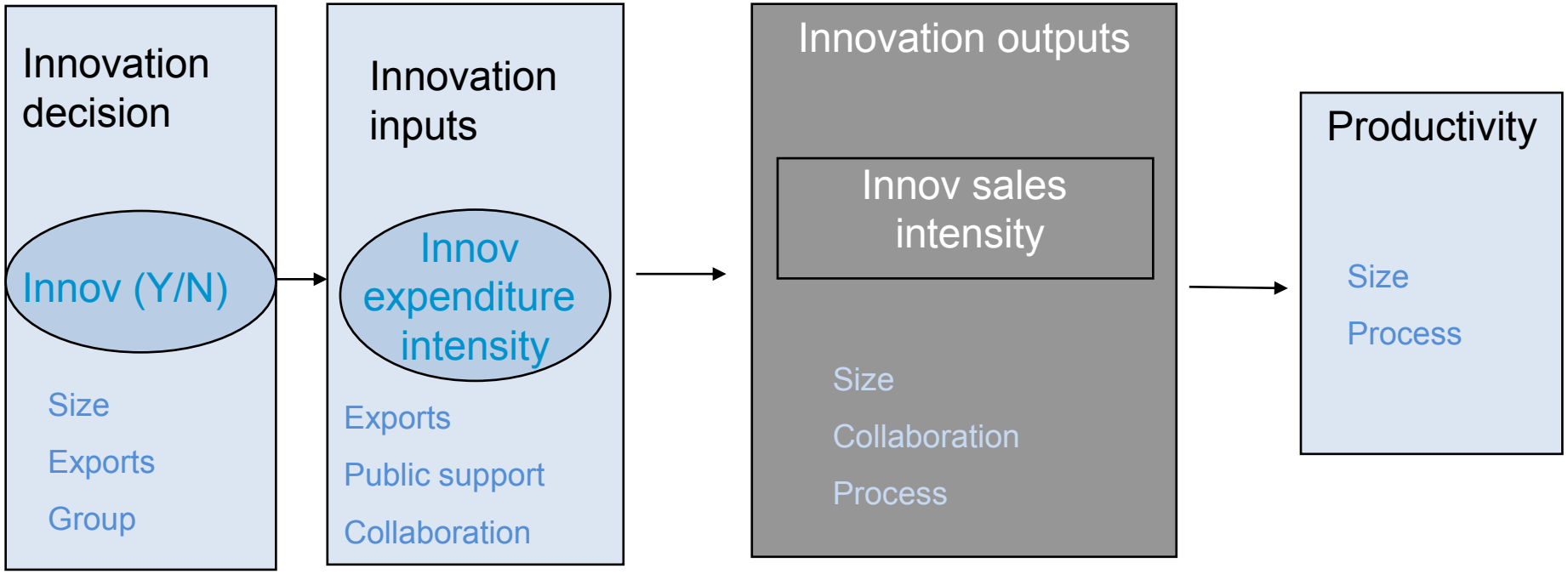
Mixed-modes: brief results

- Four common modes identified:
  - **Process modernising**
  - **Wider innovation**
  - Marketing-based imitating
  - *New-to-market innovating*
  - *[in phase 2: networked innovating + IP/technology innov]*
- Country specificities: *e.g.* relative importance of design, appropriation strategies
- No consistent pattern regarding link to productivity
- Phase 2: stability over time, adding "systems" variables on knowledge flows, examine regional/sectoral patterns

Microdata project 3: innovation and productivity

- **Rationale: use of a simplified framework to model the relation between innovation and its determinants through knowledge production function and the contribution of innovation to productivity using an output function.**
- **Core model: so-called "CDM" model (Crépon, Duguet & Mairesse, 1998)**
- **Some countries tested extended models based on data availability**

Model used



1st stage: investment phase

2nd stage: Reaping the benefits

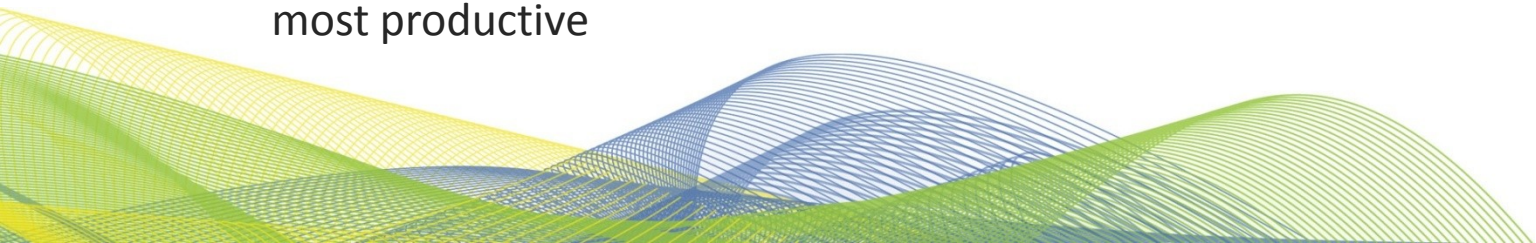
Selection equation and innovation demand function

Knowledge production function

Production function

Main messages from Phase 1

- **Positive link between investment in innovation, sales from innovative products and firm's productivity holds for most countries**
- **Firms that invest more on innovation are those that:**
  - Belong to a group; export; collaborate; receive public financial support;
- **Firms spending more on innovation (p/employee) earn greater returns from innovation (higher sales from innovative products p/employee)**
  - and among those firms, the ones that *introduce both product and process innovations* have greater returns than those introducing only product innovation
- **Firms with higher sales from innovative products are also those firms with higher productivity levels**
  - and among the (small) innovative firms, those belonging to a group are the most productive



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Phase 2: expanding the model

Incorporate:

- Measure of firms' **innovation capability** using "distance to technological frontier" (distance to most productive firms in industry)
  - Findings: public financial support increases innovation spending , especially for firms far from the TF; for collaboration results mixed across countries
- Measure of **competitive environment** (market concentration)
  - Findings: mixed → higher concentration does not necessarily hamper innovation, but differences across industries. Need further work, improve measures of competition (*e.g.* profit-based)

Ongoing OECD work

- **R&D and innovation survey redesign (2011-12) - Task Force being set up through NESTI to examine various issues including:**
  1. Methodologies and data collection: survey design (*e.g.* target population, sampling methods, unit of analysis, non-response, weighting) data collection methods (*e.g.* joint surveys, data sources, online surveys), data processing (*e.g.* estimation)
  2. Data use and indicators: quality, comparability, use and relevance
  3. Designing and testing new questions (or different formulations)
- **Framework for measuring public sector innovation**
- **Collaborate with other initiatives (e.g. ESTAT, UNESCO Institute for Statistics)**

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