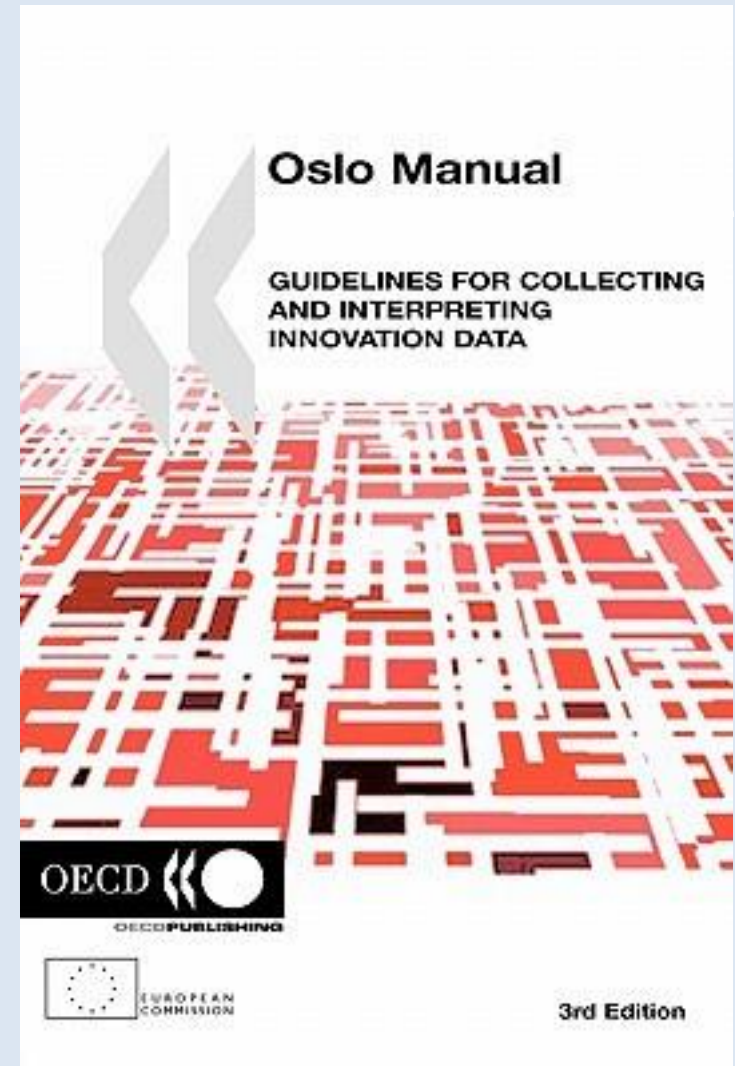


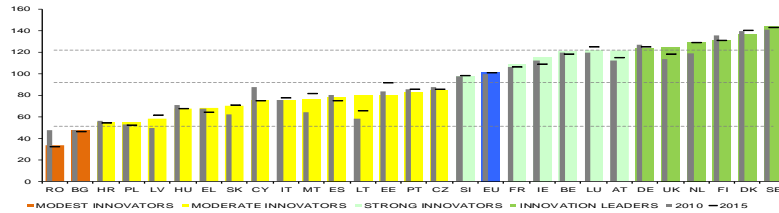
Innovation Surveys for Sustainable Development Goals: Design & Implementation

Anthony Arundel
UNU-MERIT





Purpose of innovation surveys



Benchmarking performance by sector, region, internationally, etc.

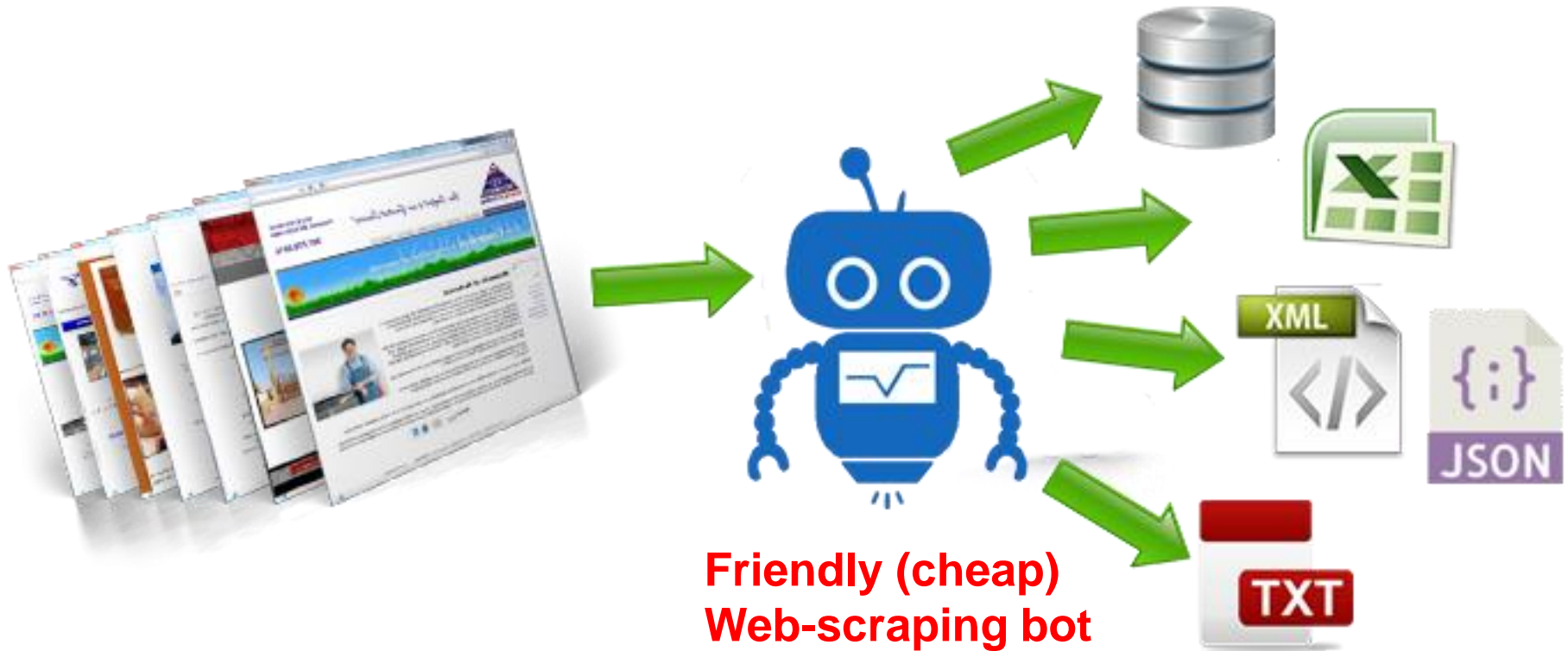
Trend analysis – how is performance changing over time?

Econometric analysis of what works and what does not work in attaining outputs

Econometric analysis of economic outcomes of innovation



Why use a survey when other methods of collecting innovation data are available?



Other data sources

- **IP registrations**
 - Patents
 - Design
 - Plant breeder's rights
- **Bibliometrics**
 - Publication counts, co-publications, citations

These do not measure innovations and only capture a small percentage of innovative firms



Disadvantages of non-survey innovation data

Self-selection – businesses only provide information that they want made public.



Incomplete - not all required information is available from other sources



Not representative – some members of a population are more likely to be visible (self-selection can cause this)



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Result: distorted picture of reality

What would patent policy look like if it was designed for all firms, and not primarily for the pharmaceutical sector?



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What types of data can we collect through an innovation survey?



1. Innovation drivers: demand, regulation, competition, etc.
2. Innovation objectives: cost reduction, product differentiation, etc.
3. Innovation strategies: exploratory or exploitative; use of IP, etc.
4. Types of innovation activities: R&D, equipment, marketing, training, design, idea generation, etc.
5. Sources of knowledge for innovation: universities, competitors, suppliers, customers, government, etc.
6. Methods used to innovate: trial and error, scientific method, design-thinking, co-creation, etc.
7. Obstacles to innovation: those that prevent innovation and those that slow it down or increase costs
8. Types of innovations: services, goods, processes, etc.
9. Types of innovation by effects: environmental, social, frugal, inclusive, etc.
10. Outcomes: on the innovative organization, on users, society, etc.
11. Specific topics: role of women, multinationals, networks, etc.



Who can be surveyed? (all SNA sectors)

Manufacturing

Services

Businesses

(65% to 75% GDP)

Resources

State-owned
enterprises

Utilities

**Non-profits serving
households (1% to
5% GDP)**

**Government (20-
30% of GDP)**

**Public
administration**

**Public service
providers (schools,
hospitals, etc.)**

**Households (plus part
of the informal sector)**

For all sectors we can collect data on 1) internal innovation activities and 2) their contributions to other sectors

Public sector agencies develop process and service innovations as part of their government function

And they support the innovation activities of the business sector through university research, procurement, subsidies etc.



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Questions for a survey of internal innovations by Australian universities

Function

General information

Time in current position

Number of staff

Restructuring

Types of innovations

Innovation environment

Drivers

Competition

Supportive environment

Inclusive innovation culture

Innovation methods

Use of Information sources

Funding & resources

Staff involvement

Use of design thinking methods



Most important innovation

Type of innovation

Source of the idea

Use of collaboration

Number of staff involved

Outcomes

Abandoned or under-performing innovation

Purpose of innovation

Causes of failure

Obstacles to innovation

Types of obstacles



In all sectors, an innovative unit is a building block of a system

INPUTS: Information and Knowledge
Human resources (education)
Capital (investments),
Resources (energy),
Physical infrastructure

OUTPUTS:
INNOVATION
Goods, services & processes
patents, academic papers

OUTCOMES
Higher productivity
Market growth
Change in profits

BROADER IMPACTS
Economic growth
Better living standards

How to collect data through an innovation survey?



Surveys use questionnaires

Good questionnaire design requires clear definitions and cognitive testing

Definitions: internationally accepted definitions are determined by the **NESTI** group of experts for the **OECD** and published in the OECD/Eurostat **Oslo Manual**.

Cognitive testing of questions: based on face-to-face interviews with 10-30 people drawn from the population of interest.



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Definitions of innovation

Schumpeter(1930s-40s): Innovation is “**new combinations**” of existing resources

Oslo Manual (new edition in October/November 2018):

Innovations are new or improved products (goods or services) or processes that meet three requirements:

1. It **differs significantly** from products previously offered on the market or processes used within the firm.
2. It must have been **implemented...as when introduced on the market.**
3. At a minimum it is **new to the firm.** An innovation does **not** have to be “**new to the market**” nor “**new to the world.**”

Oslo Manual uses a broad definition of innovation

Boeing 787:

Development costs: 32 billion USD



Point of sale ordering and payment systems for use in stores & restaurants:

Development costs for restaurants: 0

Purchase costs: \$150 each

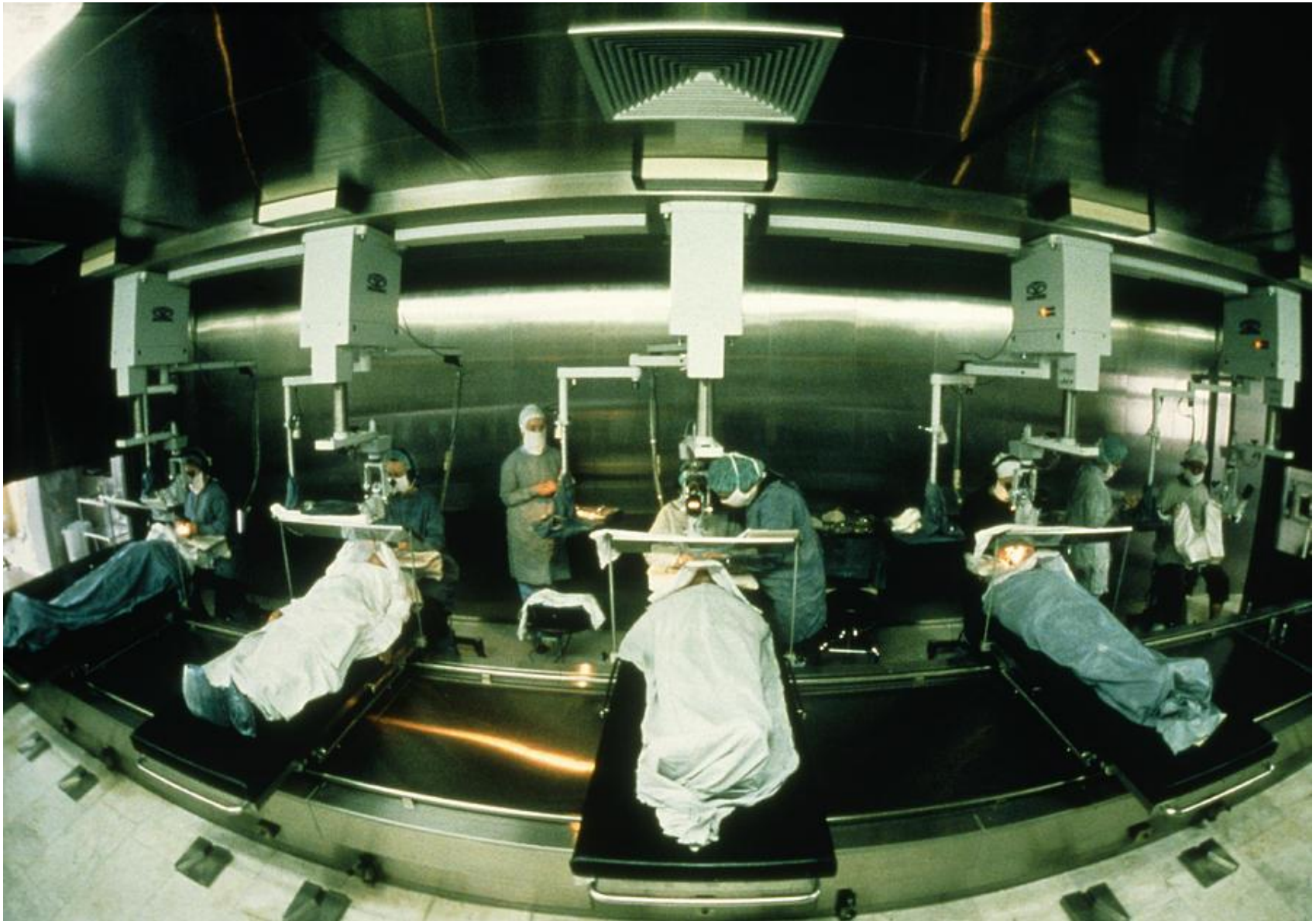


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Assembly line surgery for corneal implants



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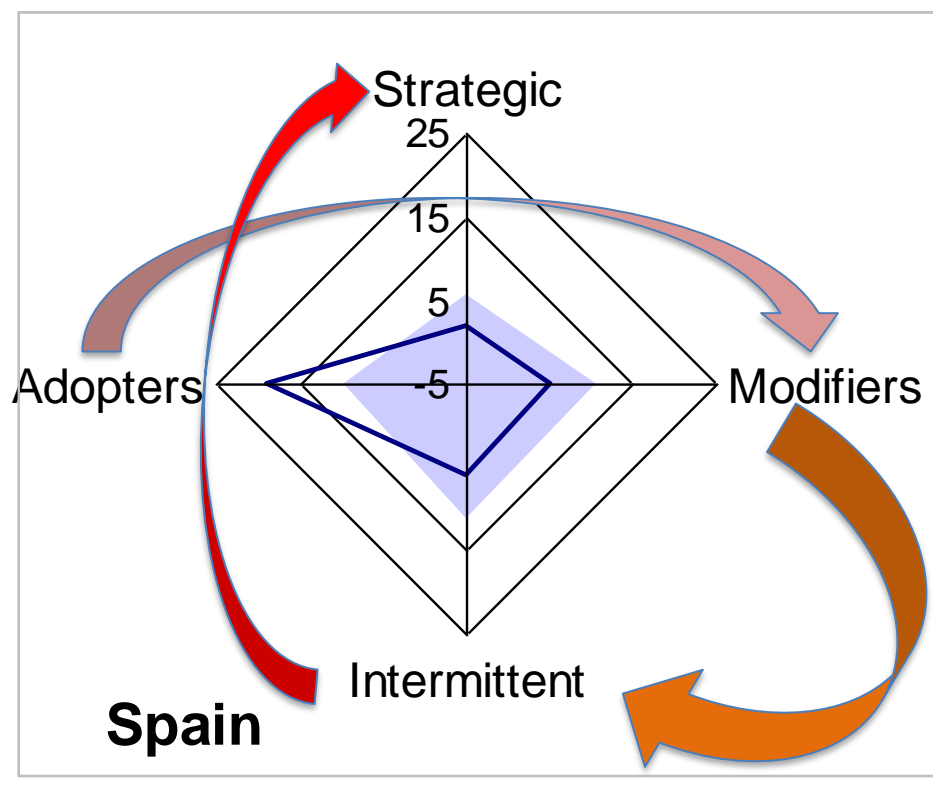
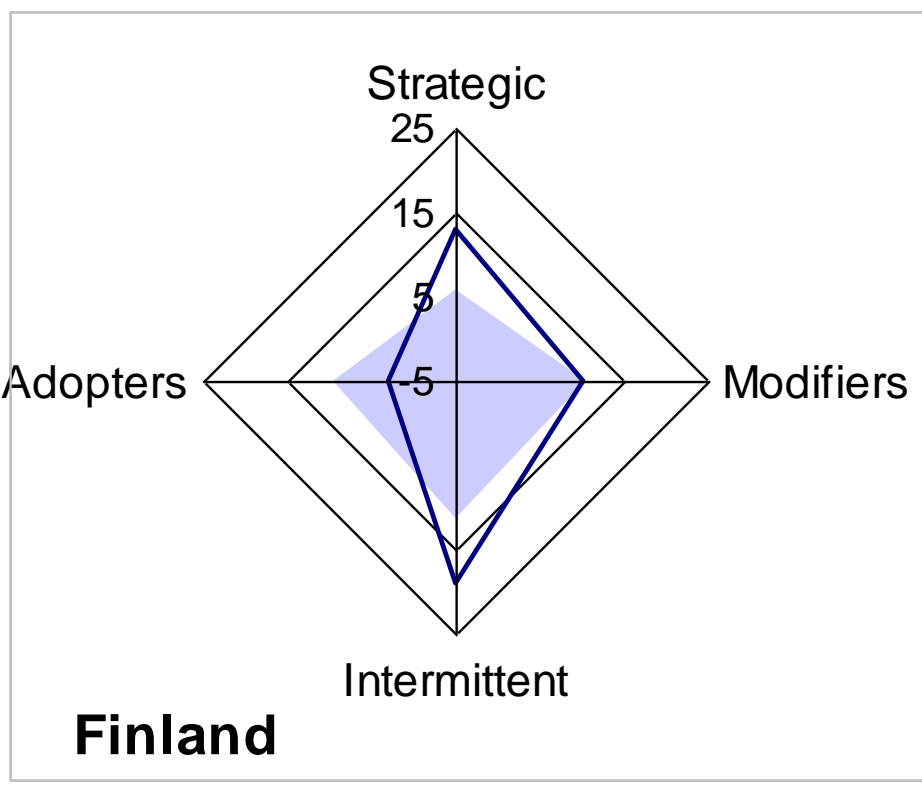
Oslo Manual Definition:

Implications of 'new to firm' for data collection

Questionnaires need to collect other data that can differentiate firms on the basis of their innovative capabilities and the novelty of their innovations.

Capabilities: investment in R&D (yes or no), investments in other types of innovation activities, use of innovation methodologies (design thinking) etc.

Novelty: introduction of new to market and new to world innovations.



Implications of a broad definition of innovation

- **Neither invention nor innovation requires R&D**
 - Approximately half of innovative firms in Europe do not perform R&D over a three-year period
 - In **manufacturing**, a lot of innovation occurs through combining existing knowledge in new ways or through engineering adjustments
 - Innovation in **services, organisational** structures or business models often uses design thinking –*how* innovation occurs can vary by sector



Cognitive testing

1. All questions need to be understood by all respondents exactly as intended (you want comparability)

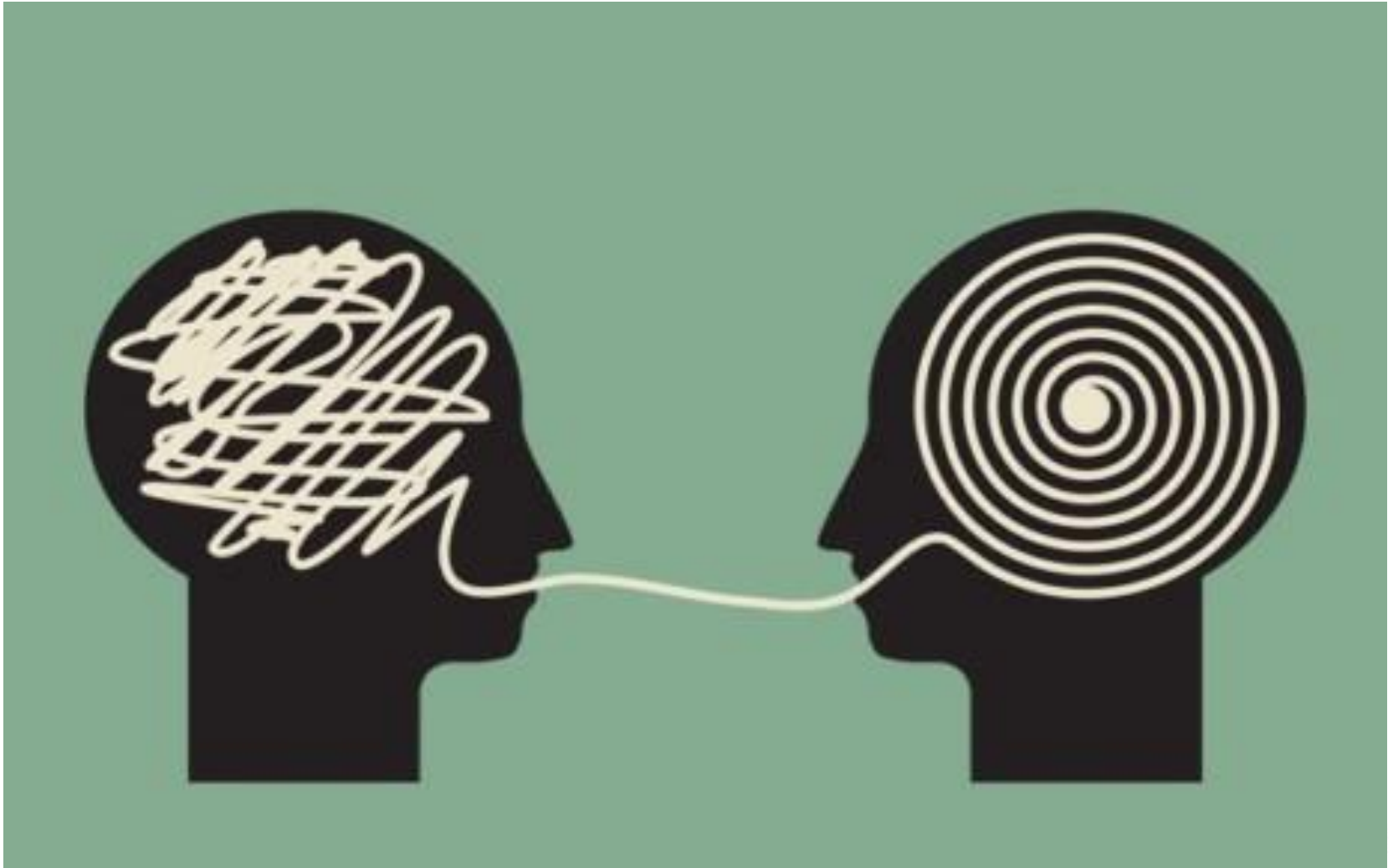
2. All respondents need to be able to give a reasonably accurate response

Don't ask questions to which almost all respondents will give the same answer or questions for which very few respondents can answer positively.



Cognitive testing addresses three problems:

1. Respondents understand questions differently



2. Respondents can understand the question, but not know the answer



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3. Respondents don't understand the question, but answer anyway (they are trying to be nice)



People (PhD students, academics, etc.) often think that they can develop questions without cognitive testing

1. What was your firm's domestic and world-wide sales in 2010?

		Don't know
Domestic	_____ '000 €	<input type="checkbox"/>
World-wide	_____ '000 €	<input type="checkbox"/>



1. Does your business unit share the new technologies that it has developed with other firms or institutions?

Sharing is defined as intentionally allowing other firms or institutions to

replicate or use the new technologies developed by your business unit.

Yes

No

Two interpretations

Does your **business unit share the new technologies that it has developed**, - with other firms or institutions?

(technologies developed by the respondent's business unit on its own)

Does your business unit share the new technologies, - **that it has developed with other firms or institutions?**

(technologies developed together with other firms or institutions)



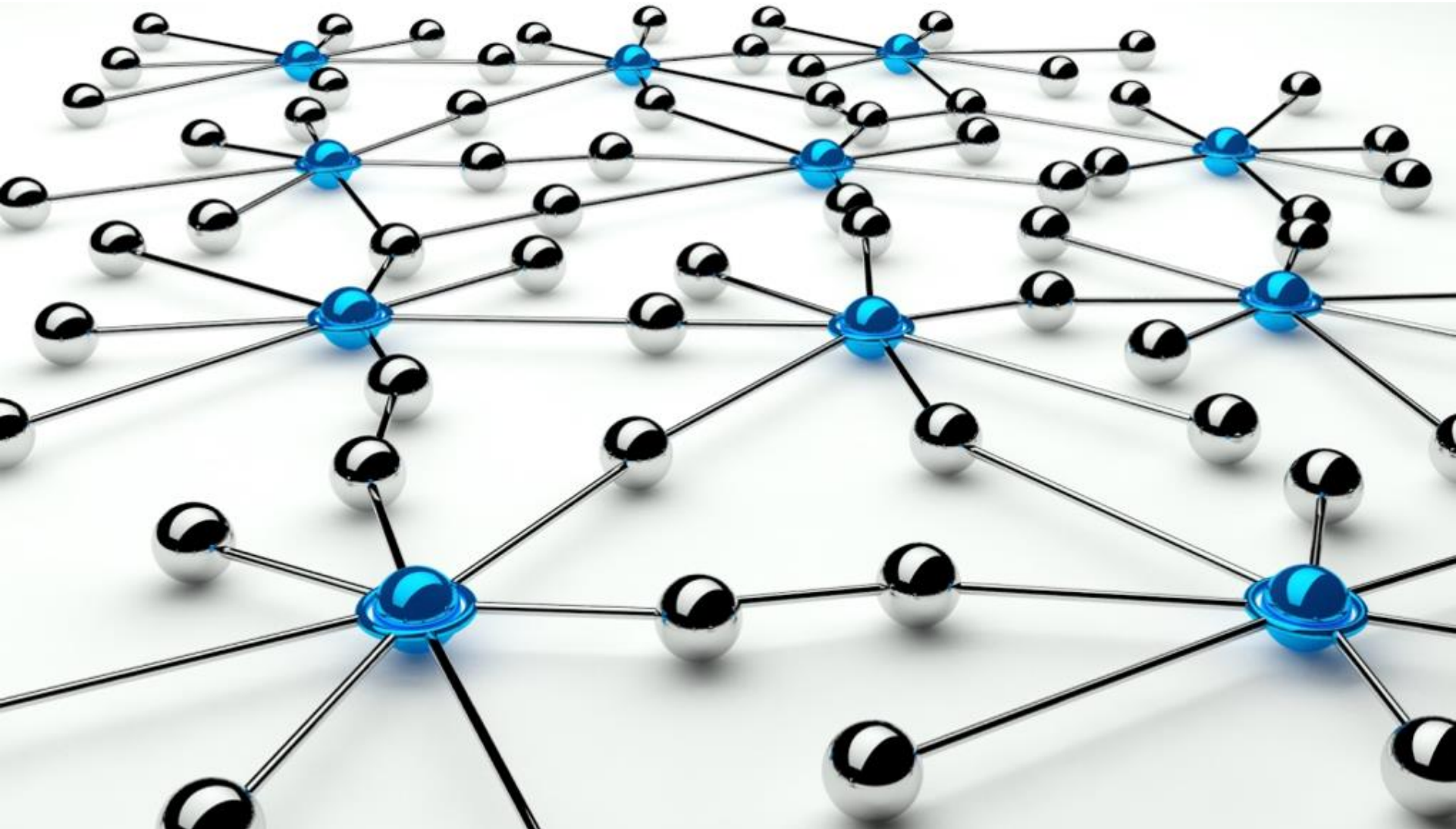
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Measuring networks or linkages through innovation surveys (innovation system)





A complementary asset



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Linkages

- Survey questions need to focus on the respondent's own area of expertise, usually their own business, or public agency, etc., but:
- National innovation systems (and policy challenges) often depend on multiple actors working on different aspects of a problem.
- Survey questions need to ask about these problems – who uses a firm's innovations, data on the firm's markets etc., who the firm collaborates with, **system-level obstacles** to innovation



For *transition changes* / *regime shifts*, a systems perspective is essential because of the number of actors and technical and organisational issues to solve



- **Eliminating CO₂ emissions:** major changes to energy consumption (transport, heating & cooling), energy production & distribution, construction
- **Solutions are not just technical:** requires organisational and social innovations



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Innovation surveys in middle & low-income countries: what needs to differ

- 2000s: research to identify questions that need to differ (Bogota Manual), but over time all countries are using the Oslo Manual.
- **How to implement the Oslo Manual?**
 - Use definitions (universal application)
 - **Develop questions using Oslo Manual guidelines for specific topics** then **cognitively test** questions with the national population
 - **Identify and develop new questions** that are required to meet national policy interests or conditions.



What the Oslo Manual does not do

- There is no expectation to use definitions exactly as written – they need to be translated so that the **meaning** is captured.
 - The European innovation surveys (CIS) use the word ‘enterprise’, while Australia and Canada use the word ‘business’.
- The Oslo Manual does not provide fully developed questions, although it does provide lists of topics. The questions need to be developed for each country (although many countries maintain comparability with the European CIS).



Implementation of innovation surveys

- Best suited to National Statistical Agencies, although academics often run innovation surveys
- New edition of the Oslo Manual will have an extensive discussion of survey methods



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Main steps for implementation

1. Selection of the population
Use a sample or census?
2. Choice of survey methods
Online (cheap but **low response rates**)
Mailed (printed) (moderate cost)
Telephone interview (moderate cost)
Face-to-face interview (expensive)
Mandatory or voluntary?
3. Follow-up protocol to maximize response rates
4. Imputation of missing data



Conclusions

- Depending on your policy needs, you can survey innovation in all four main sectors (business, government, households and non-profits surveying households).
- The Oslo Manual provides internationally recognized definitions and guidelines that you can adapt to your national context.
- Make sure that all questions are tested. If you borrow questions from others, make sure that they were also tested.
- Innovation surveys are best implemented by National Statistical Offices, but experimental surveys can be run by academics with expertise in surveys.

