RELEVANT, INCLUSIVE, TRUSTED AND OPEN INDICATORS
FOR RESEARCH AND INNOVATION POLICY

Current Challenges for Measuring Innovation, their Implications for Evidence-based Innovation Policy and the Opportunities of Big Data

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Impact of Research and Innovation Policy
at the Crossroads of Policy Design, Implementation and Evaluation

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Agenda

- Background: Evidence-based Innovation Policy
- Use of Indicators in the Policy Life Cycle
- Requirements for Innovation Indicators
- Traditional Innovation Indicators
- Paradigm Shift in Innovation Indicators
- Challenges and Opportunities

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Background

- **Policymaking** in general is **complex** and **dynamic** where outcomes are constantly influenced by external factors
- Having the correct information and relevant **evidence** regarding a policy choice is **crucial**
- **Evidence-informed policymaking**: evidence can help explain the policy environment and options, the various effects of different policies and what path to take in order to reach a certain objective or goal
- **Evidence** comes in many forms and can be: **indicators**, historical facts, statistics, and results of experiments, texts, quotes from secondary sources, real experiences or histories and expert opinions
- **New sources of evidence** have an **impact** on **evidence-based policy making**
- **Innovation policy** in particular is **highly complex and dynamic** driven by new insights in science and technology, but also changes in markets and companies
- **Timeliness of information** more **crucial for innovation policy,** but **heavily challenged by dynamics**
- **Multidimensional phenomena of innovation** requires **multiple indicators,** which are **challenging policymaking**
- **New innovation indicators: opportunities, but also challenging policymaking**

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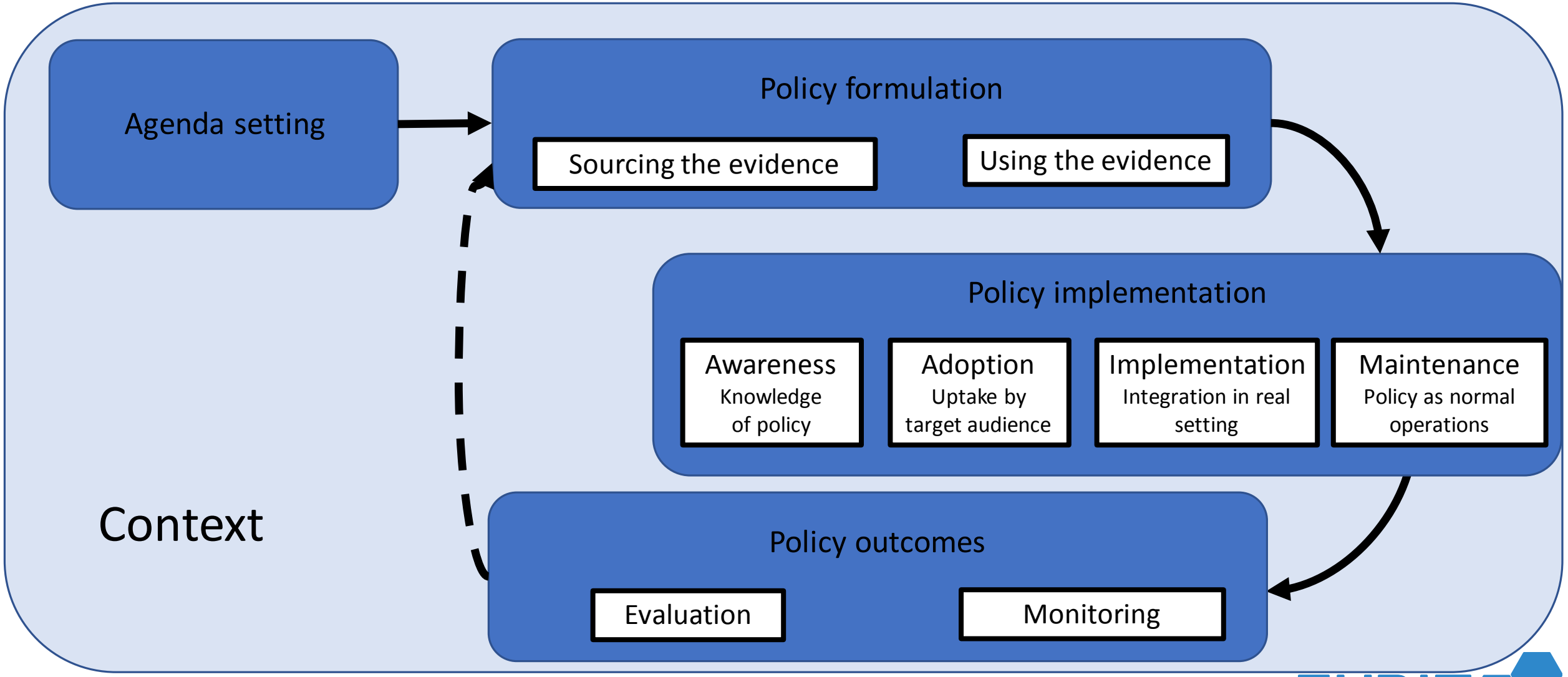
Conceptual Model for Evidence-Informed Policy



Source: based on Strehlenert et al. 2015

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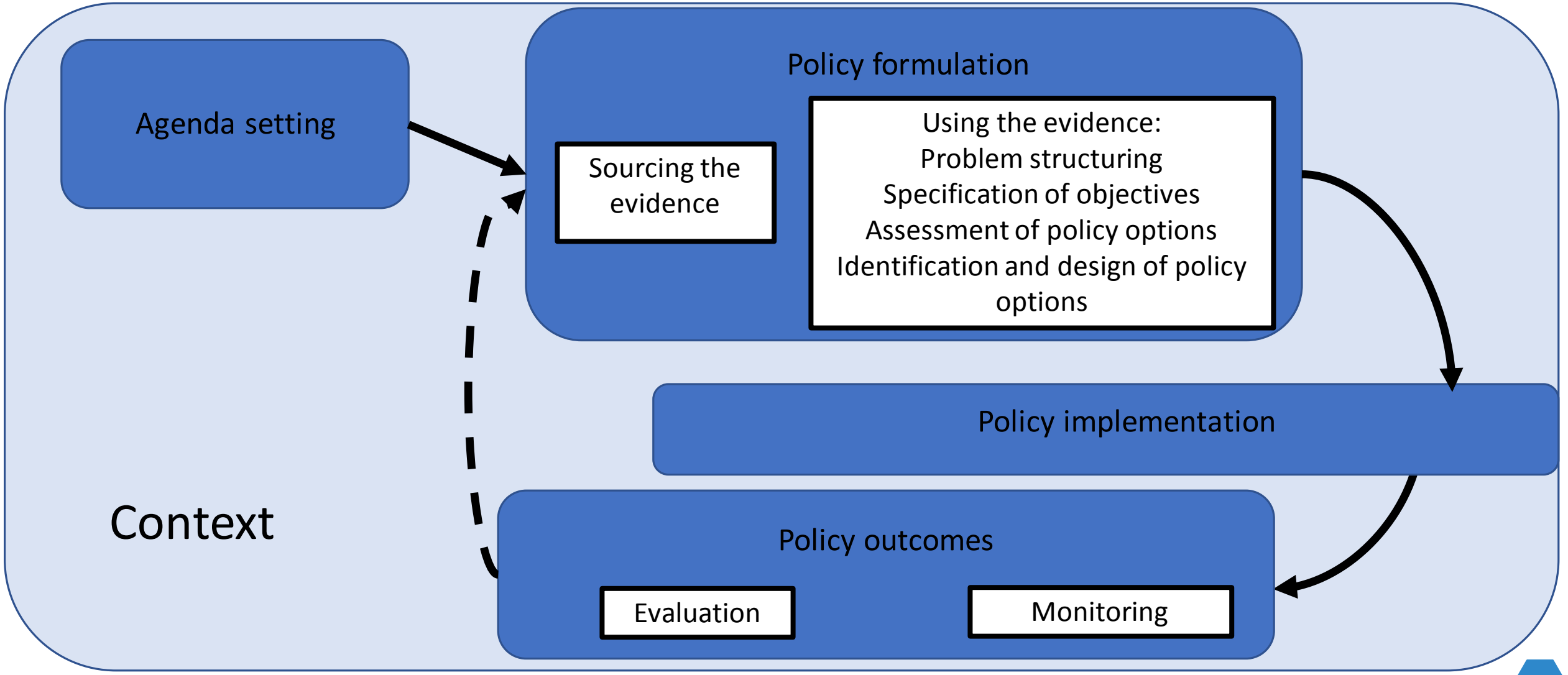
Policy Formulation Tasks in Evidence-Informed Policy



Source: own model based on Strehlenert et al. 2015 and Lehtonen 2017

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Contribution of Indicators to Different Policy Formulation Tasks

Policy formulation task	Contribution of indicators
Problem structuring ● Conceptualization of the problem by policymakers	● **Baseline information** (state of the environment indicators, sectoral indicators etc.) ● **Participatory elaboration of indicators** ● **Indicators as input to participatory policymaking** ● **Indicators as a tool for framing policy problems** ● **Indicators defined according to dominant framings**
Specification of objectives	● **Forward-looking indicators as feedstock to scenarios** ● **Quantification and simplification** ● **Translation of broad policy aims into specific goals** ● **Indicators as 'vehicles' carrying specific visions and worldviews**
Assessment of policy options ● Comparison of potential impacts of different options ● Assessment of past and future trends	● **Indicators as input to formal assessment methods**
Identification and design of policy options ● Policy recommendations	● **Indicators as input to formal assessment methods**

Source: based on Lehtonen 2017

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Requirements for Innovation Indicators

- **Quality** should be credible and analytically sound, i.e. carefully evaluated for their conceptual soundness and minimising measurement error
- **Measurability and robustness**, i.e. stable and obtainable information with wider coverage of countries as well as time periods
- **Transparency** of indicators incl. collection methods
- **Policy neutral**, impartial to political motivations
- **Timeliness** of data crucial to be used in the policy making process
- **Comparability** critical for benchmarking, monitoring and evaluation purposes
- By reducing information into a concise form, indicators can contribute to the **communicability** of a public agenda to the general public.
- **Accessibility** of indicators to users, e.g. in a user friendly format and to affordable costs
- **Relevance** to policy goals as the most critical attribute for indicators

Source: Iizuka and Hollanders 2017

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General Problems with Innovation Indicators

- **Misinterpretation** of innovation indicators, e.g. the more, the better
- **Inappropriate use** of innovation indicators, e.g. ignoring the context
- **Misuse** of innovation indicators **for policy purposes**, e.g. following policy targets without considering the context, applying indicators to policy formulation without understanding conceptual design or data collection procedure, relying only on composite indicators
- **Overlooked issues** of innovation indicators in policy domain, e.g. omitting important source of innovation (non R&D based innovation) or ignoring dynamics in science and technology and their implication on indicators
- **Mismatch** between **users** and **producers** of innovation indicators, e.g. ignoring the delayed results of innovation surveys for policy formulation or the importance of comparability of indicators over time (changing questions in surveys)

Source: Iizuka and Hollanders 2016

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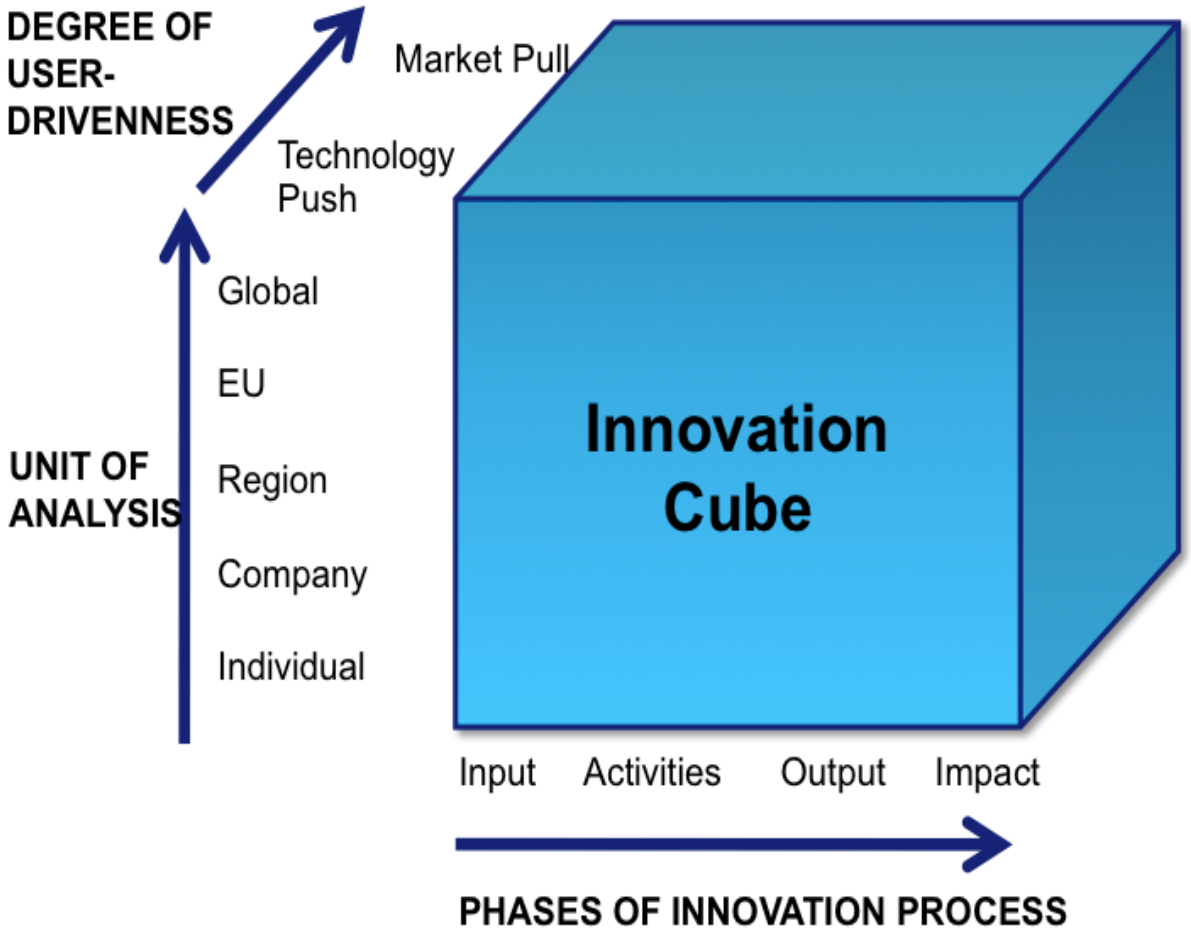
Framework of Innovation Indicators



Source: Still et al. 2012

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Paradigm Shift in Innovation Indicators

	Analog	Digital
Innovation	Companies R&D, closed innovation Few innovation actors New technology Tangibles Waterfall-model of innovation Patents, scientific publications, number of new products	Network of companies, (eco)systems Open innovation, co-creation Many innovation actors, including users New technology, new services, new processes, new products Intangibles Agile innovation, lean start-ups Time-to-market, scalability
Data	Surveys, company reporting Lack of data Structured data Statistically representative samples	Digital footprints of innovation actors Information overload Unstructured, unorganized, incomplete data Biased data
Indicators	Lagging behind Manual processes Table format, some graphs	Possibilities for real-time Efficient computer-powered processes, though challenging Interactive, data-driven visualizations, network visualizations, timelines, geospatial representations, (eco)systemic level

Source: Still et al. 2012

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New data opportunities

- World-wide web
- LinkedIn
- Kickstarter
- GitHub
- Meetup
- Crunchbase
- Twitter
- YouTube Etc.

Source: based on Nesta 2017

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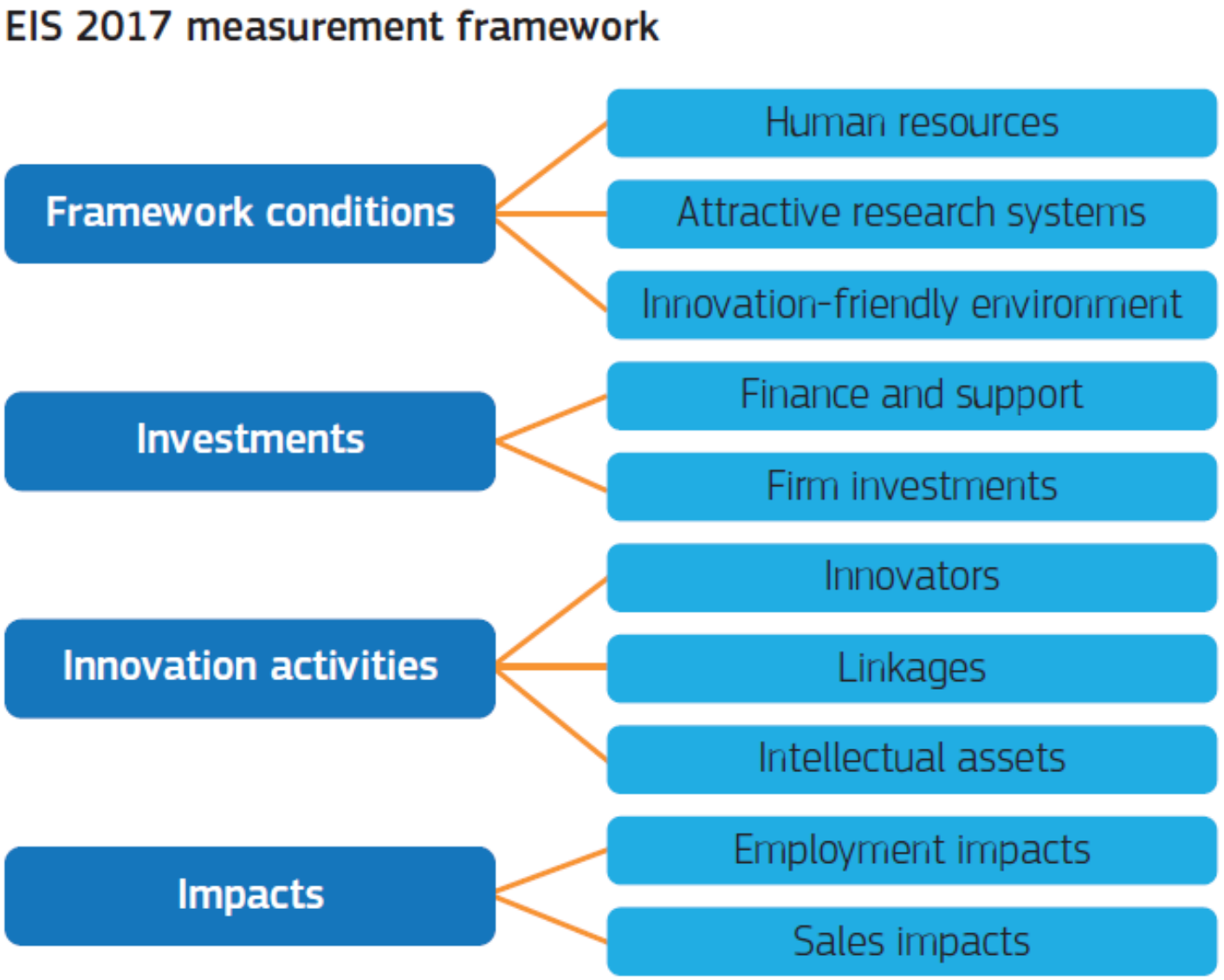
EIS 2017



Source: EIS 2017

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EIS 2017

FRAMEWORK CONDITIONS

- Human resources
  - 1.1.1 New doctorate graduates
  - 1.1.2 Population aged 25-34 with tertiary education
  - 1.1.3 Lifelong learning
- Attractive research systems
  - 1.2.1 International scientific co-publications
  - 1.2.2 Top 10% most cited publications
  - 1.2.3 Foreign doctorate students
- Innovation-friendly environment
  - 1.3.1 Broadband penetration
  - 1.3.2 Opportunity-driven entrepreneurship

INVESTMENTS

- Finance and support
  - 2.1.1 R&D expenditure in the public sector
  - 2.1.2 Venture capital expenditures
- Firm investments
  - 2.2.1 R&D expenditure in the business sector
  - 2.2.2 Non-R&D innovation expenditures
  - 2.2.3 Enterprises providing training to develop or upgrade ICT skills of their personnel

INNOVATION ACTIVITIES

- Innovators
  - 3.1.1 SMEs with product or process innovations
  - 3.1.2 SMEs with marketing or organisational innovations
  - 3.1.3 SMEs innovating in-house
- Linkages
  - 3.2.1 Innovative SMEs collaborating with others
  - 3.2.2 Public-private co-publications
  - 3.2.3 Private co-funding of public R&D expenditures
- Intellectual assets
  - 3.3.1 PCT patent applications
  - 3.3.2 Trademark applications
  - 3.3.3 Design applications

IMPACTS

- Employment impacts
  - 4.1.1 Employment in knowledge-intensive activities
  - 4.1.2 Employment fast-growing enterprises of innovative sectors
- Sales impacts
  - 4.2.1 Medium and high tech product exports
  - 4.2.2 Knowledge-intensive services exports
  - 4.2.3 Sales of new-to-market and new-to-firm product innovations

Source: EIS 2017

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OECD OSLO Manual (2018)

- "Many of these **existing and potential future sources** may have "**big data**" attributes, namely they are too large or complex to be handled by conventional tools and techniques.

- Although useful for different purposes, these data sources all have **limitations**. Many do **not** provide **representative** coverage of innovation at either the industry or national level because the data are based on **self-selection**: only firms that choose to make a product announcement, apply for R&D funding, or license knowledge from universities are included. **Information** from business registers and social, entrepreneurship, and R&D surveys is often **incomplete**, covering only one facet of innovation. Corporate annual reports and websites are **inconsistent** in their coverage of innovation activities, although **web-scraping** techniques can automate searches for innovation activities on documents posted on line and may be an increasingly valuable source of innovation data **in the future**. **Two additional limitations** are that **none** of these sources provide **consistent, comparable data** on the full range of innovation strategies and activities undertaken by all firms, …., and many of these **sources cannot** be accurately **linked to other sources**. Currently, the only source for a complete set of consistent and linkable data is a dedicated innovation survey based on a business register."

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Challenges

- Move from **market** to **system failure** and **mission oriented innovation policy** requires new innovation indicators
- Use of **more demand-oriented innovation policy** instruments requires new innovation indicators
- Many opportunities of **failures from indicator development to indicator use** and impact in policy life cycle
- **Shift i**n the paradigm of innovation indicators **from analog to digital** still not accomplished due to technical and non-technical reasons
- Many **opportunities of failures** from indicator development to indicator use and impact in policy life cycle
- Old, but also new innovation **indicators** have to **fulfill several requirements**, but still several **threats of misuse**
- Too many data may lead to their ignorance!

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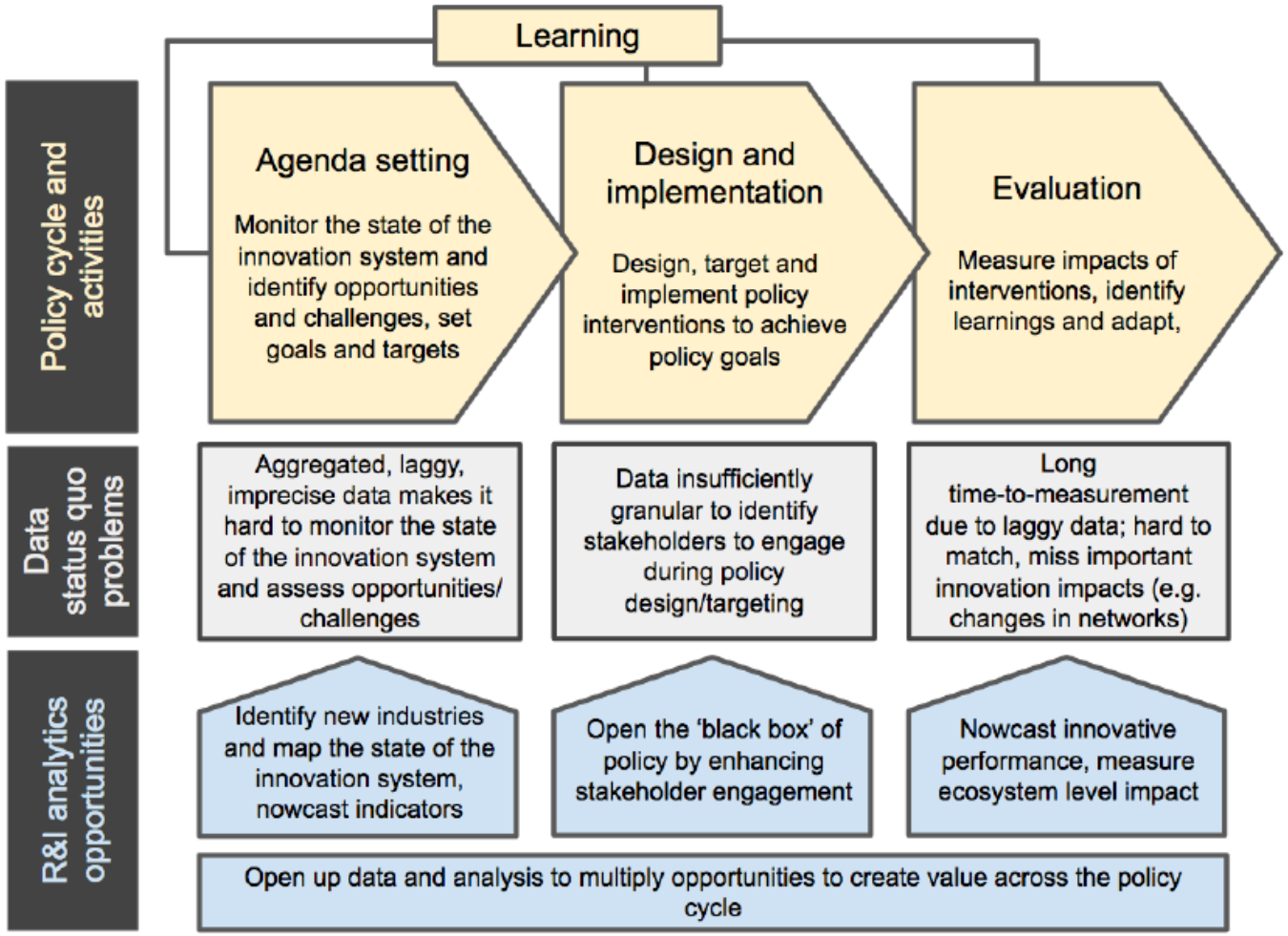
Opportunities

- Intrinsic **incentives in research community** to develop new innovation indicators
- More **competition between indicators** will increase their quality
- Using behavioral economics and political economy **approaches to explain use of traditional indicators** and steer change
- Make use of **complementary strengths** of analog and digital indicators (incl. reciprocal validation by triangulation)
- **Combine** analog and digital indicators into a common system of indicators
- Make use of **visualization of data** to improve the understanding
- Strengthen **absorptive capacity in indicator knowledge among policy makers by closer interaction with researchers**

The R&I Policy Cycle, Existing Data Limitations and New Data Opportunities



Source: EURITO 2017

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Moving forward - relevant, inclusive, trusted, timely, open R&I indicators

- Emergent technology ecosystems (AI)
- Nowcasting business R&D
- Technological change indicators
- Standards for the innovation diffusion indicators
- Evidence base for mission-driven R&I
- Advanced R&I funding analytics
- Inclusive Innovation
- Linkages and Knowledge exchange indicators (health tech)

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