ASSESSING THE PERFORMANCE OF PUBLIC RESEARCH AND ITS IMPACTS

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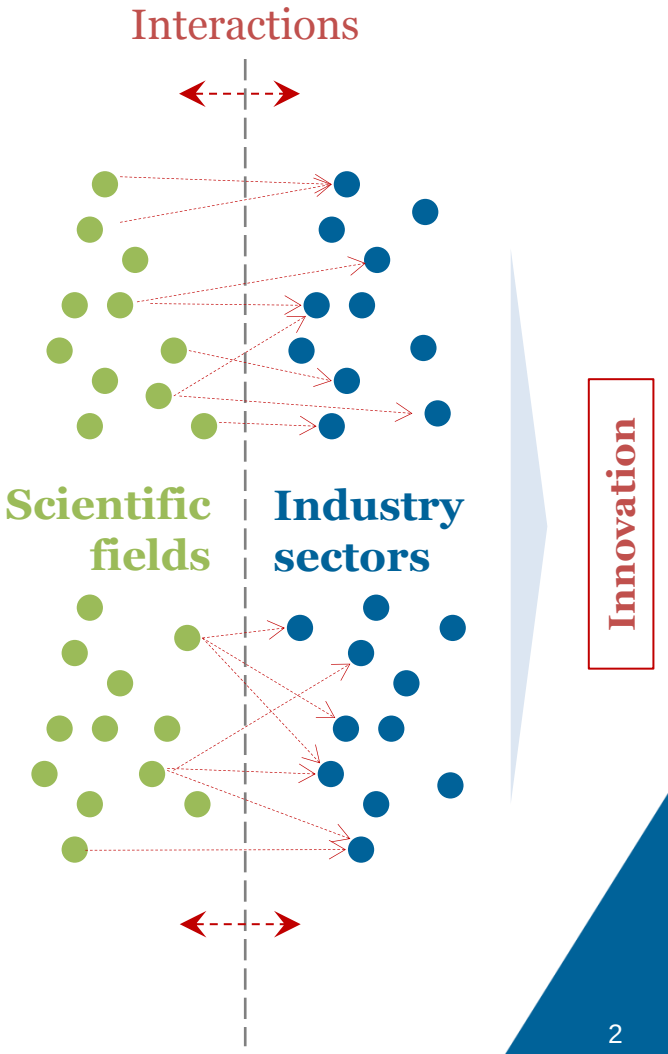
Assessing the contributions of science to industrial innovation

Objective of the project

Provide **evidence** on the impacts of **scientific disciplines on technology and industrial sectors**

- **Contribution of science to innovation** depends on its relevance to industry
- Knowing about the contributions of different fields of science to different economic sectors is **critical to inform policy**



How do science and industry interact?

Direct channels of interaction

- **Flow of skilled labour to industry**
- Academic **consultancy,** contract and collaborative research
- Intellectual property (**IP**) transactions
- **Spin-offs**

Sources of knowledge spillovers

- **Publication** of research results in scientific journals
- Presentations in **conferences**, expositions, specialised media
- Courses & **continuing education** provided to industry
- Exchanges due to **geographic proximity**

Sources of evidence on science-industry linkages

1) Specifically-designed **surveys** and **case studies**
2) **Patent data** (patent citations to non-patent literature; co-patenting)
3) **Publications data** (co-publications)
4) **Labour force and graduate surveys**

Each of these have **advantage**s and **disadvantages** and evidence is best considered jointly

Case studies show social sciences also contribute, particularly to services

Most solicited scientific fields for different industry sectors

Science field	Industry
Chemical industry	Chemical industry; Pharmaceuticals; Petroleum; Plastics/Rubber, Plastic resins; Paper; Organic chemicals; Instruments; Agriculture; Printing/publishing; Food; Textiles; Metals.
Materials science	Metals; Semiconductors; Basic Materials; Rubber/plastic, plastic resins; Computers; Communications equipment; Aerospace/Aircraft engines; Glass; Concrete/cement; Mineral products; Steel; Car/truck, auto parts; Machinery; Electronic components; TV/radio; Fabricated metal products; Furniture
Physical sciences	Semiconductors; Computers Medical devices and equipment
Mathematics	Search/navigational equipment; Electronic components; Semiconductors; Aerospace.
Economics and business	Business services; Banking and finance (financial services); Insurance; Network systems and communications; Wholesale trade; Hotels/restaurants.

Patent data show that technologies differ in the diversity of scientific fields they rely on

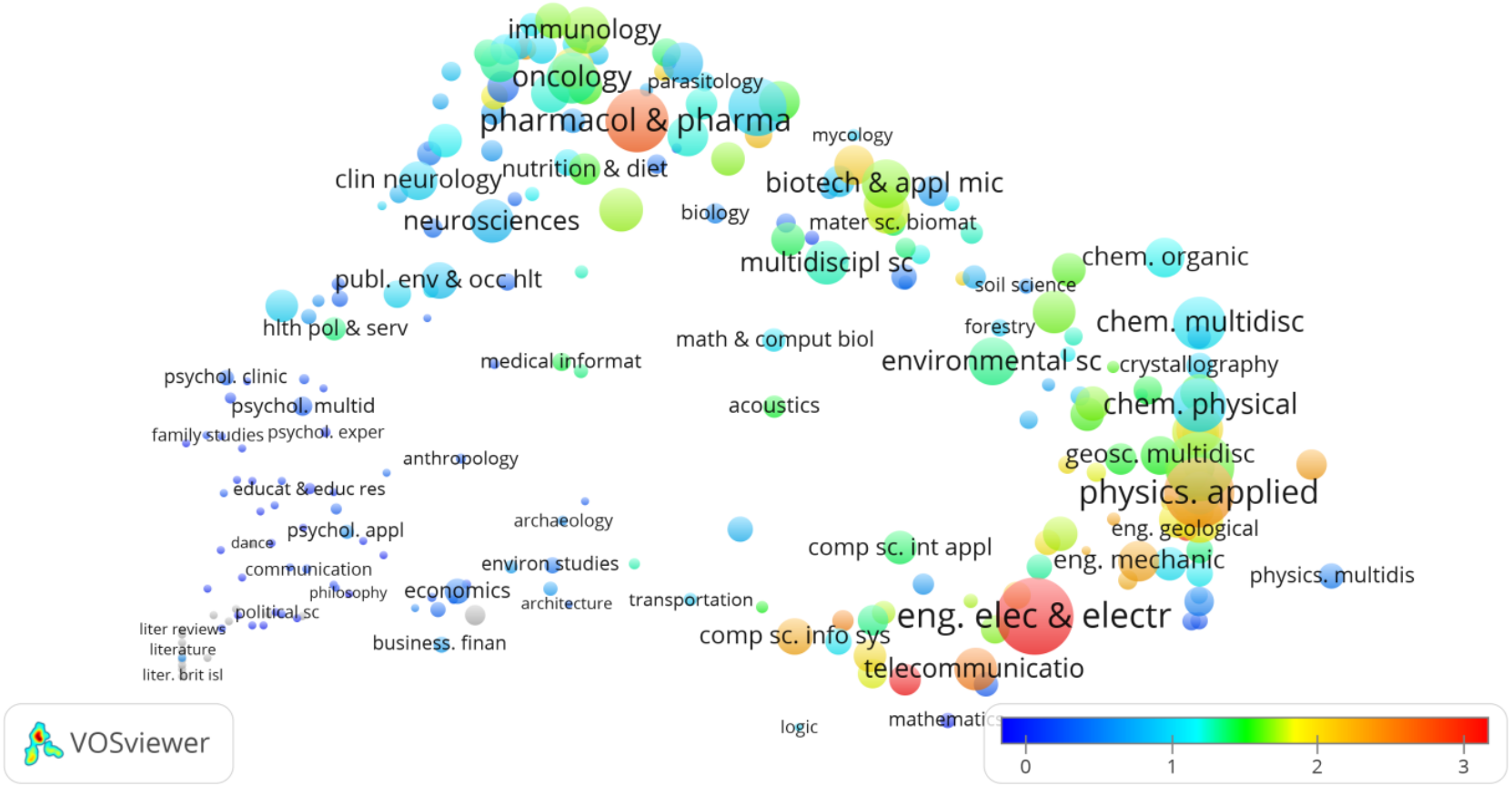
Share of scientific fields in non-patent literature cited in patents, by technology areas

Technology	Agriculture/ plant & animal science	Chemistry	Computer science/ mathematics	Earth science	Engineering	Life sciences	Materials science	Medical science	Multi-disciplinary research	Physics/ space science	Social science/
Biotechnology	5.2	7.3	0.2	0.3	0.4	**47.5**	0.9	**37.8**	0.0	0.3	0
Pharmaceuticals	2.4	**11.1**	0.1	0.1	0.1	**36.2**	1.0	**48.6**	0.1	0.2	0
Digital communication	0.1	1.4	**63.8**	0.1	**23.7**	1.3	1.3	1.7	0.9	5.6	0
Food chemistry	**44.6**	5.2	0.1	0.6	0.4	**35.2**	0.5	**13.2**	0.1	0.1	0
Civil engineering	1.5	**20.3**	2.5	**13.6**	**15.3**	12.2	**10.5**	**18.9**	0.5	4.6	0

Source: OECD STI Scoreboard 2013, citing OECD and Japan Science and Technology Agency (JST), based on Thomson Reuters Web of Science, Derwent World Patents Index and Derwent Patents Citation Index data, June 2013.

Publications data suggest collaboration is strong in pharmaceuticals, applied physics and electrical engineering

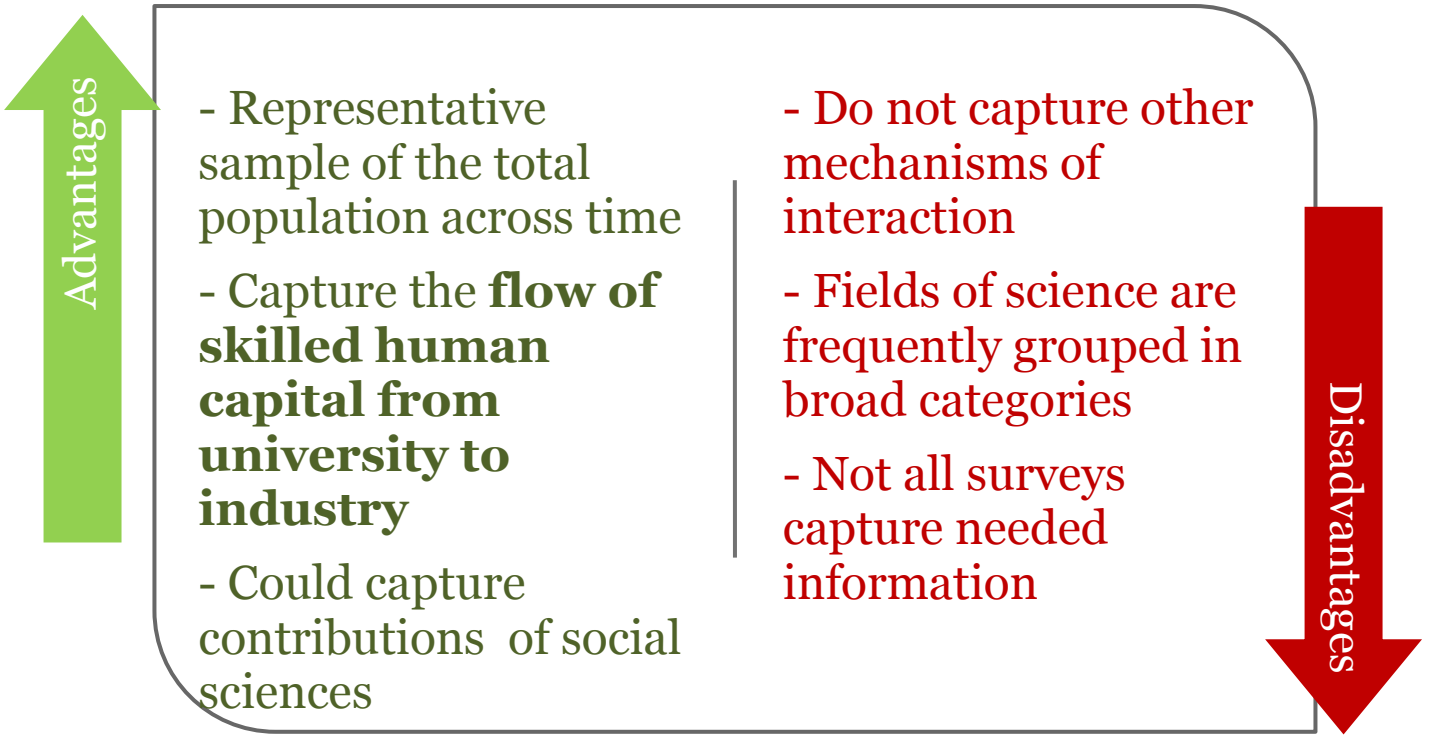
World-wide university-industry co-publications, by science field, 2014



Source: Centre for Science and Technology Studies, Leiden University. University-industry research connections (UIRC) 2014, based on Thomson Reuters' Web of Science database.

Our empirical strategy: Use of labour force and university graduate survey data

These survey data have not been widely used to assess science-industry linkages



Exploring the feasibility of national and other surveys to explore industry science linkages

Data requirements: coverage of scientific disciplines, industry sectors, &, if possible, level of degree obtained, time period, comparable scientific and industry categories

Initial explorations of available datasets:

- **Japanese School Basic Survey** (12 disciplines, 40 industry sectors, 1968-2015)
- **UK Destinations of Leavers of Higher Education Survey** (20 disciplines, 21 industry sectors) & **UK Labour Force Survey** (more than 1 000 disciplines and industry sectors, 1992 - 2015)

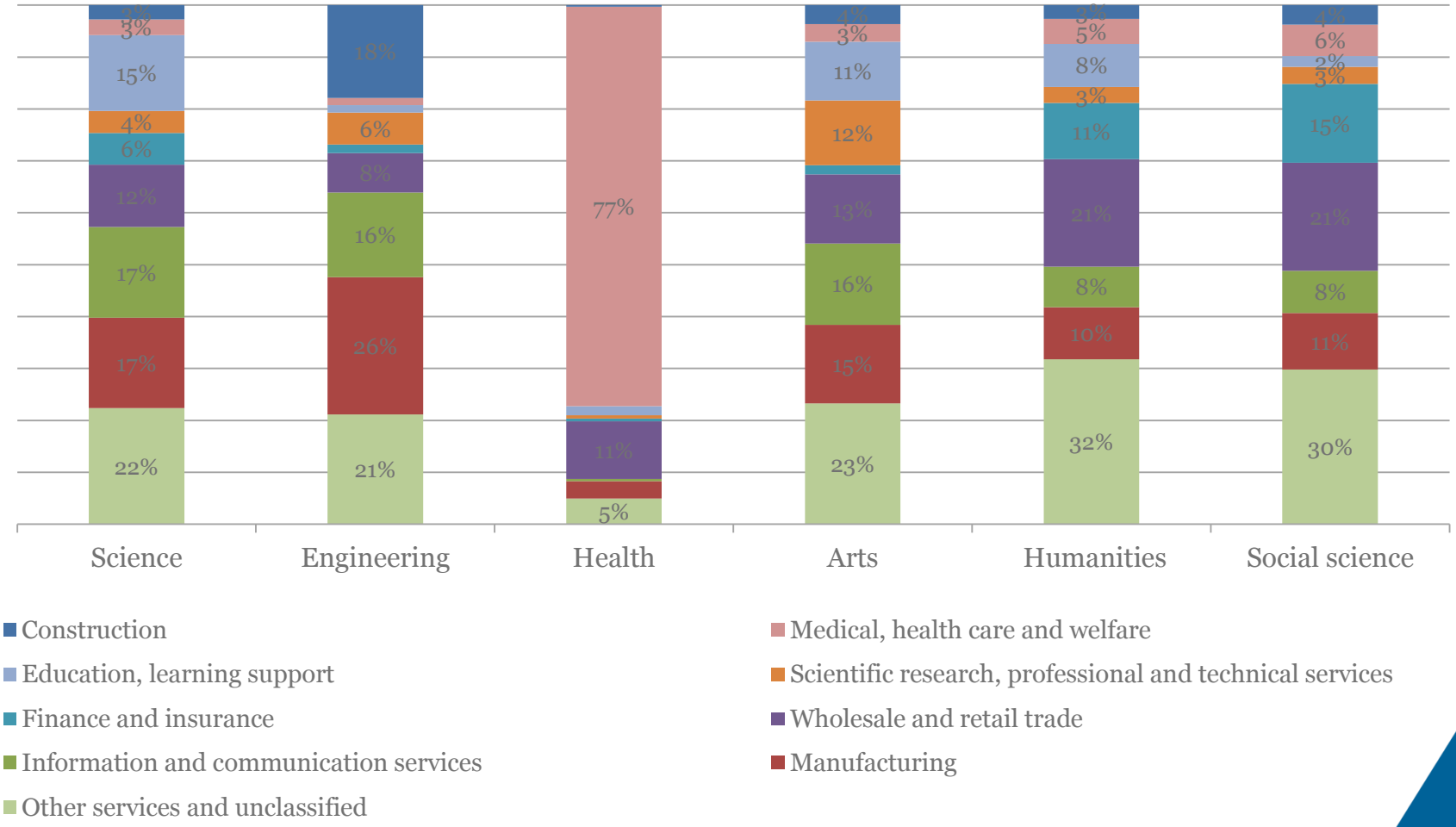
Sources for cross-country explorations for final analysis:

- **EU Labour Force Survey** (16 disciplines, 272 industries, 2006-2013)
- **PIAAC** (Programme for the International Assessment of Adult Competencies) (9 disciplines, 1 000 industries, 2012 & 2014)

Scientists and engineers are more likely to work in manufacturing and social scientists in services

Share of graduates of different disciplines by industry in Japan in 2015

(graduates with bachelor degrees - discipline = 100%)



Engineers are critical to many innovation-intensive sectors as are social scientists

Share of graduates of different disciplines by industry in Japan in 2015
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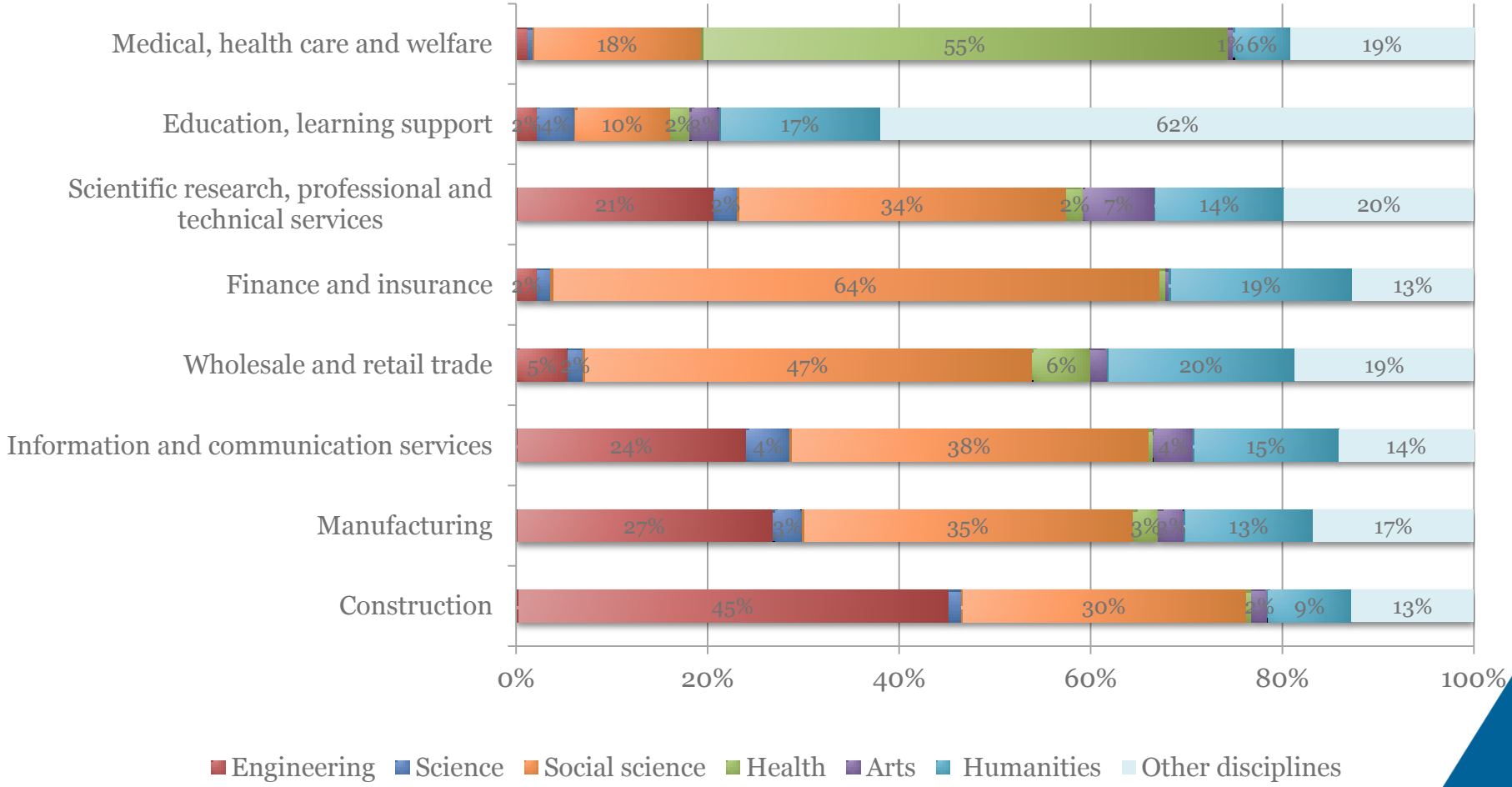

Next steps

- Explore feasibility of **wider cross-country coverage of indicators**
- Describe **cross-country trends** in industry recruitment over time and across countries
- Describe **what it implies for policies** aimed at supporting specific industry