

# OPENING DOORS

**Opportunities and education in networked innovation for new graduates with PhDs using open online resources**

Science with and for Society in Horizon 2020

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## **Guidelines for skills intelligence in Open Science & Open Innovation**

D1.1



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## List of Acronyms

Acronym	Explanation
<b>OS</b>	Open Science
<b>OI</b>	Open Innovation

These guidelines outline methods of analysis of highly qualified employees' skills required by employers active in open science (OS) and open innovation (OI) and their comparison with the current educational offerings in PhD programmes in the Czech Republic, Ireland and Denmark. The aim of the analysis is to provide a basis for a subsequent design of an open online PhD course aimed at skills needed in OS and OI contexts. As indicated in the project proposal, three partners (NTF, UCD and AU) will carry out data collection in their respective countries.

The guidelines represent a framework to be later elaborated into interview guides and templates for data collection.

The skill analysis as well as the entire project rests upon the concepts of open science and open innovation. We understand **open science** as practices that enhance accessibility and transparency of scientific procedures and outputs (open access and open data), and as efforts to encourage scientific cooperation within and across organisations, disciplines and individuals. Under **open innovation** we understand cooperation of organisations in innovating products, services and processes, and sharing of relevant valuable knowledge.

## 1. Demand for skills

### 1.1 Interviews with employers

#### **Main questions to be answered in the interviews with employers**

- What transversal (field-unspecific) skills employers active in OI / OS value the most at their highly qualified workforce
- What skills (specific for OI / OS but also other skills) do their employees and job candidates lack and/or need to develop for the future
- What is their experience with hiring PhD graduates
- Where they see possibilities for PhD education to improve

#### **Recruitment of employers**

- Companies and organisations that collaborate with other organisations in research and innovation at the institutional level and share valuable knowledge with them
- Min. 5 interviews in each country with academic and non-academic employers
- Non-academic employers to be represented by at least half of the interviews in each country
- Respondents: directors, HR directors, department heads (non-academic), heads of science / research departments (academic institutions)
- Employers will be sampled out of the following disciplines and industries:
  - Ireland: Technology (biotech, foodtech, and infotech)
  - Czech Republic: Natural science and technology
  - Denmark: Humanities (and social sciences)
- Identification of relevant employers in OI: e.g. members of OI networks, participants of projects, testbeds, conferences, advertisers of vacancies related to OI
- The interviews can be carried out through online video-calls.

## Topics of the interviews

The researchers will obtain basic information about the employers by desk research from available internet sources before the interviews. Therefore, some of the topics listed below can appear in the interviews only as specification of what the researchers will already know. Any topics below can be skipped if they are not applicable to the interviewed employer.

### Non-academic employers

- A. Basic information about the organisation (unit)
  - size, performance, ownership
  - activities, type of products or services
  - business: position in supply chain
- B. Innovation process
  - share of new products or services on sales
  - how important are innovations for the organisation
  - expenditure on R&D, share of employees in R&D
  - evolution of innovative activities in cooperation with other subjects (when it started, how has it changed since then)
  - with whom and how the organisation cooperates in innovations
  - benefits and risks of cooperative innovation (e.g. intellectual property issues, own know-how protection)
  - main differences between innovating in-house and cooperatively
  - demands on employees related to cooperative innovation networks (both quantitative - number of employees, and qualitative related to skills, attitudes, work organisation etc.)
  - is their specific knowledge, skills, attitudes and values related to OI ?
  - involving own staff into innovations
- C. Experience with high-skilled workforce, including PhD graduates
  - share of university-degree and PhD holders in the workforce
  - importance of PhD-level graduates for the company
  - positions and tasks of PhD graduates compared to lower degree holders
  - experience with performance and skills of PhD holders so far
  - what the PhD graduates bring to the organisation
  - attitudes and abilities of PhD graduates regarding:
    - interdisciplinary research
    - teamwork
    - cooperation beyond the institution
    - knowledge sharing within and outside the institution (incl. open data and open access)
  - cooperation with universities in PhD education
- D. Ideas about changes in PhD education
  - How could PhD education in the fields relevant for the organisation change so it fits the organisation needs
  - What skills should be developed during a PhD more than so far

- How can changes in PhD education programmes help the organisations alike to the respondent's one in their innovation efforts

#### Academic employers

- A. Basic information about the institution
  - size, organisation structure, ownership
  - fields of research and education, specifically at the PhD graduate level
- B. Cooperation with other subjects and within the institution in research, innovation and development
  - evolution of cooperation with other subjects (when it started, how has it changed since then)
  - with whom and how the institution cooperates
  - cooperation with other academic institutions vs. with businesses
  - benefits and risks of cooperation in research / innovation between institutions
  - initiative in cooperation with other subjects (institutional / individual)
  - demands on employees related to cooperative research / innovation networks
  - practise within the institution on knowledge-sharing and creating research teams
  - interdisciplinarity at individual level and at the level of research teams: tendencies, approaches of the institution
- C. Open Science aspects in the life of the institution
  - does the institution encourage the researchers to publish data and papers (results) in open access journals and repositories
  - benefits, barriers and risks of open data and open access at the level of the institution / individuals
  - related knowledge, skills, attitudes and values of employees
- D. Skills of PhD graduates
  - assessing of contents of PhD education regarding the success of the institution / researchers in the current world of research and science
  - experience with performance and skills of recent PhD graduates
  - attitudes and abilities of PhD graduates regarding:
    - interdisciplinary research
    - teamwork
    - cooperation beyond the institution
    - knowledge sharing within and outside the institution (incl. open data and open access)
- E. Ideas about changes in PhD education
  - How could PhD education change so it fits the needs of the institution and the current world of research and science
  - What skills should be developed during a PhD more than so far
  - How to encourage young researchers in sharing their knowledge within and outside the institution

### 1.2 Interviews with PhD graduates / students

PhD graduates or students working in non-academic organisations, preferably involved in open innovation networks, will be interviewed (min. 3 interviews in each country). The aim of these

interviews is to learn about PhD graduates' and students' view on the usability of their skills and their suggestions for changes in PhD programmes to strengthen the link between PhD education and employment outside academia. The respondents should be interviewed not longer than 10 years after their graduation.

#### Topics of the interviews

- A. Education and employment biography
  - Field of PhD, university
  - Career since then
  - Profession and tasks in the current job
- B. Activities of the organisation and of the respondent in cooperation with other subjects in innovations
  - With whom and how the organisation cooperates in innovations
  - How is the respondent involved
  - What knowledge, skills, attitudes and values are needed for these activities
- C. Motivation to work outside academia
  - Considerations of an academic career (during PhD and since then)
  - Reasons to work in business
- D. Use of the skills obtained during PhD education
  - How useful is the PhD education for the respondent in the current job
  - Skills from the PhD that the respondent uses / doesn't use
  - How well could the respondent do the same job without a PhD
  - Potential usefulness of the PhD in the future career
- E. Ideas about possible changes in PhD education to increase meaningful employment of the graduates in innovative business companies
  - What did the respondent miss in the PhD education while studying
  - How could have the respondent's PhD looked like to be more relevant for jobs like the current one

### 1.3 Review of job advertisements

We can examine two types of currently published online job postings across disciplines and industries (in each country) regarding employers' demands on (potentially) PhD-level workers:

- 1) Websites of main academic institutions
- 2) Leading job-portals.

For the review, the advertisements containing the following terms will be reviewed:

- "open science"
- "open innovation"
- "PhD" (as a requirement or advantage for the candidates)
- "research" (limited to university-degree jobs) – only if the number in the preceding categories is not sufficient.

The analysis of job postings will be done qualitatively, with the aim to present what skills and tasks are required and how they are described. A more specific list of skills and tasks will be available, based

on the preceding interviews with employers. The review can stop when no new relevant information can be found in the postings. We assume the total number of the reviewed advertisements to range between 100 and 200.

### **Websites of academic institutions or academic vacancies on leading job portals**

The aim of reviewing the job posting of academic institutions will be to explore:

- skills and tasks related to teamwork and cooperation (including with other organisations and companies)
- skills and tasks related to other fields than the main focus of the position
- other transversal (field-unspecific) skills or related tasks

Websites of leading universities and other academic institutions should be reviewed for academic and research positions across disciplines.

### **Non-academic vacancies on leading job portals**

The queries can be made either using selection categories on the portals or using keywords.

The postings will be explored for the following topics:

- skills, competencies and tasks related to teamwork and cooperation (including with academic organisations and companies)
- skills, competencies and tasks related to other fields than the core of the job (interdisciplinarity)
- other transversal (field-unspecific) skills or related tasks
- requirement to have a PhD degree.

## 2 Offer of education in OS / OI for PhD students

### 2.1 Review of OS / OI courses in PhD programmes

Leading national universities will be reviewed for the topics of open science and open innovation (including innovation management and cooperation between universities and businesses) in:

- PhD courses in OS / OI or entrepreneurship
- Centres and units specialised in OS / OI entrepreneurship at the level of universities and departments, institutionalised activities in OS / OI or entrepreneurship of other departments of universities
- Recent (last 5 years) projects, initiatives and other activities in OS / OI or entrepreneurship education

A list of annotated items found will be produced according to a template provided by NTF. This will help understand what is already available to PhD students in the three countries.

Additionally, examples of inspirational practices from other countries will be researched by the NTF.

## 2.2 Interviews with educators

Based on the previous desk research, educators directly involved in teaching or popularising of OS, OI or entrepreneurship at the universities will be contacted for short semi-structured interviews (min. 2 interviews in each country). Such recruitment will distinguish these respondents from academic employers, with which the content of the interviews will be different. The topics of the interviews with educators will be as follows:

- A. Activities of the respondents and their units in OS / OI or entrepreneurship teaching and popularisation
  - What does the respondent and the unit teach and who is the target group
  - Evolution of interest for the subject of the teaching and for related subjects among the institutional management and among PhD and other students
  - Motivation of the institution for running the course
  - Recruitment of participants of the courses, motivation to participate
  - Specific topics of the courses, recent and planned changes
- B. Opinions of the respondents on the demands on future PhD graduates
  - Changes in the world of science and research reflecting in the demands on researchers
  - Changes in the needs of employers and the PhD students
  - Gaps between the needs of the employers and the current education offering in PhD programmes
  - Demands for skills related to OS / OI or entrepreneurship

## 3 Results of the skills intelligence

The information obtained from all the activities will be synthesised into:

- 1) **Potential and gap overview.** The needs of employers will be compared to the current educational offerings for PhD students in the three countries. Gaps will be highlighted and directions for newly designed OS / OI course will be indicated.
- 2) **Profiles of PhD graduates equipped with OS and OI skills.** Several profiles will be created to guide the subsequent curriculum design. We assume four such profiles (business: industry and services, academic: natural / technical sciences, social sciences / humanities). This can, however, change, depending on the findings of the analysis.

## 4 Responsibilities of the partners and schedule

Each of the three participating partners (NTF, UCD, AU) will:

- Recruit respondents and conduct 10 semi-structured interviews (min. 5 employers, 3 PhD graduates, 2 educators) in their countries
- Provide English transcripts of the interviews to NTF
- Carry out a review of job postings and provide summaries of the findings (structured by type of job postings: websites of academic employers, postings of business employers) to NTF
- Provide a record of the desk research of the PhD education offering in OS / OI to NTF

NTF will in addition:

- Provide detailed guides of the interviews separately for business employers, academic employers, PhD graduates and educators
- Provide a template for job postings review
- Provide a template for desk research of the PhD education offering in OS / OI
- Synthesise the finding into the potential and gaps overview and the profiles of PhD graduates.

### Schedule

March 26	Guides for the semi-structured interviews sent out by the NTF
March 29 – April 20	Interviews carried out
April 8	Template for the review of OS / OI courses in PhD programmes and for job postings review sent out by the NTF
April 30	Transcripts and of the interviews, records of the findings from the job advertisements review and records of the review of the PhD courses sent by the partners to the NTF
May 20	Draft of the potential and gap analysis and of the profiles of PhD graduates (to guide the design of the curriculum) sent out by the NTF
May 24–26	Meeting of the partners to discuss the findings
May 31	Final version of the potential and gap analysis and of the profiles of PhD graduates prepared by the NTF