DIOSI

Developing and İmplementing hands-on training on Open Science and Open Innovation for Early Career Researchers

D5.3. - DIOSI Impact and graduate tracking Framework: self-report questionnaire adapted to the course contents and methodology to assess long-term impact

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List of acronyms and abbreviations

DC	Doctoral Candidate
DIOSI	Developing and Implementing hands-on training on Open Science and Open Innovation for Early Career Researchers
ECR	Early Career Researcher
EUA-CDE	European University Association's Council for Doctoral Education
HE	Higher Education
OI&E	Open Innovation & Entrepreneurship
OS	Open Science
WP	Work Package

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Executive summary

The main goal of the DIOSI project's Work Package (WP) 5 is to provide a measurable and actionable assessment of the impact of the DIOSI model for doctoral learning in general, and training on Open innovation and Entrepreneurship and Open Science in particular, through the development of the DIOSI Impact and Graduate Tracking Framework.

To develop the framework, a comprehensive review of impact evaluation methods and tools described in the literature was undertaken, ranging from projects to develop a graduate tracking system to research on the career trajectories of PhD graduates (DIOSI WP 5 first report). Also, key performance criteria for training courses on Open Science and Open Innovation & Entrepreneurship were defined (DIOSI WP 5 second report).

This **third report** focuses on developing a methodology for tracking PhD students in two time perspectives (1 and 2) and three levels of tracking (a, b, and c):
(1) the short-term perspective, which implies an individual training participation level (a);
(2) the long-term perspective, implying the individual graduate career tracking level (b) and the impact on the university, stakeholders, and the society level (c).

To this end, three questionnaires are developed and a proposal is made for a process to assess the long-term impact of entrepreneurship and open innovation education at the university, stakeholder, and the society level.

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1. Introduction

This is the third report prepared within Work Package (WP) 5 of the DIOSI project (Developing and Implementing hands-on training on Open Science and Open Innovation for Early Career Researchers). The main goal of the DIOSI project's Work Package (WP) 5 is to provide a measurable and actionable assessment of the impact of the DIOSI model for doctoral learning in general, and training on Open innovation and Entrepreneurship (OI&E) and Open Science (OS) in particular, through the development of the DIOSI Impact and Graduate Tracking Framework.

DIOSI WP 5 first report included a comprehensive review of the impact evaluation methods and tools described in the literature, ranging from projects focused on developing a graduate tracking system to research on the career trajectories of PhD graduates.

The second report defined the key performance criteria of the training courses on OS and OI&E, an important part of the newly developed DIOSI doctoral learning programme.

This **third report** focuses, in turn, on the development of the DIOSI Impact and Graduate Tracking Framework with a comprehensive, modular, and versatile structure that includes two time perspectives (1 and 2) and three levels of tracking (a, b, and c):

(1) the short-term perspective, which implies an individual training participation level (a);

(2) the long-term perspective, implying the individual graduate career tracking level (b) and the impact on the university, stakeholders, and the society level (c).

The Rugby Team Impact Framework (Rugby Team, 2008) was used as the basis for developing the DIOSI Framework. As an evaluation model for training and development activities specifically tailored to the context of training and development of researchers in higher education (HE), this framework includes 4 levels of outputs and results: 1) Reaction (participant's response to the activity), 2) Learning (attitude change, e.g., improved knowledge, increased skills), 3) Behavior (behavior change, e.g., thoughtful, confident, self-aware...), and 4) Outcomes ("external impact", e.g., better research, improved qualification rates and similar).

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2. Short-term perspective – Individual training participation level

The main objective of the **short-term perspective** and **individual training participation level** is to monitor the effectiveness of the specific programmes: Open Science training course and Open Innovation & Entrepreneurship training course for individual development of Doctoral candidates (DCs) and Early Career Researchers (ECRs). A specific self-assessment questionnaire adapted to the course content is constructed for each training course.

Questionnaires are shown in Table 1 and Table 2.

Table 1 A self-assessment questionnaire for Open Science training course

Impact level: 1. Reaction **Measurement time:** After the training	
Q1. Please indicate the extent to which you are satisfied with the following aspects of the Open Science training course using the scale below: **1** = very dissatisfied; **2** = dissatisfied; **3** = neutral; **4** = satisfied; **5** = very satisfied	
a. Applicability of the presented contents	1 2 3 4 5
b. Preparation and expertise of the trainer	1 2 3 4 5
c. Personal benefit of participating in the activities	1 2 3 4 5
d. Overall satisfaction with the training	1 2 3 4 5
Impact level: 2. Learning **Measurement time:** Before and after the training	
Q1/Q2. Please evaluate your knowledge and skills related to specific aspects of Open Science using the scale below: **1** = I have no developed knowledge and skills at all; **2** = I have poorly developed knowledge and skills; **3** = I have moderately developed knowledge and skills; **4** = I have well developed knowledge and skills; **5** = I have fully developed knowledge and skills	
a. Concepts and principles of Open Science	1 2 3 4 5
b. Concepts and principles of Open Access	1 2 3 4 5
c. Ways of Open Access Publication	1 2 3 4 5
d. Open licensing	1 2 3 4 5
e. Digital platforms, tools and services available for the practice of Open science	1 2 3 4 5
f. Concepts and principles of FAIR data/research data management (FAIR principles, policies, DMPs, documentation, archiving)	1 2 3 4 5
g. Research data sharing (data storage, archiving, publication, access control, institutional infrastructure, legal aspects)	1 2 3 4 5
Impact level: 2. Learning **Measurement time:** Before the training	
Q2. I have acquired the knowledge and skills that I already have by:	
a. Supervisor b. Colleagues or other researchers c. Previous education d. Self-study (internet) e. Other, (please specify)	

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Impact level: 3. Behavior						
Measurement time: Before and after the training						
Q2/Q3. Please indicate the extent to which you agree with each of the following statement using the scale below. 1 = strongly disagree; 2 = disagree; 3 = somehow agree; 4 = agree; 5 = strongly agree						
a.	I am confident that practicing Open Science has a lot of benefits.	1	2	3	4	5
b.	I am aware of the challenges of applying Open Science in practice.	1	2	3	4	5
c.	Open Science is simply science done right.	1	2	3	4	5
d.	In my research work I practice Open Science.	1	2	3	4	5
e.	I intend to practice Open Science in my future research work.	1	2	3	4	5
Impact level: 1. Reaction						
Measurement time: After the training						
Q4. Recommendations and suggestions for Open Science training improvements:						

Table 2 A self-assessment questionnaire for Open Innovation & Entrepreneurship training course

Impact level: 1. Reaction						
Measurement time: After the training						
Q1. Please indicate the extent to which you are satisfied with the following aspects of the Open Innovation & Entrepreneurship training course using the scale below: 1 = very dissatisfied; 2 = dissatisfied; 3 = neutral; 4 = satisfied; 5 = very satisfied						
a.	Applicability of the presented contents	1	2	3	4	5
b.	Preparation and expertise of the trainer	1	2	3	4	5
c.	Personal benefit of participating in the activities	1	2	3	4	5
d.	Overall satisfaction with the training	1	2	3	4	5
Impact level: 2. Learning						
Measurement time: Before and after the training						
Q1/Q2. Please evaluate your knowledge and skills related to specific aspects of Open Innovation and Entrepreneurship using the scale below: 1 = I have no developed knowledge and skills at all; 2 = I have poorly developed knowledge and skills; 3 = I have moderately developed knowledge and skills; 4 = I have well developed knowledge and skills; 5 = I have fully developed knowledge and skills						
a.	General processes of open innovation	1	2	3	4	5
b.	General processes of entrepreneurship	1	2	3	4	5
c.	Intellectual property management	1	2	3	4	5
d.	Brainstorming ideas and creativity	1	2	3	4	5
e.	Lean startup concept and the use of the Business Model Canvas	1	2	3	4	5
f.	Basics of accounting	1	2	3	4	5
g.	Minimum Viable Product (MVP)	1	2	3	4	5
h.	Key aspects of business strategy, such as Porter's 5 Forces and SWOT analysis	1	2	3	4	5
i.	Key sources of funding for innovation	1	2	3	4	5
j.	Presentation of an innovative idea and attracting funding, collaborations or customers	1	2	3	4	5
Impact level: 2. Learning						
Measurement time: Before the training						
Q2. I have acquired the knowledge and skills that I already have by:						

a. Supervisor	
b. Colleagues or other researchers	
c. Previous education	
d. Self-study (internet)	
e. Other, (please specify)	

Impact level: 3. Behavior
Measurement time: Before and after the training

Q2/Q3. Please indicate the extent to which you agree with each of the following statement using the scale below. 1 = strongly disagree; 2 = disagree; 3 = somehow agree; 4 = agree; 5 = strongly agree					
a. Acquiring knowledge and skills in Open Innovation and Entrepreneurship brings me more advantages than disadvantages.	1	2	3	4	5
b. My professional goal is to become an entrepreneur.	1	2	3	4	5
c. If I had the opportunity and the necessary resources, I would like to start a company.	1	2	3	4	5
d. If I tried to start a company, I would have a high probability of being successful.	1	2	3	4	5
e. In my work I intend to apply the processes of Open innovation.	1	2	3	4	5
f. I use knowledge and skills in Open Innovation and Entrepreneurship to contribute to the knowledge economy/society.	1	2	3	4	5
g. Making use of acquired knowledge and skills in Open Innovation and Entrepreneurship, a broader part of society can benefit from innovation and knowledge created.	1	2	3	4	5

Impact level: 1. Reaction
Measurement time: After the training

Q4. Recommendations and suggestions for Open Innovation & Entrepreneurship training course improvements:

3. Long-term perspective

3.1. Individual graduate career tracking level

The first part of the **long-term perspective** relates to the **individual graduate career tracking level**, which includes the development of a methodology for longitudinal monitoring of indicators of individual career success and achievements.

Follow-up is planned at 6 months and two years (24 months) after graduation. Table 3 lists the questions selected through the review of the literature (Boman et al., 2021; EUA Council for Doctoral Education, 2017; EUA Council for Doctoral Education, 2022; Rothwell et al., 2008) and highlights the questions which are aimed for the first implementation and those aimed for the second or both implementations.

The selection of questions as well as the addition of new questions was done in accordance with the holistic DIOSI model of doctoral learning and the key performance criteria of the Open Science and Open Innovation & Entrepreneurship trainings highlighted in the second report of this work package.

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Table 3 A self-assessment questionnaire for individual graduate career tracking level

Measurement time: 6 months after graduation
Part 1 Doctorate education
Q1. Please select the university where you obtained your doctorate?

a. Maastricht University, the Netherlands
    b. Nicolaus Copernicus University, Poland
    c. Universidad Carlos III De Madrid, Spain
    d. University of Antwerp, Belgium
    e. University of Bremen, Germany
    f. University of Cyprus, Cyprus
    g. University of Eastern Finland, Finland
    h. University of Essex, the United Kingdom
    i. University of Rijeka, Croatia
    j. Tor Vergata University of Rome, Italy
    k. Other, (please specify)

Q2 - In which year did you start your doctoral training programme (formal admission)?
Q3 - In which year did you defend your doctorate thesis?
Q4 - Please select the field that best corresponds to your doctorate.

a. Agricultural sciences
    b. Engineering and technology
    c. Arts and Humanities
    d. Medical and health sciences
    e. Natural sciences
    f. Social sciences
    g. Other (e.g., interdisciplinary), please specify

Q5 - Which of the following were your financial sources during your doctoral training period? *Multiple answers possible.*

a. Fellowship from your university
    b. Contracted employment with your university
    c. Fellowship from government or public research fund
    d. Fellowship from private sector, or a private not-for-profit organisation
    e. Fellowship from international institutions
    f. University position/teaching and/or research assistantship
    g. Job not related to the doctorate
    h. Non-funded
    i. Other

Q6 – Did your doctorate take place in collaboration with any other organization?

a. No
    b. Yes, with a non-university research institution
    c. Yes, with a private sector company (e.g. industrial doctorate)
    d. Yes, with a third sector organisation (e.g. NGO, charity, not-for-profit)
    e. Yes, with a university of applied sciences
    f. Yes, with another organisation (please specify)
    g. Yes, with another university (joint doctorate, cotutelle, etc.)

Q7 – During my doctoral training programme I was supervised by:
a. A single supervisor

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b.	A supervisory team with members internal to my university
c.	A supervisory team including members from other universities
d.	A supervisory team including members outside academia
e.	Other, (please specify)

Q8 - Did you receive any training from a structured training programme next to the individual supervision?

a.	Yes
b.	No

Q9 - What motivated you to pursue a doctorate? *Multiple answers possible*

a.	To work as a researcher in academia
b.	To work as a researcher outside academia
c.	To work as a highly skilled expert
d.	To diversify career opportunities
e.	Personal accomplishment
f.	Interest in the research topic
g.	Social recognition
h.	Other, (please specify)

Q10 - Please indicate the extent to which you were satisfied with the following aspects of your training while doing your doctorate using the scale below:

1 = very dissatisfied; 2 = dissatisfied; 3 = neutral; 4 = satisfied; 5 = very satisfied

a. Supervision provided by the supervisor(s)	1	2	3	4	5
b. Quality of transferable skills training	1	2	3	4	5
c. Quality of research training	1	2	3	4	5
d. Support to pursue an academic career	1	2	3	4	5
e. Support to pursue a non-academic career	1	2	3	4	5
f. Career guidance and counselling at your university	1	2	3	4	5
g. Other services for doctoral candidates at your university	1	2	3	4	5

Q11 - Have you completed one or more research stays abroad during your doctorate (over a period of at least 3 months)?

a.	Yes
b.	No

Part 2 Skills and competencies

Q12 - Did you receive any career guidance during your PhD?

a.	Yes, from my supervisors
b.	Yes, from the doctoral training programme at my university
c.	Yes, from a career advisor at my university
d.	Yes, via [open field]
e.	No

Q13 - Did you receive training in transferable skills during your doctorate?

a.	Yes, trainings were mandatory
b.	Yes, trainings were optional
c.	No, trainings were optional
d.	No, no trainings were available

Q14 - Using the scale below, please indicate the extent to which you were offered the following types of transverable skills training offered to you during your PhD:

1 = Not at all; 2 = To a small extent; 3 = To some extent; 4 = To a great extent; 5 = I don't know

a. Research Ethics and Integrity	1	2	3	4	5
b. Research Methodology	1	2	3	4	5
c. Research Data Management	1	2	3	4	5
d. Thesis Writing	1	2	3	4	5

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e.	Scientific Communication	1	2	3	4	5
f.	Proposal writing	1	2	3	4	5
g.	Responsible Research and Innovation	1	2	3	4	5
h.	Open Science and open data	1	2	3	4	5
i.	Project Management	1	2	3	4	5
j.	Career Development	1	2	3	4	5
k.	Time Management	1	2	3	4	5
l.	Intellectual property rights and Knowledge Valuation	1	2	3	4	5
m.	Public Engagement	1	2	3	4	5
n.	Conflict Management	1	2	3	4	5
o.	Leadership	1	2	3	4	5
p.	Intercultural Competences	1	2	3	4	5
q.	Open innovation and Entrepreneurship	1	2	3	4	5
r.	Teaching skills	1	2	3	4	5
s.	Other, (please specify)	1	2	3	4	5

Measurement time: 6 & 24 months after graduation

Part 3 Employability & career related experience

Q15 – Did you have a paid job at any time after completing your doctorate (including postdoctoral positions)?

    a.   No
    b.   Yes

If Q15=yes
Q16 – Approximately how many months passed between the time you completed your doctorate and your first or next paid job?

    a.   0 months
    b.   1-3 months
    c.   4-6 months
    d.   7-12 months
    e.   1-2 years
    f.   More than 2 years

If Q15=yes
Q17 - Using the scale below, please indicate how important the following resources were to you in finding your first or next job after completing your doctorate:
  1 = Not at all important; **2** = Slightly important; **3** = Moderately important; **4** = Very important; **5** = Extremely important

a.	Academic Advisor/Supervisor	1	2	3	4	5
b.	University Career Centre	1	2	3	4	5
c.	Job advertisements in Department/University	1	2	3	4	5
d.	Peers (e.g. colleagues, alumni, labour unions, associations)	1	2	3	4	5
e.	Web search/online job portal	1	2	3	4	5
f.	Job/career fairs	1	2	3	4	5
g.	Previous job, work placement or internship	1	2	3	4	5
h.	Social and professional networks	1	2	3	4	5
i.	Other, (please specify)	1	2	3	4	5

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If Q15=yes

Q18 - Did you take one or more postdoctoral positions at a university or a research performing organisation after obtaining your doctorate?

    a.   No
    b.   Yes

If Q18=yes

Q19– How many postdoctoral positions did you take?

    a.   1
    b.   2
    c.   3 or more

Q20 - Using the scale below, please indicate the extent to which you agree or disagree with the following statements:

    1 = Strongly disagree; **2** = Disagree; **3** = Neither agree, nor disagree; **4** = Agree; **5** = Strongly agree

a.	My doctorate properly prepared me for my first job	1 2 3 4 5
b.	My doctorate enabled me to progress towards my desired career	1 2 3 4 5
c.	It was clear to me what career opportunities I could aspire to after my doctorate	1 2 3 4 5
d.	My doctorate prepared me well for my future career in academia	1 2 3 4 5
e.	My doctorate prepared me well for my future career outside of academia	1 2 3 4 5
f.	My doctorate prepared me well for the leadership positions	1 2 3 4 5
g.	I can easily find out about opportunities in my chosen field.	1 2 3 4 5
h.	The skills and abilities that I possess are what employers are looking for.	1 2 3 4 5
i.	I am generally confident of success in job Interviews and selection events.	1 2 3 4 5

Q21 - Which of the following best describes your current main employment status? Please note that the term 'employed' includes postdoctoral positions.

    a.   Permanent Full-time Employed (30 hours per week or more)
    b.   Permanent Part-time Employed (less than 30 hours per week)
    c.   Temporary Full-time Employed (30 hours per week or more)
    d.   Temporary Part-time Employed (less than 30 hours per week)
    e.   Self Employed
    f.   Retired
    g.   Unemployed
    h.   Internship
    i.   Career break (including childcare, elderly people care)
    j.   Other, (please specify)

If Q21= currently employed full-time, part-time or self-employed.

Q22 – Please indicate the sector which best describes your current main employment.

    a.   Research university
    b.   Applied university
    c.   Research organisations (e.g. research institutes)
    d.   Business sector: industry
    e.   Business sector: services and other
    f.   Government or another public sector
    g.   Healthcare sector (e.g. hospital, clinical centre)
    h.   Non-higher education (e.g. secondary education)
    i.   Private not-for-profit sector
    j.   Other, (please specify)

If Q21= currently employed full-time, part-time or self-employed.

Q23 – Please indicate your main position

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a.	Postdoctoral position/early career researcher
b.	Assistant Professor/Junior Professor
c.	Associate Professor/Reader
d.	Full Professor
e.	Analyst, Specialist
f.	Research Fellow/Researcher
g.	Senior Researcher
h.	Director, Head of Unit
i.	Project Manager
j.	Lecturer
k.	Engineer
l.	Coordinator
m.	Technician
n.	Policy maker
o.	Policy officer
p.	Consultant
q.	Other, (please specify)

If Q21= currently employed full-time, part-time or self-employed.
Q24 – What was the minimum education or experience level requirement for your current main job?

a.	Bachelor or lower
b.	Master
c.	Doctorate
d.	Postdoctoral level
e.	Other

If Q21= currently employed full-time, part-time or self-employed.
Q25 - Which of the following activities do you perform as part of your main job? *Multiple answers possible*

a.	Research performing activities (including publications)
b.	Teaching/mentoring/supervision activities
c.	Administrative activities
d.	Staff management responsibilities
e.	Budget management responsibilities
f.	International partnerships
g.	Entrepreneurship, start-up activities
h.	Communication or scientific journalism
i.	Artistic creation
j.	Other, (please specify)

If Q21= currently employed full-time, part-time or self-employed.
Q26 - To what extent is the content of your work in your current main job related to the thematic field of your doctorate degree?

a.	Closely related
b.	Partly related
c.	Not related

If Q21= currently employed full-time, part-time or self-employed.
Q27 - In your current main job are you engaged in research?

a.	No
b.	Yes

If Q27=No
Q28 – Using the scale below, please rate the importance of the following reasons for not working as a researcher.
1 = Not at all important; **2** = Slightly important; **3** = Moderately important; **4** = Very important; **5** = Extremely important

a.	Availability of job positions/offers not focused on research	1	2	3	4	5
b.	Interest in a non-research career	1	2	3	4	5

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		1	2	3	4	5
c.	Unavailability of a suitable research post or position	1	2	3	4	5
d.	Difficulty securing a tenured/permanent research post or position	1	2	3	4	5
e.	Bigger variety of career paths	1	2	3	4	5
f.	Better income	1	2	3	4	5
g.	Personal/family reasons	1	2	3	4	5
h.	Something else…	1	2	3	4	5

Q29 - What percentage of your working time do you spend on tasks from which you can learn?

0-100%

If Q27=Yes
Q30 - At which level do you work (as per European Framework for Research Careers)?

a. R2: Recognised Researcher or Postdoc (PhD holders or equivalent who are not yet fully independent, including Assistant Professors)
b. R3: Established Researcher (Researchers who have developed a level of independence, including Associate Professors)
c. R4: Leading Researcher (Researchers leading their research area or field, including Research/ Full Professors)

If Q21= currently employed full-time, part-time or self-employed.
Q31 - Using the scale below, please indicate the extent to which the following skills and competences are important in your current main job:
1 = Not at all important;   **2** = Slightly important; **3** = Moderately important; **4** = Very important; **5** = Extremely important

		1	2	3	4	5
a.	Research Ethics and Integrity	1	2	3	4	5
b.	Research Methodology	1	2	3	4	5
c.	Research Data Management	1	2	3	4	5
d.	Thesis Writing	1	2	3	4	5
e.	Scientific Communication	1	2	3	4	5
f.	Proposal writing	1	2	3	4	5
g.	Responsible Research and Innovation	1	2	3	4	5
h.	Open Science and open data	1	2	3	4	5
i.	Project Management	1	2	3	4	5
j.	Career Development	1	2	3	4	5
k.	Time Management	1	2	3	4	5
l.	Intellectual property rights and Knowledge Valuation	1	2	3	4	5
m.	Public Engagement	1	2	3	4	5
n.	Conflict Management	1	2	3	4	5
o.	Leadership	1	2	3	4	5
p.	Intercultural Competences	1	2	3	4	5
q.	Open innovation and Entrepreneurship	1	2	3	4	5
r.	Teaching skills	1	2	3	4	5
s.	Other, (please specify)	1	2	3	4	5

If Q21= currently employed full-time, part-time or self-employed.
Q32 - Using the scale below, please indicate how satisfied you are with the following aspects of your current work environment: 1 = Very dissatisfied; **2** = Somewhat dissatisfied; **3** = Neither satisfied, nor dissatisfied; **4** =

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Somewhat satisfied; **5** = Very satisfied

		1	2	3	4	5
a.	Skills development	1	2	3	4	5
b.	Career growth opportunities	1	2	3	4	5
c.	Intellectual challenge	1	2	3	4	5
d.	Autonomy and responsibility	1	2	3	4	5
e.	Reputation of organisation	1	2	3	4	5
f.	Organisational culture	1	2	3	4	5
g.	Job security/stability	1	2	3	4	5
h.	Salary	1	2	3	4	5
i.	Mentoring and training	1	2	3	4	5
j.	Possibility for community engagement	1	2	3	4	5
k.	Work/life balance	1	2	3	4	5
l.	Job in general	1	2	3	4	5
m.	Other (please specify)	1	2	3	4	5

If Q21= currently employed full-time, part-time or self-employed.

Q33 – What is your annual gross income (before deductions)?

a. Under €5,000
b. €5,001 - €10,000
c. €10,000 - €15,000
d. €15,001 - €20,000
e. €20,001 - €25,000
f. €25,001 - €30,000
g. €30,001 - €40,000
h. €40,001 - €60,000
i. €60,001 - €85,000
j. €85,001 - €100,000
k. €100,001 - €150,000
l. €150,001 - €200,000
m. Over €200,000
n. Prefer not to say

If Q21= currently employed full-time, part-time or self-employed.

Q34 – Using the scale below please indicate the extent to which each of the following reasons was important to you in taking up your current main position:

1 = Not at all important; **2** = Slightly important; **3** = Moderately important; **4** = Very important; **5** = Extremely important

		1	2	3	4	5
a.	To take the next step in my desirable career path	1	2	3	4	5
b.	To improve/gain new skills	1	2	3	4	5
c.	To work with a specific person, organisation or company	1	2	3	4	5
d.	It was the only acceptable employment I could find at the time	1	2	3	4	5
e.	Intellectual challenge	1	2	3	4	5
f.	Autonomy and responsibility	1	2	3	4	5
g.	Salary	1	2	3	4	5
h.	Job security/stability	1	2	3	4	5
i.	Work/life balance	1	2	3	4	5

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j.	Reputation of organisation	1	2	3	4	5
k.	Family/personal reasons	1	2	3	4	5
l.	Other (please specify)	1	2	3	4	5

If Q21= currently employed full-time, part-time or self-employed.
Q35 – Using the scale below please indicate the extent to which you believe your doctorate has contributed to the following aspects of your professional life:

1 = Not at all; **2** = A little; **3** = Moderately ; **4** = A lot; **5** = Greatly

a.	Improved my skills and competencies	1	2	3	4	5
b.	A higher salary	1	2	3	4	5
c.	More interesting job assignments	1	2	3	4	5
d.	More demanding job assignments	1	2	3	4	5
e.	Better status at my place of work	1	2	3	4	5
f.	A job with a new employer	1	2	3	4	5
g.	A better position on the labour market	1	2	3	4	5
h.	Starting my own business	1	2	3	4	5
i.	Other (please specify)	1	2	3	4	5

Measurement time: 24 months after graduation

Q 36 - Did you follow any job-related courses/training during the past two years?
    a. No
    b. Yes

If Q36 =Yes
Q37 - What was the main focus of the most important job-related course/training you followed?
(In case of multiple focus, please select the most important focus of the job-related course/training)
    a. collaboration
    b. communication and presentation skills
    c. physical condition and strength
    d. specialist knowledge and skills
    e. problem solving
    f. time management
    g. information processing and administration
    h. reading and writing
    i. numerical insight
    j. digital skills
    k. personal development
    l. leading and coaching
    m. Open Science and Open data
    n. Open Innovation and Entrepreneurship
    o. other (please specify)

Measurement time: 6 & 24 months after graduation

Part 4 Mobility

If Q21= currently employed full-time, part-time or self-employed.
Q38 – Are you considering changing the sector of your current employment?
    a. Yes, I work in the academic sector and I want to move to the non-academic sector
    b. Yes, I work in the non-academic sector, and I want to move to the academic sector
    c. Yes, I work in the non-academic sector, and I want to move to another non-academic sector
    d. Yes, I want to mix the work in the academic and non-academic sectors at the same time
    e. No, I am not considering changing the sector of my current employment

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Q39 - Have you lived and worked outside your country of citizenship, after completing your doctorate?
a. No b. Yes, for less than 3 months c. Yes, for a period of 3 to 6 months d. Yes, for a period of 6 to 12 months e. Yes, for 12 months or more
Q40 – Are you considering living and working outside your country of citizenship?
a. No b. Yes, for less than 3 months c. Yes, for a period of 3 to 6 months d. Yes, for a period of 6 to 12 months e. Yes, for 12 months or more f. Yes, but I'm not sure for how long g. I'm not sure
Part 5 Demographical details
Q41 – In which country do you currently live? [dropdown list with all possible countries]
Q42 – In which country do you currently work? [dropdown list with all possible countries]
Q43 – What is your year of birth? [dropdown list]
Q44 – What is your gender?
a. Female b. Male c. Other d. Prefer not to say
Q 46 - This survey is the first in a longitudinal study exploring the careers of PhD graduates. Please provide your permanent email address if we are allowed to send you invitations to participate in further PhD graduation surveys:
[open field]

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3.2. Impact on the university, stakeholders, and society level

The second part of the **long-term perspective** of graduate tracking refers to the **impact on the university, stakeholders, and society level.**

When the second report defined the key performance criteria of the DIOSI doctoral learning programme, it highlighted a non-exhaustive list of indicators for the university, the stakeholder, and the society impact levels. This list includes various "external" indicators such as:

- Number of applications for doctoral programmes;
- Number of open access publications;
- Growth in technology-based companies;
- Number of spin-offs and start-ups;
- Income from spin-offs and start-ups;
- Number of invention disclosures;
- Number of intellectual property licenses (patent filings, copyright and trademark registrations) & assignments;
- Income from licenses & assignments;
- Number of research collaboration agreements & research contracts with non–academic third parties;
- Income from research collaboration agreements & research contracts with non–academic third parties.

These indicators could undoubtedly be used as good examples or sources of inspiration for how to measure the long-term impact of the implementation of the DIOSI doctoral learning programme.

It should be noted, however, that due to the high complexity, the larger number of contributory factors with nonlinear causality, and the longer time span, coupled with factors that are not controlled by the universities, the indicators must be supported by the assumed logic and must be consistent with the university strategy. Consequently, a unified portfolio of indicators is unlikely, as the impact indicators for the universities participating in the DIOSI project will not be identical (although some could be shared if the strategic goals and circumstances are similar). Given all of the above, each university should establish indicators for assessing impact in terms of strategic goals and intentions (vision, mission, and other forms of strategy formulation, if relevant), baseline situation, and underlying logic of impact.

In the event that one of the key strategic goals and intentions of a university is to become an entrepreneurial university in an entrepreneurial society, Table 4 proposes a methodology for assessing the long-term impact of entrepreneurial and open innovation education integrated into doctoral programmes on various aspects of society. The proposed methodology should allow the measurement of:

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a) The transformation into a more entrepreneurial university;
b) The role (and the results achieved) of the university in creating the entrepreneurial society;
c) The impact of the more entrepreneurial university in the entrepreneurial society on the stakeholders.

Table 4 Procedure for assessing the long-term impact of entrepreneurial and open innovation education

	Step	Description
1	PhD course intervention goals	The why and how of PhD course transformation. All reasons, motivations and ambitions formulated as expectations or goals from the integration of entrepreneurial and open innovation education elements into the PhD course.
2	University strategy / strategic goals	Identification of the strategic goals which are relevant or might be impacted by the intervention into the PhD courses
3	University strategy's implications towards society and stakeholders	Implications of university strategy goals toward society and stakeholders (impacted by the course and specifically relevant for selected stakeholders and society)
4	Assumptions about impact mechanisms	Impact logic of PhD course interventions a) identification of changes that are assumed to make impacts b) rationale of how the selected changes in the PhD course impact the university, society and the stakeholders.
5	Indicators formulation	Identification of a set of indicators that will enable a balanced measurement of impacts towards the university, society and the stakeholders: a) lagging indicators which enable measurement of goal achievement level b) leading indicators which enable to measure and understand the impact mechanisms and test the impact assumptions
6	Measurement and review elements	Formulation of indicators' operational elements that enable measurement and review (baseline, targets, measurement procedure & responsibility, "what ifs", review model and frequency)

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4. Conclusion

In this third report written within Work Package (WP) 5 of the DIOSI project, the main goal was to provide a measurable and actionable assessment of the impact of the DIOSI model for doctoral learning in general, and training on Open innovation and Entrepreneurship and Open Science in particular, through the development of the DIOSI Impact and Graduate Tracking Framework.

To this end, we proposed three different assessments. First, we developed questionnaires for measuring the impact of specific training offers (OS and OI&E) within the DIOSI model (Chapter 2). Second, we developed a graduate tracking questionnaire to be implemented 6 and 24 months after PhD graduation (Chapter 3.1). In the survey 6 months after graduation, the focus is on a general evaluation of the graduate training, as well as labour market outcomes at the time of the survey. The survey 24 months after graduation focuses on labour market outcomes at the time of the survey, as well as changes in the past 18 months and some considerations regarding mobility in the future. In addition, this version of the questionnaire can be used for longer follow-up periods. Third, we have listed indicators which could be used to measure the long-term impact of the implementation of the DIOSI doctoral learning programme (Chapter 3.2). These indicators mainly serve as good examples or sources of inspiration for how to measure universities' strategic goals and circumstances. We have worked out one set of indicators for the strategic goal to become an entrepreneurial university in an entrepreneurial society.

However, we would like to point out that we should be cautious when drawing conclusions about impact evaluation, since we are not using experimental conditions. This is especially true for the long-term effects of implementing the DIOSI doctoral learning programme.

This, however does not mean that it is not important to monitor key performance indicators for specific training offers as well as the DIOSI doctoral learning programme as a whole. Keeping track experiences and labour market outcomes of our doctoral graduates, as well as developments and outcomes at the societal level are crucial to asses and further develop high quality graduate training.

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List of tables

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