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Key Transversal Competences for Researchers

>> A SURVEY IN THE FIELD OF SOLAR ENERGY HARVESTING ACROSS SIX EUROPEAN COUNTRIES

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Abstract

This research aims to identify key transversal competences for researchers, particularly in the field of solar energy harvesting, across six European countries – Belgium, the Czech Republic, Finland, Greece, Ukraine, and Switzerland. A total of 155 respondents, including managers, researchers, RDI professionals and support staff from research and higher education institutions, companies and other organisations, participated in an online survey. As a result, seven tentative competence areas were identified: 1) self-management, 2) working with others, 3) logical thinking, 4) creative thinking, 5) project management, 6) research and data management, and 7) dissemination and impact. While respondents generally agreed on the importance of all competence areas, subtle differences in responses were observed across countries. However, due to the limited sample size, statistically robust cross-country comparisons cannot be made. The results can be used to support the professional and career development of young researchers and innovators, and to raise awareness of their transversal competences.

1. Introduction

The importance of transversal competences - also known as transferable skills - has gained attention as employment opportunities for researchers outside academia increase, and research becomes more interdisciplinary and international. Transversal competences are a combination of knowledge, skills and attitudes acquired in one context that are useful in another. (European Commission, 2022a) Transversal competences, together with original research abilities, can enhance the employability of early career researchers and enable them to pursue diverse career paths, expanding their opportunities across academic, governmental, and private sectors (Eurodoc, 2018).

Transversal competences can therefore support researchers in different career paths, promote better research outcomes, and foster innovation and economic growth (OECD, 2012). While there is an urgent need to foster international and intersectoral mobility in times of labour shortages, there is still a lack of attention or recognition of transversal competences outside the academic sector in the training and career development of researchers (European Commission, 2022a).

This research aims to address this shortage by identifying key transversal competences for researchers. particularly in the field of solar energy harvesting. across six European countries – Belgium, the Czech Republic, Finland, Greece, Ukraine, and Switzerland. An online survey was used to collect responses from managers, researchers, RDI professionals and support staff in research and higher education institutions, as well as companies and other organisations. This diversity helps identify competences that are valued in different sectors and countries, which in turn fosters better alignment between the needs of academia, business, and industry, and supports the professional and career development of young researchers and innovators. This study seeks to answer following questions:

1. What are key transversal competences for researchers?

2. How do respondents from Belgium, the Czech Republic, Finland, Greece, Ukraine and Switzerland perceive the importance of these competences for researchers, particularly in the field of solar energy harvesting?

The research was conducted in the APPROACH[1] project, co-funded by the European Commission's Horizon Europe Research Programme. The project aims to support the training and mobility of researchers and innovation talents across sectors by developing best practices for intersectoral talent exchange for the benefit of the participating widening countries. It seeks to foster a dynamic innovation ecosystem by promoting collaboration between academia and industry. (APPROACH, 2024.) The survey results will be used in the project to support the post-academic training and professional development of young researchers and innovators in the widening countries, i.e. in the Czech Republic, Greece, and Ukraine.

This research report consists of five chapters: After the introduction, chapter two outlines the conceptual background of the study, defines transversal competences and provides insights into some existing transversal competence frameworks for researchers. Chapter three presents the methodology, including the survey design, data collection and demographic profile of survey respondents, and the analysis methods. Chapter four analyses the key competences identified through cross-country comparisons. Finally, chapter five summarises the main findings, provides practical implications and considers the limitations of the study.

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[1] APPROACH is an acronym for Advanced Photonic PRocesses for novel sOlar energy hArvesting teCHnologies.

2. Conceptual Background

2.1 Defining Transversal Competences

Before defining what transversal competence means in this study, let's start with the concept of competence itself. According to the Council of the European Union Recommendation on Key Competences for Lifelong Learning (ST/9009/2018/INIT), competences are defined as "**a combination of knowledge, skills and attitudes**, where: a) knowledge is composed of the facts and figures, concepts, ideas and theories which are already established and support the understanding of a certain area or subject; b) skills are defined as the ability and capacity to carry out processes and use the existing knowledge to achieve results; c) attitudes describe the disposition and mind-sets to act or react to ideas, persons or situations" (European Commission, 2018: 14).

Competences refer to the ability to adequately apply learning outcomes within a specific context, such as education, work, or personal and professional development. They include both cognitive (involving the use of theory, concepts or tacit knowledge), functional (involving technical skills) and interpersonal (e.g. social or organisational skills) aspects and ethical values. (Cedefop, 2011.) Competences may be domain-specific, focusing on knowledge, skills, and attitudes within a particular subject or discipline, or they may be general/transversal, applicable across all domains and subjects (UNESCO, 2013).

Transversal competences are often used as a synonym for transferable or transversal skills, generic competences and processional skills (OECD, 2012). What these terms have in common is that they encompass competences that are not typically considered to be specific to a particular job, task, academic discipline or field of knowledge, and that can be used in a wide variety of situations and work settings. (UNESCO, 2013). Transversal competences are holistic in nature, combining both hard and soft skills (Polyakova & Galstyan-Sargsyan, 2014). Soft skills are non-job-specific skills that relate to an individual's

ability to operate effectively in the workplace and are usually described as highly transferable. Generic hard skills are technical and job-specific skills that can be used effectively in almost all jobs in the majority of companies, occupations and sectors and are therefore considered to be highly transferable. (Balcar & Mickova, 2011.)

Thus, transversal competences allow individuals to apply knowledge, skills and attitudes across diverse contexts to accomplish tasks in different environments. These competences enable individuals to adapt to change, address complexity, and engage in lifelong learning. (Polyakova & Galstyan-Sargsyan, 2014.) In the research context in particular, the European Science Foundation (2009: 47) defines transversal competences as "(...) skills learned in one context (for example research) that are useful in another (for example future employment whether that is in research, business etc). They enable subject- and research-related skills to be applied and developed effectively. Transferable skills may be acquired through training or through work experience." In our study we refer to transversal competences as an overarching concept of knowledge, skills and attitudes that researchers can apply in a wide variety of situations and work settings to support and contribute to research, development and innovation activities.

2.2 Transversal Competence Frameworks for Researchers

Analysis by the Directorate-General for Research and Innovation (ERA) shows that competence frameworks for researchers are scarce and scattered across EU Member States, varying considerably in their structure and content. Only a few fully developed transversal competence frameworks for researchers have been identified (European Commission, 2022a), such as Researcher Development Skills Framework (RDSF) (University of Canberra, n.d.), Researcher Development Framework (RDF) (Vitae, 2010), Eurodoc's Transferable Skills Matrix (2018), and ResearchComp (European Commission, 2022b).

Many existing frameworks are based on the Researcher Development Framework (RDF), an internationally recognised tool for its broad applicability across different career paths and disciplines. Outside Europe, Researcher Development Skills Framework (RDSF) offers a similar model. These frameworks support researcher training, career planning, mobility, and skill assessment. They clearly define proficiency levels, aiding progression from beginner to expert. (European Commission, 2022a.) More recently, European Commission (2022b) established ResearchComp framework to support These competence frameworks as described in the following chapters.

Researcher Development Skills Framework (RDSF) from the University of Canberra is a structured framework designed to guide and support the development of research skills for postgraduate students and early career researchers. It helps researchers to understand the competences they need to develop during their candidatures and/or career. RDSF identifies 177 skills that individuals need to develop at different stages of a researcher's career, from postgraduate studies to early career and beyond. These skills are further organised into 9 skills categories and 4 main transversal competence areas: personal/professional development, communication, research management, and engagement and impact. In addition to these transversal competences, RDSF highlights core skills that are unique to the researcher and his/her research area, including subject knowledge, discipline specific skills, and intellectual ability. (University of Canberra, n.a.)

Researcher Development Framework (RDF), developed by Vitae, is a comprehensive tool designed to guide and support the personal, professional, and career development of researchers in higher education institutions. It defines the knowledge, behaviours, and attributes that characterise successful researchers, empowering them to achieve their full potential. RDF was developed based on empirical data gathered through interviews with researchers to identify the traits of exceptional researchers. It is organised into 4 interrelated domains - knowledge and intellectual abilities; personal effectiveness; research governance and organisation; engagement, influence, and impact – and 12 sub-domains with

63 descriptors. Each of the descriptors includes three to five phases, which correspond to different stages of development or performance levels within that descriptor. (Vitae, 2010.)

ResearchComp framework, established by the European Commission (2022b), is based on extensive research, including a literature review, online surveys, case studies, analysis of 2020 Euraxess, interviews, focus groups and a multi-stakeholder validation meeting. ResearchComp includes 38 competences grouped into 7 competence areas: cognitive abilities, self-management, working with others, doing research, managing research, managing research tools, and making an impact. It also allows researchers to assess their skills at four levels - foundational, intermediate, advanced and expert. ResearchComp aims to improve the recognition and development of researchers' competences within and beyond academia at different stages of their careers. It serves as an inspirational tool for both organisational and individual use, supporting skills development, career progression and mobility across sectors.

Another notable categorisation of researchers' transversal competences, although not as fully developed as the competence frameworks presented above, in the EU context is Eurodoc's (2018) Transferable Skills Matrix. It identifies 9 key categories of essential transferable skills tailored for early-career researchers (ECRs). These categories cover research, career development, digital, communication, cognitive, interpersonal, teaching and supervision, enterprise, and mobility skills, comprising a total of 66 skills. The matrix aims to raise awareness and encourage the adoption of transferable skills training among ECRs and higher education institutions. It serves as a resource to help ECRs assess the transferable skills they already possess and identify areas for further development.

The comparison of these four transversal competence frameworks for researchers – RDSF, RDF, ResearchComp and Eurodoc's skills matrix – reveals both similarities and differences in their focus, structure and application. These frameworks emphasise the importance of a holistic approach in supporting the

professional and career development of researchers by identifying, organising and promoting the acquisition of transversal competences. They are designed to enable researchers to succeed within academia, while also preparing them for roles and opportunities beyond the doctoral education.

However, there are differences in their integration of sector-specific needs, especially outside traditional academic settings. A notable difference lies in their alignment with career stages and applicability across sectors. RDSF, RDF and Eurodoc's skill matrix are rooted in academia, whereas ResearchComp explicitly concentrates on competences that are relevant for both academic and non-academic careers. RDSF, RDF and Eurodoc's skill matrix focus primarily on research and teaching roles, which are particularly useful for the early-stage researchers during their doctoral education and may be less comprehensive for later stages outside the academia. ResearchComp, on the other hand, explicitly concentrates on competences relevant to both academic and non-academic careers, recognising the growing need for mobility and interdisciplinary collaboration.

While existing frameworks define a wide range of transversal competences for researchers, there are some areas related to soft skills that are overlooked or not given sufficient attention, such as the emotional aspect of self-management and a broader view of creative thinking. Therefore, this research seeks to take a more exploratory and open-minded approach to identifying transversal competences of researchers, rather than testing or applying an existing framework.

3. Methodology

3.1 Data Collection

This chapter outlines the data collection process and provides an overview of the demographic background of the survey respondents. It begins with information on the design and implementation of the survey. This is followed by a description of the characteristics of the respondents, including details of their country, age, gender, education, research experience, work role, and organisational context.

3.1.1 SURVEY DESIGN AND IMPLEMENTATION

The data for this study was collected through an online survey via Webropol in January-February 2024. The survey was conducted in six European countries: Belgium, the Czech Republic, Finland, Greece, Ukraine, and Switzerland, with a total of 155 respondents. The target group included managers, researchers and other RDI professionals, and support staff from higher education and research institutions, companies, and other organisations. These respondents represented a diverse range of demographics, including varying ages, genders, levels of experience, education, work roles, organisation types, and sectors.

The questionnaire was designed to gather responses on the perceived importance of various transversal competences essential for researchers. The questionnaire consisted of two sections: I Demographic Information (8 questions with drop-down list and single selection) and II Identifying Researchers' transversal Competences (75 sub-competence questions with Likert scale and additional open-ended questions). The survey asked respondents to rate the importance of sub-competences on a Likert scale of 1 to 5, with 1 being "not important" and 5 being "extremely important".

Based on the synthesis of previous researchers' transversal competence frameworks and literature review, the competences in the questionnaire were

categorised into 7 tentative competence areas, each defined by relevant sub-competences and their descriptions:

1. self-management (16 sub-competences),
2. working with others (13 sub-competences),
3. logical thinking (9 sub-competences),
4. creative thinking (9 sub-competences),
5. project management (9 sub-competences),
6. research & data management (8 sub-competences), and
7. dissemination & impact (11 sub-competences).

3.1.2 DEMOGRAPHIC BACKGROUND OF RESPONDENTS

This chapter provides an overview of the demographic information of the survey respondents. Key attributes such as country, age, gender, education, research experience, work role, and organisational context, are described to offer insights into the diversity and representativeness of the survey sample. This information, particularly on the country of the respondents, provides the background for analysing the perceptions shared in the survey and identifying any patterns or variations between different groups of respondents.

The demographic profile of the survey respondents shows that participation varies from country to country, reflecting geographical and cultural representation. Of the 155 respondents, Belgium has the highest share (25,8 %, n=40), followed by the Czech Republic (23,2 %, n=36). Finland (18,1 %, n=28) and Greece (17,4 %, n=27) have similar proportions, while Ukraine (12,3 %, n=19) and Switzerland (3,2 %, n=5) have smaller shares. This distribution reflects the international scope of the survey but limits robust cross-country comparisons due to the uneven sample sizes. (Figure 1)
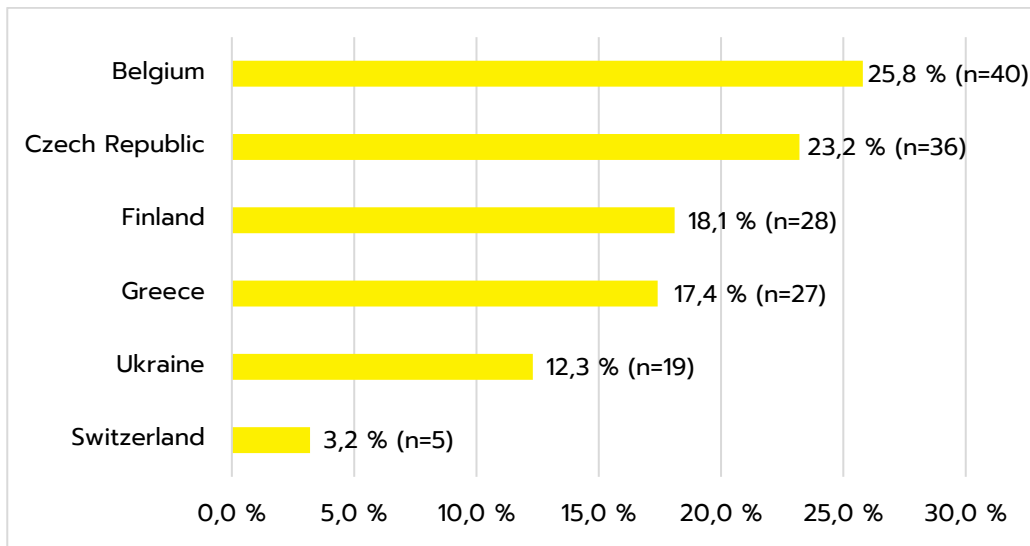
Figure 1. Country

The demographic profile of the respondents shows a notable gender gap. Specifically, there is a significant difference in representation, with a much larger proportion of men (61,3 %) compared to women (35,5 %). A small percentage of respondents (3,2%) chose not to disclose their gender. (Figure 2
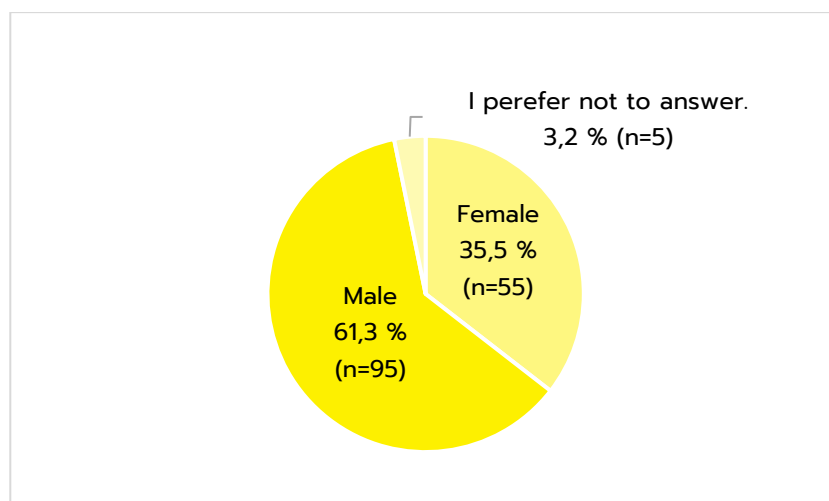
Figure 2. Gender

The survey has a wide age range of respondents. The largest group is aged 25-34 (37,4 %), likely to be early career professionals, followed by 35-44 (35,5 %), representing mid-career and emerging leaders. Respondents aged 45-54 make up 17,4 %, reflecting established expertise. Smaller groups include 18–24 year olds (4,5 %), 55-64 year olds (4,5 %) and 65+ year olds (0,7 %), ensuring a broad age representation for well-rounded insights. (Figure 3)
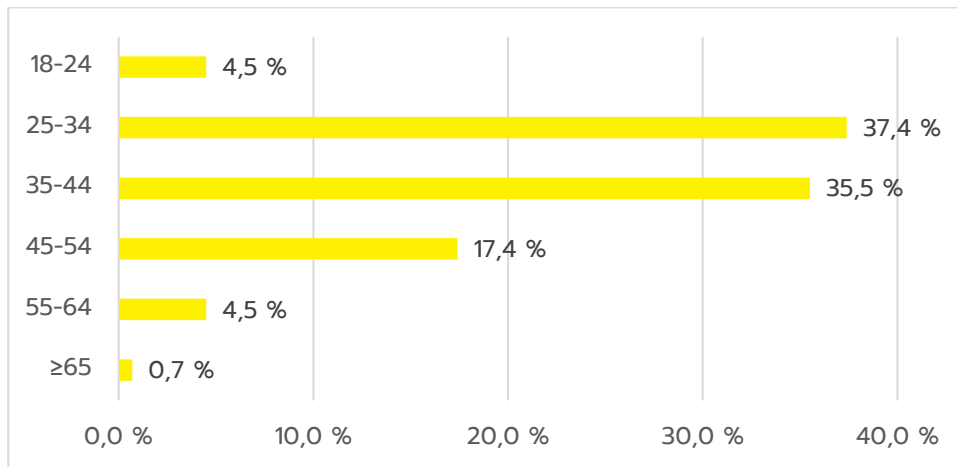
Figure 3. Age

The educational background of the respondents ranges from upper secondary school (2,6 %) to Bachelor's (7,7 %), Master's (36,1 %) and Doctorate (53,6 %), demonstrating the diversity of expertise within the survey sample. (Figure 4)
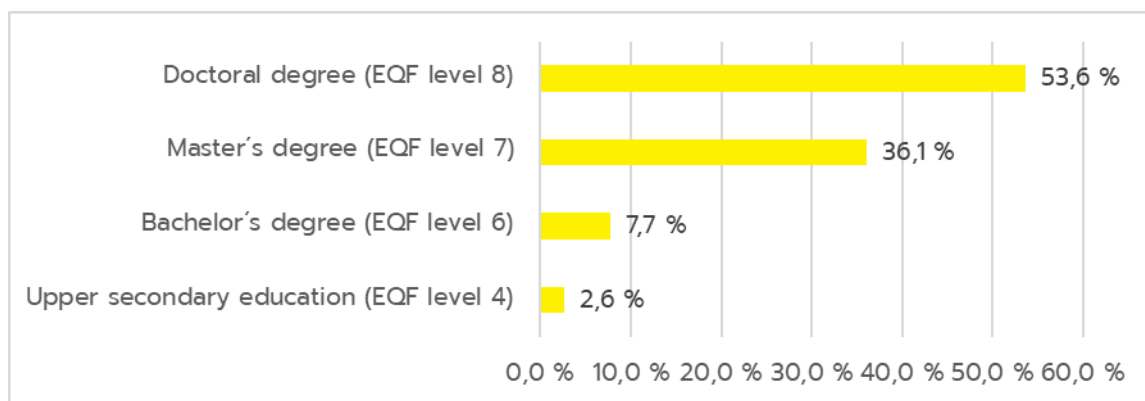
Figure 4. Education

The survey highlights the diversity of research experience among respondents. Those in the early-stages[2] of their career with 4 years or less account for 21,6 %, while 24,5 % have 5–9 years of experience. Mid-career professionals (10–14 years) represent 18,7 %, and 12,9 % have 15–19 years. 15,5 % of respondents report more than 20 years of experience, demonstrating extensive expertise. Additionally, 5,8% indicated that their experience did not apply, reflecting a variety of backgrounds and roles. (Figure 5)

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[2] European Charter for Researchers and Code of Conduct for the Recruitment of Researchers: "The term Early-Stage Researcher refers to researchers in the first four years (full-time equivalent) of their research activity, including the period of research training. Experienced Researchers are defined as researchers having at least four years of research experience (full-time equivalent) since gaining a university diploma giving them access to doctoral studies, in the country in which the degree/diploma was obtained or researchers already in possession of a doctoral degree, regardless of the time taken to acquire it." (European Commission, 2005: 28–29).
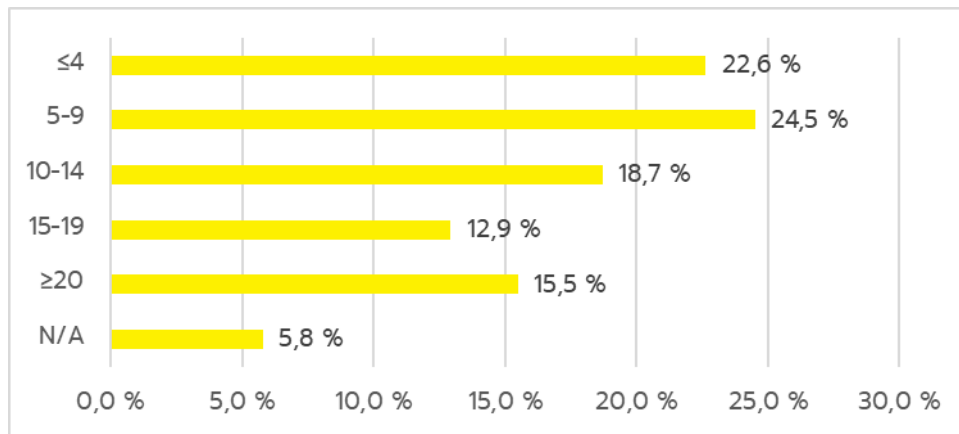
Figure 5. Research experience

32,9 % of respondents work in managerial roles that are essential for over-seeing and directing research, development, and innovation activities in their organisations, such as RDI directors, executives, research managers, professors, project managers, and team leaders. The largest group, 57.4%, includes both early-stage researchers, such as PhD students, research trainees, and student researchers, as well as more experienced professionals engaged directly in RDI activities. 9,0 % work in RDI support roles, and 0,6 % classified themselves as "other." (Figure 6)
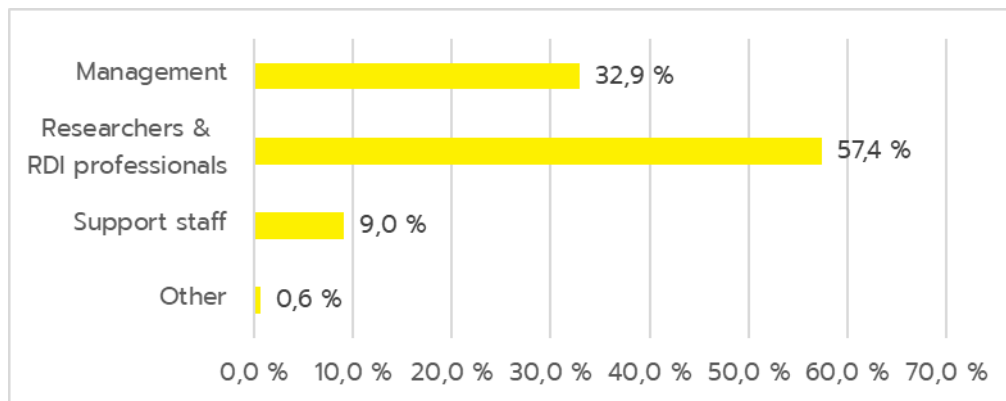
Figure 6. Work role

The majority of respondents are affiliated to research organisations, including higher education institutions (43,2), such as universities and universities of applied sciences, and research institutes (38,1 %). 16,1 % of respondents work for companies in the solar energy sector or other related industries. A small group (2,6 %) represents other kinds of organisations such as chambers of commerce and innovation centres, supporting solar energy related RDI initiatives. This distribution highlights the collaborative and multidisciplinary nature of solar energy research and innovation across academia, industry, and support organisations. (Figure 7)
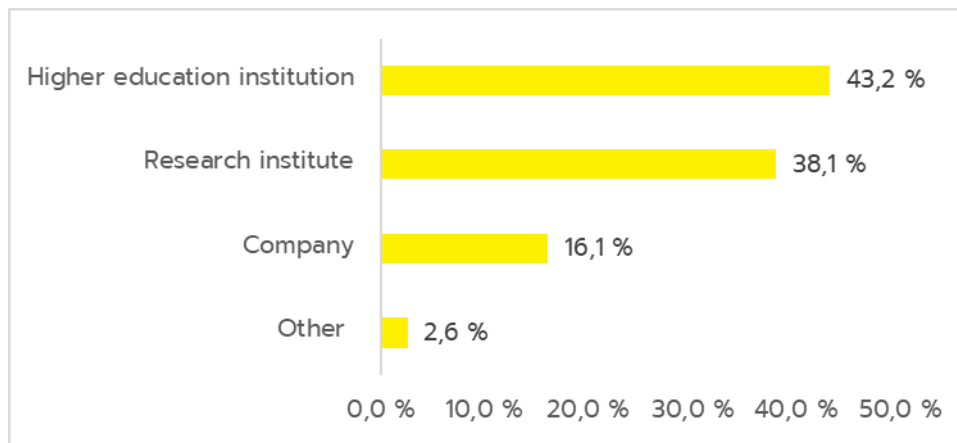
Figure 7. Organisation type

3.2 Analysis Methods

The analysis methods involved descriptive statistics and comparative analysis. To summarise and describe the main characteristics of the collected data, descriptive statistical methods were employed. The analysis focused on two key metrics:

- **Mean scores:** The average rating of the importance of each sub-competence was calculated, both for the total number of respondents and

separately for each country.

- **Standard deviation:** This metric was used to measure the variability of responses, indicating how consistently respondents rated the importance of each sub-competence, within their respective countries. Standard deviation was calculated for the total sample to assess overall variability of the responses in a broader context.

Means and standard deviations are derived directly from the Webropol system, with results automatically rounded to one decimal place from the original data. They offer a comprehensive overview of the perceived importance of each sub-competence, while also highlighting the variability in responses in the total sample, but also within countries. To further explore the data, comparative analysis was conducted to identify similarities and differences in perceived importance of specific sub-competences across the countries. The mean scores for each sub-competence and competence areas were compared between countries to determine, which competences were rated as more important in some countries than others.

4. Results – Key Competences Identified

4.1 Self-Management

Self-management competence area is consistently considered very important in all countries, with an overall mean score of 4,1 out of 5. The overall mean scores for this competence area vary only slightly between countries: Belgian and Greek respondents gave the highest ratings, both at 4,2, emphasising the strong perceived importance of this competence. Czech, Ukrainian, and Swiss respondents followed closely with an overall mean of 4,0, reflecting similar importance. Finnish respondents rated the competence slightly lower, with an overall mean of 3,9, suggesting a slightly less emphasis compared to other countries. (Table 1)

There appears to be a moderate consensus among respondents about the significant importance of the self-management competence area. The standard deviations for its sub-competences are between 0,6 and 0,9, indicating low to moderate variation in the responses. While the variation in standard deviations suggests some diversity in how specific sub-competences are valued, there seems to be a consensus among most respondent. The following sections examine the similarities and differences in how the self-management-related sub-competences are perceived across countries.

Table 1 Mean scores for self-management competence area

Sub-competences	BE (n=40)	CZ (n=36)	FI (n=28)	GR (n=27)	UA (n=19)	CH (n=5)	OM	SD
Continuous learning	4,4	4,4	4,3	4,6	4,3	4,4	4,4	0,6
Autonomy	4,4	4,4	4,1	4,1	4,3	4,2	4,3	0,7
Intrinsic motivation	4,4	4,3	4,3	4,2	4,4	4,8	4,3	0,7
Time management	4,3	4,2	4,2	4,3	4,2	4,2	4,2	0,7
Adaptability	4,3	3,9	3,9	4,1	4,1	4,0	4,1	0,7
Perseverance	4,3	4,0	4,0	4,1	4,0	4,2	4,1	0,7
Work-life balance	4,1	3,6	4,1	4,1	4,1	4,4	4,0	0,9
Stress management	4,1	3,9	4,1	3,9	4,0	4,0	4,0	0,9
Resilience	4,3	3,8	4,0	3,8	4,0	4,0	4,0	0,8
Self-awareness	4,1	4,0	3,5	4,3	4,1	3,4	4,0	0,8
Self-reflection	4,1	4,1	3,6	4,1	3,8	3,6	4,0	0,8
Self-confidence	4,2	4,0	3,7	4,0	4,1	3,8	4,0	0,8
Tolerance of uncertainty	4,3	3,7	3,9	3,7	4,0	3,8	3,9	0,8
Positive outlook	4,2	3,8	3,5	3,7	4,2	3,6	3,9	0,9
Self-regulation	4,1	3,9	3,6	3,9	4,1	3,4	3,9	0,8
Self-compassion	4,0	3,9	3,6	3,9	3,9	3,8	3,9	0,9
Overall mean of competence area	**4,2**	**4,0**	**3,9**	**4,1**	**4,1**	**4,0**	**4,1**	

Abbreviations:

BE=Belgium, CZ=the Czech Republic, FI=Finland, GR=Greece, UA=Ukraine, CH=Switzerland

OM = Overall mean, SD = Standard deviation

Continuous learning (OM 4,4) is considered very important in most countries, with mean scores ranging from 4,3 to 4,4. The only exception is Greece, where respondents gave it the highest score of 4,6, placing it in the "extremely important" range. The standard deviation of 0,6 indicates low variation, suggesting a consensus among respondents on the importance of this sub-competence.

Autonomy (OM 4,3) is considered very important in all countries, with mean scores between 4,1 and 4,4. The standard deviation of 0,7 indicates low variation

in responses across countries. This suggests that there is a consensus among the respondents about the importance of autonomy, with only small differences in ratings.

Intrinsic motivation (OM 4,3) is rated as very important in other countries, with mean scores between 3,5–4,4, except in Switzerland. Swiss respondents stand out, rating it as extremely important, with a score of 4,8. The standard deviation of 0,7 indicates low variation, suggesting a consensus among the respondents on the importance of this sub-competence.

Time management (OM 4,2) is considered very important in all countries, with mean scores ranging from 4,2 to 4,3. The standard deviation of 0,7 indicates low variation, suggesting a consensus among the respondents on the importance of time management.

Adaptability (OM 4,1) is considered very important, with mean scores ranging from 3,9 to 4,3. The standard deviation of 0,7 indicates low variation in the responses, meaning that all respondents agree on the importance of adaptability, with only small variations.

Perseverance (OM 4,1) is considered very important in all countries, with mean scores ranging from 4,0 to 4,3. The standard deviation of 0,7 indicates low variation, suggesting that there is a consensus among the respondents about the importance of perseverance.

Work-life balance (OM 4,0) is considered very important in all countries, with Swiss respondents rating it highest with a mean score of 4,4. Belgians, Finns, Greeks, and Ukrainians rate it at 4,1, while Czechs rate it the lowest with a mean score of 3,6. The standard deviation of 0,9 indicates moderate variation, suggesting that while work-life balance is generally valued, the importance attached to it varies between respondents in different countries. In addition, work-life balance was rated more highly by those working in research and higher education institutions (4,1) compared to companies (3,6) and other organisations (3,3).

Stress management (OM 4,0) is considered very important in all countries, with mean scores ranging from 3,9 to 4,1. Belgian and Finnish respondents rate it the highest emphasis at 4,1, closely followed by Ukrainians and Swiss at 4,0. Czechs and Greeks rate it slightly lower at 3,9 but still in the same importance range. There is a consensus among the respondents about its high importance, although the standard deviation of 0,9 indicates moderate variation in responses. This is probably because respondents from other organisations (4,3) considered stress management more important than those from research and higher education institutions (4,1) and companies (3,6).

Resilience (OM 4,0) is rated as very important in all countries, with Belgian respondents rating it the highest with a mean score of 4,3 and respondents from other countries with scores ranging from 3,8–4,0. The standard deviation of 0,8 indicates moderate variation in responses. Thus, while the importance of resilience is widely recognised in all countries, there are some differences in opinions.

Self-awareness (OM 4,0) is considered very important in most countries, with Belgians, Czechs, Greeks, and Ukrainians, rating it between 4,0 and 4,3, and Finns at 3,5. However, Swiss respondents rate it as moderately important (3,4), suggesting a lower emphasis on this competence compared to other countries. The standard deviation of 0,8 indicates moderate variation. While there is a broad recognition of its importance, the level of agreement on the importance of self-awareness is varies moderately across countries.

Self-reflection (OM 4,0) is considered very important in most countries, with Belgians, Czechs, and Greeks rating it at 4,1. Finns, Swiss and Ukrainians rated it slightly lower, but it still in the "very important" range (3,6–3,8). The standard deviation of 0,8 suggests a moderate variation in responses across countries. While self-reflection is generally considered to be very important, there are some differences in the emphasis placed on this competence in different countries.

Self-confidence (OM 4,0) is considered very important in all countries. Belgian respondents rate it the highest with a mean score of 4,2, while Czechs, Greeks, and Ukrainians rate it between 4, and 4,1. Swiss and Finns rate it slightly lower, with mean scores of 3,8 and 3,7 respectively, but still in the "very important" range. The standard deviation of 0,8 indicates a moderate variation in responses across countries, whit self-confidence is generally seen as very important.

Tolerance of uncertainty (OM 3,9) is considered very important in most countries, with Belgians scoring it the highest (4,3) and respondents from other countries giving it a slightly lower rating (3,7–4,0) but still within the "very important" range. The standard deviation of 0,8 indicates moderate variation, revealing that while tolerance of uncertainty is generally viewed as important across countries, there are some differences in how strongly it is emphasised.

Positive outlook (OM 3,9) is considered very important in all countries, with Belgians and Ukrainians rating it the highest (4,2) and respondents from other countries rating it slightly lower (3,5–3,8). The standard deviation of 0,9 indicates moderate variation, showing that there are some differences in how much respondents in each country value the positive outlook.

Self-regulation (OM 3,9) is considered very important in all countries, except Switzerland, where it is considered moderately important. Belgians and Ukrainians rate it the highest (4,1), while Czechs, Greeks, and Finns rate slightly lower (3,6–3,9), but still in the "very important" range. Swiss rate it the lowest, at 3,4, which puts it in the "moderately important" range. A standard deviation of 0.8 indicates moderate variation, suggesting some differences in the weight given to it by respondents in different countries, although most respondents generally agree on the importance of this sub-competence.

Self-compassion (OM 3,9) is regarded as very important in all countries, with scores ranging from 3,6 to 4,0. The highest score is from Belgians (4,0), closely followed by Czechs, Greeks, Ukrainians (all 3,9), and Swiss (3,8). Finnish respondents give the lowest mean score of 3,6, but still in the "moderately

important" range. The standard deviation of 0,9 indicates moderate variation in responses. While self-compassion is generally considered to be very important in all countries, there are some differences in how much emphasis respondents in each country place on it.

4.2 Working with Others

The overall mean score for the working with others is 4,1 out of 5, indicating that it is perceived as a very important transversal competence area for researchers. The overall mean scores for this competence area are consistent across countries, with slight variations: Greek respondents rated it the highest at 4,3, indicating the strongest emphasis on the importance of working with others. Belgian respondents also rated it highly at 4,2, closely followed by Ukrainians, Swiss, and Czechs with an overall mean score of 4,1. Finnish respondents gave comparatively the lowest rating for this competence area at 4,0, which still reflects a consistent view of its importance. (Table 2)

The standard deviations of the different sub-competences range from 0,7 to 0,8, indicating low to moderate variation in the responses. While the self-management-related sub-competences are generally valued, there are some differences in emphasis and prioritisation between respondents. Nevertheless, this competence area is widely considered to be very important, with consistent mean scores across countries and only moderate variations in responses for some sub-competences. The following sections analyse similarities and differences between these sub-competences through cross-country comparisons.

Table 2. Mean scores for working with others competence area

Sub-competences	BE (n=40)	CZ (n=36)	FI (n=28)	GR (n=27)	UA (n=19)	CH (n=5)	OM	SD
Collaboration	4,3	4,3	4,3	4,6	4,4	4,8	4,4	0,7
Recognition	4,2	4,1	4,3	4,6	4,3	4,2	4,3	0,7
Equality and diversity	4,4	3,9	4,3	4,6	4,2	4,0	4,3	0,8
Feedback	4,2	4,3	4,3	4,3	4,1	4,4	4,2	0,7
Active listening	4,2	4,0	4,2	4,3	4,4	4,0	4,2	0,7
Networking	4,3	4,1	4,1	4,0	4,3	4,0	4,2	0,8
Lead by example	4,2	4,0	4,0	4,3	4,1	4,2	4,1	0,7
Mentoring	4,2	4,0	3,9	4,2	4,1	4,2	4,1	0,7
Motivating others	4,1	4,0	3,8	4,2	3,9	4,2	4,0	0,7
Empathy	4,1	3,9	3,8	4,3	4,0	4,0	4,0	0,8
Conflict resolution	4,1	3,9	4,0	4,1	4,0	4,4	4,0	0,7
Cultural sensitivity	4,2	3,5	3,9	4,2	3,8	3,4	3,9	0,8
Negotiation	4,1	3,8	3,7	3,9	4,0	3,6	3,9	0,8
Overall mean of competence area	4,2	4,0	4,0	4,3	4,1	4,1	4,1	

Abbreviations:
BE=Belgium, CZ=the Czech Republic, FI=Finland, GR=Greece, UA=Ukraine, CH=Switzerland
OM = Overall mean, SD = Standard deviation

Collaboration (OM 4,4) is considered very important to extremely important in all countries, with mean scores ranging from 4,3 to 4,8. Swiss respondents give the highest score of 4,8, closely followed by Greeks (4,6). Ukrainians rate collaboration at 4,4, while Belgian, Czech, and Finnish respondents give it the lowest mean score of 4,3. The standard deviation of 0,7 indicates low variation, reflecting a consensus on the importance of collaboration with only slight differences in opinions.

Recognition (OM 4,3) is considered very important to extremely important in all countries, with mean scores ranging from 4,1 to 4,6. Greek respondents give the highest score of 4,6, considering it as extremely important. Respondents

from other countries regard recognition as very important. Ukrainians and Finns both rate at 4,3, closely followed by Belgians and Swiss respondents at a mean score of 4,2. Czechs give the lowest score at 4,1. The standard deviation of 0,7 indicates low variation, reflecting a consensus on the importance of recognition, with only slight differences in opinions.

Equality and diversity (OM 4,3) is rated as very important to extremely important in all countries, with mean scores ranging from 3,9 to 4,6. Greek respondents give the highest score of 4,6 considering it as extremely important. Respondents from other countries consider this sub-competence to be very important. Belgians rate it at 4,4, closely followed by Finns (4,3), Ukrainians (4,2), and Swiss (4,0), while Czechs give the lowest rating of 3,9. The standard deviation of 0,8 indicates moderate variation, suggesting some differences of opinions on the importance of equality and diversity. In addition to differences between countries, respondents from research and higher education institutions (4,4) considered equality and diversity to be more important than those from companies (3,8) and other organisations (3,5).

Feedback (OM 4,2) is rated as very important in all countries, with mean scores ranging from 4,1 to 4,4. Swiss respondents give the highest score of 4,4. closely followed by Czechs, Finns, Greeks (all 4,3), and Belgians (4,2). Ukrainians give the lowest rating of 4,1. The standard deviation of 0,7 indicates low variation, suggesting a consensus on the importance of feedback, with only slight differences in opinions between countries.

Active listening (OM 4,2) is considered very important in all countries, with mean scores ranging from 4,0 to 4,4. Ukrainians give the highest score of 4,4, followed by Greeks (4,3). Belgians and Finns at 4,2, while Czechs and Swiss give the lowest rating of 4,0. The standard deviation of 0,7 indicates low variation, suggesting that respondents largely agree on the importance of active listening, with only slight differences in opinions between countries.

Networking (OM 4,2) is rated as very important in all countries, with mean scores ranging from 4,0 to 4,3. Belgians and Ukrainians give the highest score

of 4,3, while Czechs and Finns rate it at 4,1. Greeks and Swiss rate it the lowest at 4,0. The standard deviation of 0,8 indicates moderate variation, suggesting some differences of opinions on the importance of networking. This is mostly because respondents from other organisations (4,8) considered networking to be more important than those from research and higher education institutions (4,2) and companies (3,8).

Lead by example (OM 4,1) is rated as very important in all countries, with mean scores ranging from 4,0 to 4,3. Greeks give the highest score of 4,3, followed closely by Belgians and Swiss (both 4,2). Ukrainians rate it at 4,1, while Czechs and Finns give the lowest rating of 4,0. The standard deviation of 0,7 indicates low variation, suggesting a consensus on the importance of leading by example, with only slight differences in opinions between countries.

Mentoring (OM 4,1) is rated as very important in all countries, with mean scores ranging from 3,9 to 4,2. Belgians, Greeks, and Swiss respondents give the highest score of 4,2, while Ukrainians rate it at 4,1 and Czechs at 4,0. Finns give the lowest score of 3,9, still within the "very important" range. The standard deviation of 0,7 indicates low variation, suggesting a general agreement on the importance of mentoring, with only slight differences in opinions between countries.

Motivating others (OM 4,0) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,2. Greek and Swiss respondents give the highest score of 4,2, closely followed by Belgians (4,1), Czechs (4,0), and Ukrainians (3,9). Finns give the lowest score of 3,8, still within the "very important" range. The standard deviation of 0,7 indicates low variation, suggesting general agreement on the importance of motivating others, with only slight differences in opinions between countries.

Empathy (OM 4,0) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,3. Greek respondents give the highest score of 4,3, closely followed by Belgians (4,1), Ukrainians and Swiss (both 4,0), and Czechs (3,9). Finns give the lowest score of 3,8, still within the "very important" range.

The standard deviation of 0,8 indicates moderate variation, suggesting some differences in opinions between countries on the importance of empathy.

Conflict resolution (OM 4,0) is rated as very important in all countries, with mean scores ranging from 3,9 to 4,4. Swiss respondents give the highest score of 4,4, closely followed by Belgians, Greeks (both 4,1), Ukrainians and Finns (both 4,0). Czechs give the lowest score of 3,9, still within the "very important" range. The standard deviation of 0,7 indicates low variation, suggesting a consensus on the importance of conflict resolution, with only slight differences in opinions between countries.

Cultural sensitivity (OM 3,9) is rated as very important in all countries, with mean scores ranging from 3,4 to 4,2. Belgians and Greeks give the highest score of 4,2, closely followed by Finns (3,9), Ukrainians (3,8), and Czechs (3,5). Swiss respondents give the lowest score of 3,4, still within the "moderately important" range. The standard deviation of 0,8 indicates moderate variation, suggesting some differences of opinions between countries on the importance of cultural sensitivity.

Negotiation (OM 3,9) is rated as very important in all countries, with mean scores ranging from 3,6 to 4,1. Belgians give the highest score of 4,1, closely followed by Ukrainians (4,0), Greeks (3,9) Czechs (3,8), and Finns (3,7). Swiss respondents give the lowest score of 3,6, also within the "very important" range, but closer to moderately important. The standard deviation of 0,8 indicates moderate variation, suggesting some differences of opinions between countries on the importance of negotiation, while most respondents generally agree on its importance.

4.3 Logical Thinking

The overall mean score for the logical thinking is 4,3, indicating it is widely considered a very important competence area across countries. Respondents from Belgium, Czechia, and Ukraine provided the highest overall mean scores of

4,3, closely followed by Finns and Greeks with 4,2, reflecting strong agreement on the importance of logical thinking among these respondents. Swiss respondents, with an overall mean score of 3,9, rated this competence area lowest, but showing only slightly less emphasis compared to other countries.

The standard deviations of the different sub-competences, which are consistently between 0,6 and 0,8, indicate low to moderate variation in the responses. While there seems to be a consensus on the importance of logical thinking as a transversal competence area for researchers, these differences in the standard deviation reflect some differences in prioritisation. The similarities and differences in the perceived importance of different sub-competences are analysed in cross-country comparisons in the following chapters. (Table 3)

Table 3. Mean scores for logical thinking competence area

Sub-competences	BE (n=40)	CZ (n=36)	FI (n=28)	GR (n=27)	UA (n=19)	CH (n=5)	OM	SD
Critical thinking	4,4	4,6	4,4	4,4	4,6	4,2	4,5	0,6
Analytical thinking	4,4	4,4	4,5	4,3	4,3	4,2	4,4	0,7
Logical reasoning	4,3	4,3	4,4	4,4	4,2	3,8	4,3	0,7
Attention to detail	4,2	4,2	3,9	4,4	4,3	4,0	4,2	0,7
Systemic thinking	4,2	4,2	4,3	4,1	4,3	3,8	4,2	0,7
Strategic thinking	4,3	4,4	4,0	4,2	4,3	3,4	4,2	0,8
Interpretation	4,3	4,4	4,0	4,1	4,3	3,8	4,2	0,7
Decision-making	4,3	4,3	4,1	4,2	4,2	4,2	4,2	0,7
Situational awareness	4,2	4,0	4,0	4,0	4,1	3,8	4,1	0,7
Overall mean of competence area	4,3	4,3	4,2	4,2	4,3	3,9	4,3	

Abbreviations:
BE=Belgium, CZ=the Czech Republic, FI=Finland, GR=Greece, UA=Ukraine, CH=Switzerland
OM = Overall mean, SD = Standard deviation

Critical thinking (OM 4,5) is rated as very important to extremely important in all countries, with mean scores ranging from 4,2 to 4,6. Czech and Ukrainian respondents give the highest score of 4,6, considering it as extremely important. Belgians, Finns, and Greeks rate it at 4,4, while Swiss respondents give the lowest score of 4,2, still all within the "very important" range. The standard deviation of 0,6 indicates low variation, suggesting a consensus across countries on the importance of critical thinking, with only slight differences in opinions.

Analytical thinking (OM 4,4) is rated as very to extremely important in all countries, with mean scores ranging from 4,2 to 4,5. Finnish respondents give the highest score of 4,5, considering it as extremely important. Belgians and Czechs both rate is at 4,4, closely followed by Greeks and Ukrainians (both 4,3). Swiss respondents give the lowest score of 4,2, but still within "very important" range. The standard deviation of 0,7 indicates low variation, suggesting general agreement across countries on the importance of analytical thinking, with only slight differences in opinions.

Logical reasoning (OM 4,3) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,4. Finnish, Greek, and Czech respondents give the highest score of 4,4, closely followed by Belgians (4,3) and Ukrainians (4,2). Swiss respondents give the lowest rating of 3,8, still within the "very important" range. The standard deviation of 0,7 indicates low variation, suggesting general agreement on the importance of logical reasoning, with only slight differences in opinions across countries.

Attention to detail (OM 4,2) is rated as very important in all countries, with mean scores ranging from 3,9 to 4,4. Greek respondents give the highest score of 4,4, followed by Ukrainians (4,3), Belgians and Czechs (both 4,2), and Swiss (4,0). Finns rate it the lowest at 3,9, still within the "very important" range. The standard deviation of 0,7 indicates low variation, suggesting general agreement across countries, with only slight differences in opinions.

Systemic thinking (OM 4,2) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,3. Finns and Ukrainians give the highest score

of 4,3, followed by Czechs and Belgians (both 4,2), and Greeks (4,1). Swiss respondents give the lowest rating of 3,8, still within "very important" range. The standard deviation of 0,7 indicates low variation, reflecting consensus with only slight differences in opinions.

Strategic thinking (OM 4,2) is rated as moderate to very important, with mean scores ranging from 3,4 to 4,4. Czechs give the highest score of 4,4, followed by Ukrainians and Belgians (both 4,3), Greeks (4,2), and Finns (4,0). Swiss rate it the lowest at 3,4, considering is as moderately important. The standard deviation of 0,8 indicates moderate variation, suggesting more some differences in opinions, particularly with the Swiss rating significantly lower.

Interpretation (OM 4,2) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,4. Czechs rate it the highest at 4,4, closely followed by Belgians and Ukrainians (both 4,3). Greeks and Finns give it 4,1 and 4,0, respectively, while Swiss rate it the lowest at 3,8. The standard deviation of 0,7 indicates low variation, showing general agreement, with slight differences in opinions between countries.

Decision-making (OM 4,2) is rated as very important in all countries, with mean scores ranging from 4,1 to 4,3. Belgians and Czechs rate it the highest at 4,3, closely followed by Greeks, Ukrainian, and Swiss (all 4,2). Finnish respondents rate it the lowest at 4,1. The standard deviation of 0,7 indicates low variation, reflecting general agreement on the importance of decision-making, with only slight differences across countries.

Situational awareness (OM 4,1) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,2. Belgian respondents give the highest score of 4,2, closely followed by Ukrainians (4,1), Czechs, Finns, and Greeks (all 4,0). Swiss give the lowest rating at 3,8, still within "very important" range. The standard deviation of 0,7 indicates low variation, reflecting a consensus, with slight differences in opinions across countries. Situational awareness was considered equally important by respondents from research and higher education

institutions and companies (4,1), while those from other organisations (3,5) rated it slightly less important.

4.4 Creative Thinking

Creative thinking, with an overall mean score of 4,2 out of 5, shows that it is considered a very important competence area by respondents in all respondent groups. Respondents from Ukraine and Switzerland provided the highest overall mean score of 4,3, closely followed by Belgians, Czechs, and Finns with 4,2, reflecting a strong emphasis on creative thinking. Greek respondents gave the lowest overall mean score of 4,1, but still recognised the importance of this competence area. (Table 4)

While the overall mean scores demonstrate consensus about the perceived importance of this competence area, the analysis of standard deviations reveals that there is some variation how the importance of specific sub-competences is perceived among respondents. The standard deviations range between 0,6 and 0,8, indicating low to moderate variation in the responses, with some differences in the prioritisation of specific sub-competences. The following sections describe the similarities and differences in creative thinking-related sub-competences through cross-country comparisons.

Table 4. Mean scores for creative thinking competence area

Sub-competences	BE (n=40)	CZ (n=36)	FI (n=28)	GR (n=27)	UA (n=19)	CH (n=5)	OM	SD
Open-mindedness	4,3	4,5	4,4	4,3	4,3	4,2	4,4	0,6
Curiosity	4,4	4,4	4,4	4,3	4,3	4,6	4,4	0,7
Creative problem solving	4,4	4,4	4,3	4,3	4,2	4,4	4,3	0,7
Innovativeness	4,2	4,4	4,2	4,2	4,3	4,6	4,3	0,7
Experimentation	4,3	4,2	4,3	4,2	4,3	4,8	4,3	0,7
Synthesising	4,2	4,1	4,2	4,0	4,3	4,4	4,2	0,7
Visual thinking	4,2	3,9	4,0	4,0	4,4	4,0	4,1	0,7
Abstract thinking	4,0	3,9	4,0	3,9	4,2	4,0	4,0	0,7
Imagination	4,2	3,9	3,8	4,0	4,2	3,8	4,0	0,8
Overall mean of competence area	**4,2**	**4,2**	**4,2**	**4,1**	**4,3**	**4,3**	**4,2**	

Abbreviations:
BE=Belgium, CZ=the Czech Republic, FI=Finland, GR=Greece, UA=Ukraine, CH=Switzerland
OM = Overall mean, SD = Standard deviation

Open-mindedness (OM 4,4) is rated as very important to extremely important, with mean scores ranging from 4,2 to 4,5. Czechs give the highest score of 4,5, considering it as extremely important. Finns rate it at 4,4, followed closely by Belgians, Greeks, and Ukrainians (all 4,3). Swiss respondents rate this subcategory the lowest at 4,2. The standard deviation of 0,6 indicates low variation, reflecting general agreement across countries, with only slight differences in opinions.

Curiosity (OM 4,4) is rated as very important to extremely important, with mean scores ranging from 4,3 to 4,6. Swiss respondents rate it the highest at 4,6, considering it extremely important. Belgians, Czechs, and Finns all rate it at 4,4, followed by Greeks and Ukrainians at 4,3. The standard deviation of 0,7 indicates low variation, suggesting consensus with slight differences in opinions.

Creative problem solving (OM 4,3) is rated as very important in all countries, with mean scores ranging from 4,2 to 4,4. Belgians, Czechs, and Swiss all give a score of 4,4, rating it the highest. Finns and Greeks rate it at 4,3, while Ukrainians give the lowest mean score of 4,2. The standard deviation of 0,7 indicates low variation, reflecting general agreement with only slight differences in opinions.

Innovativeness (OM 4,3) is rated as very important to extremely important, with mean scores ranging from 4,2 to 4,6. Swiss respondents give the highest score of 4,6, considering it extremely important. Czechs rate it at 4,4, followed by Ukrainians (4,3). Belgians, Greeks and Finns all rate it the lowest at 4,2. The standard deviation of 0,7 indicates low variation, suggesting a consensus, with only slight differences across countries.

Experimentation (OM 4,3) is rated as very important to extremely important, with mean scores ranging from 4,2 to 4,8. Swiss respondents give the highest rating of 4,8, considering it extremely important. Belgians, Finns, and Ukrainians all rate it at 4,3, closely followed by Czechs and Greeks, who give it the lowest score of 4,2. The standard deviation of 0,7 indicates low variation, reflecting general agreement with slight differences in opinions.

Synthesising (OM 4,2) is rated as very important in all countries, with mean scores ranging from 4,0 to 4,4. Swiss respondents give the highest rating of 4,4, closely followed by Ukrainians (4,3), Finns and Belgians (both 4,2), and Czechs (4,1). Greeks give the lowest rating at 4,0. The standard deviation of 0,7 indicates low variation, suggesting a consensus with only slight differences in opinions.

Visual thinking (OM 4,1) is rated as very important in all countries, with mean scores ranging from 3,9 to 4,4. Ukrainians give the highest score of 4,4, followed by Belgians (4,2), Finns and Greeks (both 4,0), and Swiss (4,0). Czechs rate it the lowest at 3,9. The standard deviation of 0,7 indicates low variation, suggesting general agreement, with only slight differences in opinions across countries.

Abstract thinking (OM 4,0) is rated as very important in all countries, with mean scores ranging from 3,9 to 4,2. Ukrainians give the highest score of 4,2, followed closely by Belgians, Finns, and Swiss (all 4,0). Czechs and Greeks rate it the lowest, with a mean score of 3,9. The standard deviation of 0,7 indicates low variation, reflecting general agreement, with only slight differences in opinions between countries.

Imagination (OM 4,0) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,2. Belgian, Ukrainian respondents give the highest rating of 4,2, followed by Greeks (4,0), and Czechs (3,9). Finns and Swiss rate it the lowest at 3,8. The standard deviation of 0,8 indicates moderate variation, suggesting more some differences in opinions.

4.5 Project Management

The overall mean score for the project management is 3,9 out of 5, indicating that it is generally perceived as a very important competence area for researchers by the surveyed respondents. Respondents from Ukraine gave project management the highest overall mean score of 4,3, closely followed by Belgians and Greeks with 4,0. Czech, Finnish and Swiss respondents share the lowest overall mean score of 3,8, which still shows a high relevance of this competence area. (Table 5)

The standard deviations for the sub-competences range 0,8 to 1,0, indicating moderate variation in the responses. While most respondents generally agree on the importance of project management, there is some spread in their responses, with some considering sub-competences in this area to be less important or more important. The similarities and differences of the project management-related sub-competences are further explored in the following chapters through cross-country comparisons.

Table 5. Mean scores for project management competence area

Sub-competences	BE (n=40)	CZ (n=36)	FI (n=28)	GR (n=27)	UA (n=19)	CH (n=5)	OM	SD
Scheduling	4,0	3,9	4,0	4,3	4,4	4,0	4,1	0,8
Coordination	4,0	4,0	3,9	4,2	4,2	4,6	4,1	0,8
Funding acquisition	4,1	4,0	4,0	3,8	4,1	3,2	4,0	1,0
Action planning	4,0	4,0	3,8	4,1	4,4	4,0	4,0	0,8
Risk management	4,0	3,9	3,8	3,6	4,3	3,6	3,9	0,8
Quality management	4,0	3,8	3,8	4,0	4,4	3,8	3,9	0,8
Progress monitoring & reporting	4,0	3,7	3,8	4,1	4,3	3,8	3,9	0,9
Budgeting	3,8	3,6	3,4	3,9	4,3	4,0	3,8	1,0
Resource allocation	3,9	3,7	3,8	3,8	4,2	3,6	3,8	0,9
Overall mean of competence area	**4,0**	**3,8**	**3,8**	**4,0**	**4,3**	**3,8**	**3,9**	

Abbreviations:
BE=Belgium, CZ=the Czech Republic, FI=Finland, GR=Greece, UA=Ukraine, CH=Switzerland
OM = Overall mean, SD = Standard deviation

Scheduling (OM 4,1) is rated as very important in all countries, with mean scores ranging from 3,9 to 4,4. Ukrainians give the highest score of 4,4, closely followed by Greeks (4,3), Belgians and Finns (both 4,0), and Swiss (4,0). Czechs rate it the lowest at 3,9. The standard deviation of 0,8 indicates moderate variation, reflecting some differences in opinions. Respondents from research and higher education institutions (4,1) considered scheduling more important than those from companies (4,0) and other organisations (3,5), but all still rated it as very important.

Coordination (OM 4,1) is considered very important to extremely important, with mean scores ranging from 3,9 to 4,6. Swiss respondents give it the highest score of 4,6, considering it extremely important. Respondents from other countries rate this sub-competence as very important. Greeks and Ukrainians both rate it is at 4,2, followed by Czechs at 4,0. Finns give coordination the lowest

score of 3,9, which is still is in the very important range. The standard deviation of 0,8 indicates moderate variation, reflecting some differences in responses, with Swiss in particular rating it significantly higher than the others.

Funding acquisition (OM 4,0) is rated as very important, except Switzerland, where it falls into the moderately important range, with a score of 3,2. Other countries, including Belgians, Ukrainians (both 4,1), Czechs, Finns (both 4,0), and Greeks (3,8), rate it as the very important. The standard deviation of 1,0 indicates moderate variation, suggesting notable differences in opinions, particularly with Swiss respondents rating much lower. Additionally, respondents from research and higher education institutions (4,1) considered funding acquisition to be more important than those from companies (3,6) and other organisations (3,3).

Action planning (OM 4,0) is rated as very important in all countries, with mean scores ranging from 3,8 to 4,4. Ukrainians give the highest score of 4,4, followed by Greeks (4,1), Belgians, Czechs, and Swiss (all 4,0). Finns rate it the lowest at 3,8. The standard deviation of 0,8 indicates moderate variation, showing some differences in opinions, especially from the Finnish respondents.

Risk management (OM 3,9) is rated as very important in all countries, with mean scores ranging from 3,6 to 4,3. Ukrainians give the highest score of 4,3, followed by Belgians (4,0), Czechs (3,9), and Finns (3,8). Greeks and Swiss respondents rate it the lowest at 3,6, still considering it very important. The standard deviation of 0,8 indicates moderate variation, reflecting some differences in opinions, particularly with Greek and Swiss respondents rating it comparatively lower than respondents form other countries.

Quality management (OM 3,9) is considered very important in all countries, with mean scores ranging from 3,8 to 4,4. Ukrainians give the highest score of 4,4, followed by Belgians and Greeks (both 4,0). Czechs, Finns, and Swiss rate this sub-competence the lowest at 3,8. The standard deviation of 0,8 indicates moderate variation, reflecting some differences in opinions.

Progress monitoring and reporting (OM 3,9) is rated as very important in all countries, with mean scores ranging from 3,7 to 4,3. Ukrainians give the highest score of 4,3, followed by Greeks (4,1), Belgians (4,0), Finns and Swiss (both 3,8). Czechs rate it the lowest at 3,7. The standard deviation of 0,9 indicates moderate variation, reflecting some differences in opinions, while most respondents generally agree on the importance of this sub-competence. Respondents from research and higher education institutions (4,0) considered progress monitoring and reporting more important than those from companies (3,8) and other organisations (3,3).

Budgeting (OM 3,8) is rated as moderately important to very important, with mean scores ranging from 3,4 to 4,3. Ukrainians give the highest score of 4,3, followed by Swiss (4,0), Greeks (3,9), Belgians (3,8), and Czechs (3,6). Finns rate it the lowest at 3,4. The standard deviation of 1,0 indicates moderate variation, reflecting notable differences in opinions, particularly with Finnish and Czech respondents rating it much lower compared to the others.

Resource allocation (OM 3,8) is rated as very important in all countries, with mean scores ranging from 3,6 to 4,2. Ukrainians give the highest score of 4,2, followed by Belgians (3,9), Greeks and Finns (both 3,8), and Czechs (3,7). Swiss rate it the lowest at 3,6. The standard deviation of 0,9 indicates moderate variation, reflecting some differences.

4.6 Research and Data Management

With an overall mean score of 4,1 out of 5, research and data management is considered to be as a very important transversal competence area for researchers. The highest overall mean of 4,4 is reported by Ukrainian respondents, closely followed by Czechs (4,2) and Belgians (4,2). Greek and Finnish respondents share a similar rating of 4,1, while Swiss respondents gave the lowest overall mean score of 3,9. These mean scores reflect a common view among respondents on the significant importance of this competence area.

However, the standard deviation for the specific sub-competences ranges from 0,7 to 0,9, indicating low to moderate variation in the responses. While most respondents had similar views on the importance of this competence area, there were still some differences in their responses. The similarities and differences of the research and data management-related sub-competences are explored in more detail in the following chapters through cross-country comparisons. (Table 6)

Table 6. Mean scores for research and data management competence area

Sub-competences	BE (n=40)	CZ (n=36)	FI (n=28)	GR (n=27)	UA (n=19)	CH (n=5)	OM	SD
Data analysis	4,2	4,3	4,2	4,3	4,3	4,0	4,3	0,7
Information retrieval	4,1	4,2	4,2	4,1	4,5	4,4	4,2	0,7
Data collection	4,0	4,3	4,2	4,1	4,3	4,2	4,2	0,7
Research design	4,0	4,1	4,2	3,9	4,4	3,6	4,1	0,8
Ethical considerations	4,1	4,2	4,0	4,0	4,4	4,0	4,1	0,8
Intellectual Property Rights	4,1	4,1	3,9	4,0	4,6	4,2	4,1	0,9
Data privacy	4,0	3,9	3,7	4,0	4,4	3,0	4,0	0,8
Data storage	3,9	4,1	3,5	3,8	4,1	3,6	3,9	0,8
Overall mean of competence area	4,1	4,2	4,0	4,0	4,4	3,9	4,1	

Abbreviations:
BE=Belgium, CZ=the Czech Republic, FI=Finland, GR=Greece, UA=Ukraine, CH=Switzerland
OM = Overall mean, SD = Standard deviation

Data analysis (OM 4,3) is rated as very important in all countries, with mean scores ranging from 4,0 to 4,3. Czechs, Greeks, and Ukrainians give the highest score of 4,3, followed closely by Belgians and Finns (4,2). Swiss respondents rate it the lowest at 4,0. The standard deviation of 0,7 indicates low variation, suggesting general agreement across countries with only slight differences in opinions.

Information retrieval (4,2) is rated as very important to extremely important, with mean scores ranging from 4,1 to 4,5. Ukrainians give the highest score of 4,5, considering it extremely important. Swiss respondents rate it at 4,4, followed by Czechs and Finns (both 4,2). Belgians and Greeks give the lowest mean score of 4,1. The standard deviation of 0,7 indicates low variation, reflecting consensus across countries, with minor differences in ratings.

Data collection (OM 4,2) is rated as very important in all countries, with mean scores ranging from 4,0 to 4,3. Czechs and Ukrainians give the highest score of 4,3, followed by Finns and Swiss (both 4,2), and Greeks (4,1). Belgians give it the lowest mean score of 4,0. The standard deviation of 0,7 indicates low variation, suggesting consistency in responses across countries.

Research design (OM 4,1) is rated as very important in all countries, with mean scores ranging from 3,6 to 4,4. Ukrainians give the highest score of 4,4, followed by Finns (4,2), Czechs (4,1), Belgians (4,0), and Greeks (3,9). Swiss respondents rate it the lowest at 3,6. The standard deviation of 0,8 indicates moderate variation, reflecting some differences in opinions, particularly with Swiss respondents rating it comparatively lower.

Ethical considerations (OM 4,1) are rated as very important in all countries, with mean scores ranging from 4,0 to 4,4. Ukrainians give the highest score of 4,4, followed by Czechs (4,2), and Belgians (4,1). Greeks, Finns, and Swiss respondents give the lowest mean score of 4,0. The standard deviation of 0,8 indicates moderate variation, suggesting some differences in opinions, particularly with Ukrainian respondents rating it comparatively higher. Ethical considerations were considered more important by respondents from research and higher education institutions than those from companies (4,0) and other organisations (3,5), but all still rated them as very important.

Intellectual property rights (OM 4,1) are rated as very important to extremely important, with mean scores ranging from 3,9 to 4,6. Ukrainians give the highest score of 4,6, considering it extremely important. Swiss rate this sub-competence at 4,2, closely followed by Belgians and Czechs (both 4,1), and

Greeks (4,0). Finns rate it the lowest at 3,9. The standard deviation of 0,9 indicates moderate variation, reflecting significant differences in opinions, particularly Ukrainians rating it comparatively higher compared to others.

Data privacy (OM 4,0) is rated as moderate important to very important, with mean scores ranging from 3,0 to 4,4. Ukrainians give the highest score of 4,4, followed by Belgians and Greeks (both 4,0), Czechs (3,9), and Finns (3,7), all of whom consider it very important. Swiss respondents gave it the lowest score of 3,0, considering this this sub-competence to be "moderately important. The standard deviation of 0,8 indicates moderate variation, reflecting some differences, particularly with Swiss respondents rating it significantly lower than others. Data privacy was considered more important by respondents from research and higher education institutions (4,0) than by those from companies (3,9) and other organisations (3,3).

Data storage (OM 3,9) is rated as very important in all countries, with mean scores ranging from 3,5 to 4,1. Ukrainians and Czechs give the highest score of 4,1, followed by Belgians (3,9), Greeks (3,8), and Swiss (3,6). Finnish respondents rate it the lowest at 3,5, still considering it very important. The standard deviation of 0,8 indicates moderate variation, reflecting differences in opinions, particularly with Swiss and Finnish respondents rating it comparatively lower than others. Respondents from companies (4,1) perceived data storage more important than those from research and higher education institutions (3,8) and other organisations (3,5), but all still considered it very important.

4.7 Dissemination and Impact

Dissemination and impact received a comparatively lower rating than other competence areas, with an overall mean score of 3,8 out of 5. However, the overall mean scores indicates that it is generally recognised as a very important transversal competence area for researchers. Ukrainian and Belgian respondents (both 3,9) gave the highest rating to this competence area, closely followed by Czechs and Swiss (both 3,8), and Greeks (3,7). Finnish respondents gave the

lowest overall mean score of 3,6, indicating a slightly less emphasis on this competence area than other counterparts.

While the overall mean scores reflect similar opinions and a consensus on the importance of the dissemination and impact competence area, the standard deviations for the specific sub-competences indicate moderate variability, ranging from 0,8–1,0. While there is some variation in the responses, it is not enough to suggest widespread disagreement. In the following chapters, the similarities and differences of the dissemination and impact-related sub-competences are described in more detail through cross-country comparison. (Table 7)

Table 7. Mean scores for dissemination and impact competence area

Sub-competences	BE (n=40)	CZ (n=36)	FI (n=28)	GR (n=27)	UA (n=19)	CH (n=5)	OM	SD
Scientific publications	4,1	4,1	4,4	4,3	4,4	4,0	4,2	0,8
Publications for professional community	4,0	4,2	4,0	4,1	4,3	4,0	4,1	0,8
Presentations	4,2	4,0	4,0	4,1	4,1	4,4	4,1	0,8
Public speaking	4,2	3,9	3,7	3,9	3,9	4,2	4,0	0,8
Open access publications	3,8	3,7	4,2	3,7	3,9	4,2	3,9	0,9
Publications for general public	3,8	3,9	3,4	3,7	4,1	4,0	3,8	0,9
Commercialisation of innovation	3,8	4,1	3,5	3,4	3,9	4,0	3,7	0,9
Policy impact	3,7	3,5	3,1	3,7	4,0	3,2	3,6	1,0
Audiovisual publications	3,7	3,5	3,2	3,3	3,5	3,8	3,5	0,9
Media outreach	3,7	3,6	2,9	3,4	3,6	3,4	3,4	0,9
Social media engagement	3,7	3,4	2,9	3,4	3,7	3,0	3,4	1,0
Overall mean of competence area	**3,9**	**3,8**	**3,6**	**3,7**	**3,9**	**3,8**	**3,8**	

Abbreviations:
BE=Belgium, CZ=the Czech Republic, FI=Finland, GR=Greece, UA=Ukraine, CH=Switzerland
OM = Overall mean, SD = Standard deviation

Scientific publications (OM 4,2) are rated as very important in all countries, with mean scores ranging from 4,0 to 4,4. Ukrainians and Finns give the highest scores (both 4,4), followed by Greeks (4,3), Belgian, Finns, and Czechs (all 4,1). Swiss respondents rate it the lowest at 4,0. The standard deviation of 0,8 indicates moderate variation, suggesting some differences in ratings across countries.

Publications for professional community (OM 4,1) are rated as very important in all countries, with mean scores ranging from 4,0 to 4,3. Ukrainians rate it the highest at 4,3, followed by Czechs (4,2), and Greeks (4,1). Finnish and Swiss respondents rate it the lowest at 4,0. The standard deviation of 0,8 indicates moderate variation, showing some differences in responses across countries.

Presentations (OM 4,1) are rated as very important in all countries, with mean scores ranging from 4,0 to 4,4. Swiss respondents rate it the highest at 4,4, followed by Belgians (4,2). Ukrainians and Greeks (both 4,1). Czechs and Finns give the lowest score of 4,0. The standard deviation of 0,8 indicates moderate variation, reflecting some differences in opinions.

Public speaking (OM 4,0) is rated as very important in all countries, with mean scores ranging from 3,7 to 4,2. Swiss and Belgian respondents rate it the highest at 4,2, followed by Czechs, Greeks, and Ukrainians (all 3,9). Finns give the lowest mean score of 3,7. The standard deviation of 0,8 indicates moderate variation, showing differing views on its importance.

Open access publications (OM 3,9) are considered very important in all countries, with mean scores ranging from 3,7–4,2. Finnish and Swiss respondents give the highest scores (both 4,2), followed by Ukrainians (3,9), and Belgians (3,8). Greeks and Czechs rate it the lowest at 3,7. The standard deviation of 0,9 indicates moderate variation, showing some differences in opinions. Besides differences between countries, respondents from other organisations (3,3) considered open access publications less important than those from research and higher education institutions (3,9) and companies (3,9).

Publications for the general public (OM 3,8) are considered moderate to very high importance, with mean scores ranging from 3,4–4,1. While Ukrainians (4,1), Swiss (4,0), Czechs (3,9), Belgians (3,8) and Greeks (3,7) consider it as very important, Finns give it a lower rating of moderate importance (3,4). The standard deviation of 0,9 indicates moderate variation, suggesting varied opinions on its importance.

Commercialisation of innovation (OM 3,7) is regarded as moderately important to very important, with mean scores ranging from 3,4–4,1. Czech respondents give the highest score of 4,1, followed by Swiss (4,0), Ukrainians (3,9), Belgians (3,8), and Finns (3,5), all of whom consider it very important. Greek respondents give the lowest score of 3,4, considering it to be moderately important. The standard deviation of 0,9 indicates moderate variation, with some differences between countries.

Policy impact (OM 3,6) is rated as moderately important to very important, with mean scores ranging from 3,1–4,0. Ukrainians give the highest score of 4,0, followed by Belgians and Greeks (both 3,7), and Czechs (3,5), all of whom consider it very important. Swiss (3,2) and Finnis (3,1) rate it lower, as moderately important. The standard deviation of 1,0 indicates moderate variation, reflecting notable differences in responses. Respondents from other organisations (4,0) considered policy impact more important than those from research and higher education institutions (3,6) and companies (3,5).

Audiovisual publications (OM 3,5) are rated as moderately important to very important, with mean scores ranging from 3,2–3,8. Swiss give the highest mean score of 3,8, followed by Belgians (3,7), Czechs and Ukrainians (both 3,5), all of whom consider it very important. Greek (3,3) and Finnish (3,2) respondents rate it lower, as moderately important. The standard deviation of 0,9 indicates moderate variation, suggesting varied views across countries.

Media outreach (OM 3,4) is rated as moderately important to very important, with mean scores ranging from 2,9–3,7. Belgians give the highest mean score of 3,7, closely followed by Czechs and Ukrainians (both 3,6), all of whom

consider it very important. Greeks and Swiss rate it at 3,4, while Finns give the lowest score of 2,9, considering it as moderately important. Thes standard deviation of 0,9 indicates moderate variation, reflecting some differences in opinions.

Social media engagement (OM 3,4) is rated as moderately important to very important, with scores ranging from 2,9 to 3,7. Belgians and Ukrainians give the highest score at 3,7, considering it very important. Greek, Czech (both 3,4), Swiss (3,0) and Finnish (2,9) respondents rate it as moderately important. The standard deviation of 1,0 indicates moderate variation, suggesting notable differences in responses.

5. Summary and Conclusions

5.1 Summary and Key Findings

This research aimed to identify key transversal competences for researchers, particularly in the field of solar energy harvesting, across six European countries – Belgium, the Czech Republic, Finland, Greece, Ukraine, and Switzerland. A total of 155 respondents, including managers, researchers, RDI professionals and support staff from research and higher education institutions, companies and other organisations, participated in an online survey. As a result, seven tentative competence areas were identified: 1) self-management, 2) working with others, 3) logical thinking, 4) creative thinking, 5) project management, 6) research and data management, and 7) dissemination and impact.

All seven competence areas were considered very important with low to moderate variation, suggesting that there is a consensus among respondents, albeit with some differences in their opinions across countries. There is a notable consistency in the perceived importance of all the competence areas, with overall mean scores ranging from 3,8 to 4,3. Respondents rated each competence area from highest to lowest as follows: logical thinking 4,3 creative thinking 4,2; self-management 4,1; working with others 4,1; research and data management 4,1; project management 3,9; and dissemination and impact 3,8. This suggests that they were generally considered to be very important. (Figure 8)

Logical and creative thinking were considered the most highly valued competence areas by respondents in all countries, with overall mean scores of 4,3 and 4,2, respectively. These competences received consistently high scores across countries, with mostly low variations in emphasis (SD 0,6–0,8). Belgian, Czechs and Ukrainians gave the highest score of 4,3 for logical thinking, while Swiss rated it the lowest at 3,9. Ukrainian and Swiss respondents in turn put relatively highest emphasis on creative thinking (both 4,3), whereas Greeks gave the lowest (4,1).
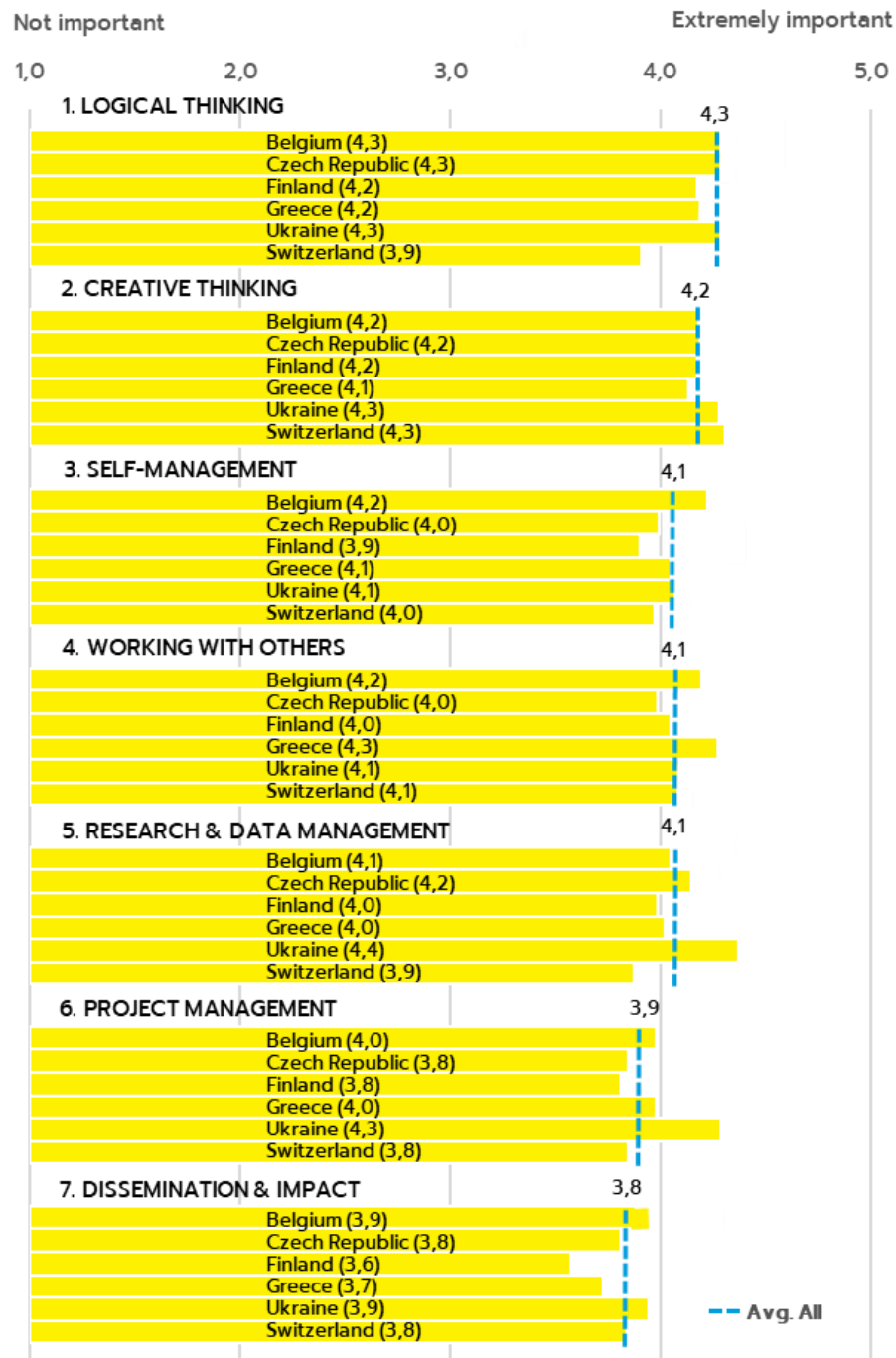
Figure 8. Summary of the results

Self-management, working with others, and research & data management were considered equally important, with an overall mean score of 4,1 and low to moderate variation (SD 0,6–0,9), reflecting a consensus on their importance among respondents. Belgian respondents gave self-management the highest score of 4,2, while Finnish respondents rated it the lowest at 3,9, Working with others also received consistently high scores across all countries, with Greek respondents giving it the highest score of 4,3, while Czechs and Finns rated it the lowest at 4,0. In terms of research & data management, Ukrainians rated it the highest at 4,4, while Swiss and Finnish respondents gave it the lowest score of 4,0. Despite some differences in ratings, the importance of these competence areas are generally recognised in all countries.

Project management (3,9) and dissemination & impact (3,8) received comparatively less emphasis and more variation (SD 0,8–1,0) in ratings than other competence areas. The results suggests that while these competence areas are considered very important, there is a slightly lower priority and less consensus among respondents compared to other competence areas. Project management was rated highest by Ukrainians (4,3), while respondents from Switzerland, Finland and the Czech Republic gave it the lowest score (3,8). Dissemination & impact, in turn, received the highest score of 3,9 from Ukrainian and Belgian respondents, while Finns gave the lowest score of 3,6.

In conclusion, the results show a balanced emphasis on both soft skills (i.e., self-management, working with others, logical and creative thinking) and hard skills (i.e., project management, research and data management, dissemination and impact), with a slight preference for soft skills. All seven areas were considered to be very important transversal competences for researchers, with a consensus among respondents, although there were some slight differences in ratings between countries.

In addition, the organisational background of respondents appears to influence their perceptions of the importance of specific sub-competences, such as work-life balance and stress management (self-management); equality and

diversity and networking (working with others); situational awareness (logical thinking); funding acquisition, scheduling, progress monitoring & reporting (project management); data storage, data privacy, ethical considerations (research & data management); open access publications and policy impact (dissemination & impact). This may reflect differences in priorities, objectives, and operational practices of working environments within their respective sectors.

THE KEY FINDINGS

1. All seven competence areas were considered very important with low to moderate variation, suggesting that there is a consensus among respondents, albeit with some differences in their opinions between countries and different organisational backgrounds.

2. Logical and creative thinking were considered the most highly valued competence areas by respondents in all countries.

3. Self-management, working with others, and research & data management were all considered equally important, receiving the same overall mean score.

4. Project management and dissemination & impact were rated comparatively lower than other competence areas, with more variation in responses, indicating a slightly lower priority among respondents.

5.2 Practical Implications

The results can be used to support the professional and career development of young researchers and innovators, and to raise awareness of their transversal competences, for example in following ways:

- **Integration into HEI curricula:** Integrating transversal competences into higher education curricula can help to prepare students for the diverse demands of the work life, enhance their employability and their ability to make a meaningful contribution to society. This could involve, for example, integrating modules or courses on creative thinking, self-management, and working with others into existing programmes.

- **Development of a transversal competence framework for researchers:** The results of the survey can serve as a basis for the development of a transversal competence framework for researchers in the Approach project. Integrating the survey results with the interviews conducted in the project can help to develop a more holistic understanding of the transversal competences needed by researchers, particularly in the field of solar energy harvesting.

- **Provision of tailored post-academic training:** By addressing the identified competence development areas through targeted training, young researchers and innovators can be supported in their professional and career development and strengthened in their ability to work effectively across sectors. Here are some suggestions for what training could include for each competence area:

    - Logical thinking training could focus on advanced problem-solving techniques, critical thinking and decision making under uncertainty.

    - Creative thinking training could emphasise techniques to foster creativity, such as brainstorming, lateral thinking exercises and techniques to overcome creative blocks.

    - Self-management training could include setting and achieving goals, time management, stress management, and strategies for emotional regulation and maintaining a work-life balance.

    - Working with others training could focus on effective communication, conflict resolution, teamwork, leadership, and cultural sensitivity.

- Project management training could include project planning, re-source allocation, risk management, and monitoring and evaluation techniques.

- Dissemination and impact training could focus on strategies for effective dissemination of research results, engaging with stakeholders, measuring and maximising research impact, commercialisation of innovation, and understanding other pathways to impact.

5.3 Limitations of the Study

Although this study can provide valuable insights into researchers' transversal competences, it has some limitations. The first and most important of these is the small and uneven sample size, which may limit the generalisability of the findings and lead to a bias in the results, reflecting a disproportionate influence of one perspective over another. Secondly, the survey was conducted specifically in the solar energy harvesting and its related fields, which may limit the applicability of the results to other disciplines. However, this narrow focus was chosen due to the objectives and target groups of the APPROACH project. Thirdly, the competence areas and sub-competences, although partly derived from established frameworks and literature review, require further testing and validation to ensure accuracy and applicability.

These limitations highlight the need for further research with larger and more balanced samples. Future research could use both quantitative and qualitative methods to explore, how and why the perceived importance of transversal competences varies in different contexts, such as institutional, sectoral, and cultural – and to interpret the underlying reasons for different perceptions in more detail.

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