D3.2 *Analysis report of geographical gaps & student mobility characteristics*

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Abstract

This report, *D3.2 Analysis of Geographical Gaps and Student Mobility Characteristics* evaluates space-related education across the EU-27 and the UK, focusing on geographical disparities and student mobility. Based on desktop research, ASTRAIOS outputs, LinkedIn Talent Insights, and surveys, it highlights the concentration of space education programmes in Western Europe, especially in France, Germany, and the UK, while Eastern and Southern Europe remain underrepresented. This imbalance drives brain drain as students move to established hubs. Despite mobility programmes like ERASMUS, barriers such as language, finances, and limited opportunities persist. Student mobility is influenced by curriculum appeal, economics, and culture. To address these challenges, targeted recommendations are planned to be further developed within the ASTRAIOS project.

Keywords

Space Education, Geographical Coverage, Student Mobility, ERASMUS, Underrepresented Countries, Europe

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1. INTRODUCTION

Background and Context

The space sector plays a critical role in the European economy, both as a high-tech industry and as a strategic asset. According to the 2023 Eurospace[1], despite facing challenges, the European space manufacturing industry achieved final sales worth €8.2 billion in 2022, although this represented a 4% decline from the previous year. The industry is experiencing structural slowdowns in certain segments, notably in the commercial satellite and launcher markets, and faces competitive pressures from global players such as SpaceX.

However, the employment figures tell a more positive story, with the European sector employing more than 57,000 people in 2022[2], an 8% increase from the previous year. This growth is largely driven by new entrants in the space sector, particularly startups, which are contributing to an increase in workforce numbers, though not yet significantly impacting overall productivity or sales. The report also underscores the significance of institutional programmes in sustaining the European space sector, with steady demand from government programmes across Europe. Nevertheless, the commercial market is struggling, particularly in areas like geostationary satellites (GEO) and launch services, which are under pressure from lower demand and competitive pricing from international competitors. Furthermore, the European space industry is a net contributor to the European economy, consistently providing a trade surplus of approximately $900 million annually over the past decade. European exports of space systems and launch services, though challenged, remain significant in contributing to the trade balance.

Overall, the space sector remains a vital part of the European economy, despite facing market fluctuations and competition. Its strategic importance is highlighted by its contribution to high-tech manufacturing, employment growth, and its positive trade balance. However, continued support and innovation are needed to maintain its global competitiveness, especially in the commercial space market, in addition to the significant role of the educational system in producing a qualified workforce that satisfies the needs of the European space market.

Trying to further understand the role that education generally and student mobility specifically play on the space sector, the European Space Policy Institute (ESPI) report[3], dated March 2022, on space education, highlights several key roles that education and student mobility play in supporting growth and innovation in the European space sector. These significantly contribute to growth and innovation in the space sector by training specialized professionals, promoting multidisciplinary collaboration, and fostering entrepreneurship and international cooperation.

The ESPI report on space education also provides detailed information about student mobility within the space education sector in the EU. It highlights that space education in Europe offers a wide variety of international opportunities, reflecting the broader internationalization of European higher education.

[1] Press Release F&F 2023 FINAL RELEASE V2
[2] Press Release F&F 2023 FINAL RELEASE V2
[3] Space Education in Europe - ESPI

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The ASTRAIOS Project and Task 3200

ASTRAIOS – Analysis of Skills, Training, Research, And Innovation Opportunities in Space – is a Horizon Europe Coordination and Support Action (CSA) that holds significant potential to generate key insights, recommendations, and findings that could benefit a wide array of stakeholders across Europe's space sector. By addressing various stakeholders from different levels, the project aims to provide valuable information that will shape the future of space education and workforce alignment in Europe.

One of the primary objectives of ASTRAIOS is to deliver a comprehensive understanding of the current and future landscape of space curricula and courses offered across the EU-27 and UK. Through this effort, the project will assess the needs of the European space industry and work towards improving the alignment between educational offerings and the skills required by the evolving space sector. This alignment is crucial for fostering innovation and enhancing the EU's competitiveness in the global space industry.

For these ambitious goals to be effectively achieved, ASTRAIOS operates through a series of interlinked work packages (WP). Figure 1 elaborates on the project workplan and the workflow starting with Status-Quo Analysis (WP1000), followed by Trends and Challenges (WP2000), then Gap Analysis and Recommendations (WP3000) leading to Initiatives that will pinpoint keyways forward.

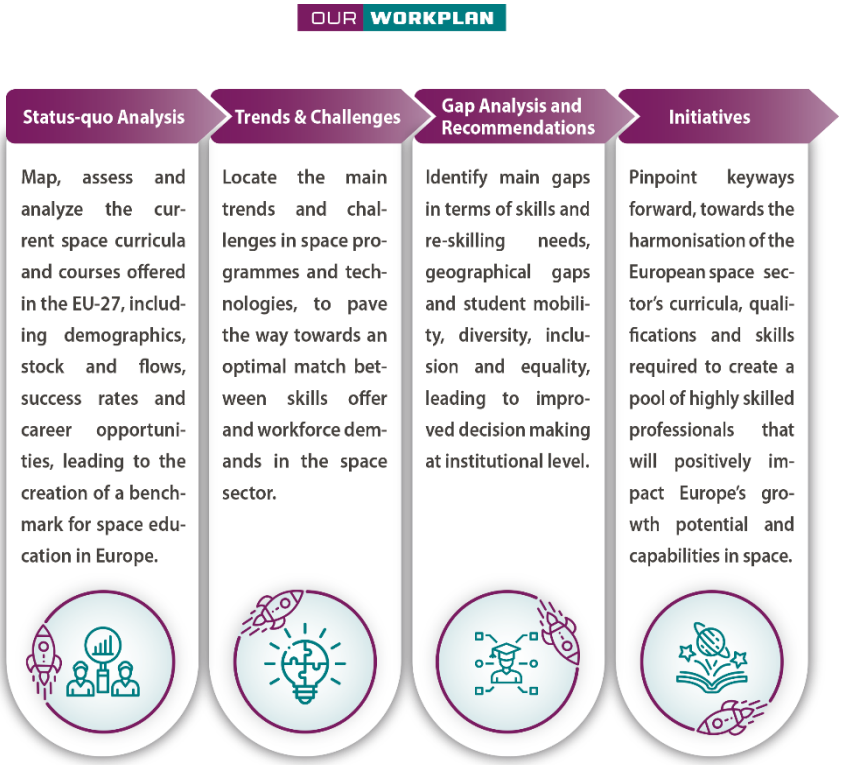

Figure 1: ASTRAIOS Workplan

Specifically, WP3000 focuses on identifying gaps that hinder the development of the European space industry. It aims to offer actionable recommendations and support for pilot programmes, initiatives, and existing working groups both within and outside the EU-27 and UK. By analyzing data from WP1000 and WP2000, WP3000 will provide socio-demographic insights into space education and issue recommendations to policymakers at both the EU and national levels, as well as to educational institutions.

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The report at hand forms the deliverable related to the mapping and analysis of geographical gaps and mobility of students within the 27 EU countries and the United Kingdom (UK) – Deliverable D3.2.

Following this introductory section, the present document sets the background and context of the analysis, followed by presenting its objectives and scope. The approach to implement the analysis is elaborated and a detailed analysis of the different sources of information and findings is ensured.

Scope and Objectives

This report analyses two parallel phenomena 1) Geographical gaps and 2) Student mobility. It focuses to better understanding, identifying, and analysing the current status, and provides insights into potential strategies for bridging existing gaps within the EU27 and UK space sector.

Drawing from the findings of WP1000 and WP2000, this report aims to:

- **Identify underrepresented countries or regions in the European space education system.**
- **Evaluate the potential impact of these geographical gaps on workforce demand, including issues like brain drain or brain gain.**
- **Assess patterns in student mobility, recognizing that mobility programmes offer students opportunities to acquire marketable skills and gain practical job experience in the global economy.**
- **Analyse key mobility and immobility trends, with a focus on factors such as attractive curricula, location, economic considerations, and cultural aspects within the EU-27.**

As the ASTRAIOS project mandates, this report analyses the space education student mobility and geographical coverage within the EU27 and the UK.

Educational institutions offering university-level education (undergraduate, Master, and PhD levels) within these countries are the centre of the analysis in addition to existing mobility programmes within and between these countries.

Section 2 provides further elaboration on the methodology and data collection process.

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2. METHODOLOGY

To complete the analysis, various sources of information were considered, including desktop research, by reviewing and confirming existing publications and information on related topics. These included published reports, articles, and press releases from European bodies, statistics outlets, and publications by other related projects.

Desktop research data used for analysis date back to 2021, and the timeframe of the ASTRAIOS-generated data covers the project's timelines since its start in 2023.

Information gathered by the ASTRAIOS consortium is the culmination of the work done within the various work packages of the project, since the project start.

The main analysis is focused on **ASTRAIOS-produced information and data** by firstly reviewing and analysing produced information and outputs in WP1000, WP2000 and WP3000 and secondly by implementing surveys to collect data directly from the target audience.

In the following sections, the following outputs and data are analysed in relation to student mobility trends and geographical coverage of offered curricula:

1- **ASTRAIOS Web-Catalogue (refer to deliverable 1.1)**

2- **ASTRAIOS EU-27 and UK Factsheets on Space Skills and Workforce 2023 (D1.3)**

3- **Further collection of data and analysis based on D1.3 through LinkedIn Talent Insights on education and location movement.**

4- **Existing Mobility Programmes – ERASMUS, and ERASMUS+**

5- **UK Focus – UKSEDS Survey**

6- **Two surveys implemented during 2024 which included targeted questions on career t mobility patterns.**

   a. **ASTRAIOS Survey on Mobility and Soft Skills (EUSurvey - Survey)**

   b. **ASTRAIOS Survey on Career Paths (EUSurvey - Survey)**

The ASTRAIOS consortium partners prepared both survey questionnaires after discussions and considerations on the main information points intended to be identified from these surveys. Mainly, combining the Mobility (WP3000) and Soft Skills (WP2000) questionnaires was agreed upon to reduce the number of open surveys during the same period and so as to not overburden the target group with several survey requests. The target survey fillers were participants of significant space events, conferences, workshops and international congresses. These events were identified as the most appropriate platforms for having these surveys filled out due to their prominence, in addition to attracting a wide range of space professionals.

Moreover, the formulation and write-up of the questions were strategically planned considering the psychological and valued time of the audience while attending events. As the survey on Mobility and Soft Skills tackles two distinct topics, it was decided to implement a longer survey within this one survey to help with correlated analysis of the questionnaire and use it mainly to analyse soft skills and mobility for a future task within WP2000. Combining this survey and launching it as one has served to be useful and

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successful, as the survey first starts with the general mobility questions and then delves into the specific questions related to soft skills.

The ASTRAIOS Survey on Career Paths was set up to provide quantitative data for analyses of career paths, including movement in/out of sector, career breaks, and geographic mobility. It is a much shorter survey to be completed in less than 10 minutes during a rapid encounter at a space event.

QR codes were created and circulated for both surveys to help reach out to as many potential survey fillers as possible and that can be easily filled via a desktop or a tablet during the various events where the project team disseminated the surveys.

It is worth noting that for the implementation of the Survey on Mobility and Soft Skills, printed paper copies of the surveys were distributed at the various events. This has immensely helped secure a higher response rate to this survey than the Career Paths survey. Experience has shown that handing out physical surveys to fill has secured higher response rates compared to showing online links or QR codes.

Collected data from both surveys were exported to excel and analysed.

The survey links provide the reader with the ASTRAIOS project information and visual identity, disclaimer and data protection statements.

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3. ANALYSIS

3.1 Desktop Background Research Analysis

Geographical Gaps

In reference to the Space Education in Europe report published by the ESPI in 2022, there are several geographical gaps in access to space education. Countries like Estonia, Latvia, and Bulgaria have fewer institutions offering specialized programmes in Bachelor and Master levels, and the majority of available programmes are concentrated in Western Europe. This disparity might reflect a need for improved access to specialized education and international opportunities in these areas.

While these are the geographic gaps revealed within the ESPI report, when reviewing the distribution of Space Generation Advisory Council (SGAC) Members[4], we can also notice similar trends and results to the ones identified in the ESPI report, included there.

The database analysis within the 2021 SGAC Membership Report covered 163 countries. The top ten countries by member count were India: 1,992 members, United States: 1,620 members, **Italy: 595 members**, Nigeria: 561 members, **France: 537 members**, **United Kingdom: 519 members**, Colombia: 492 members, Mexico: 407 members, **Spain: 388 members**, and Australia: 353 members. This reveals that 3 European countries are within the top 10 countries by count, in addition to the United Kingdom which is now an associated country with Europe.

In addition to national distribution, members were categorized by six major regions: Asia-Pacific: 26.4%, Europe: 26.2%, North, Central America, and the Caribbean: 19.4%, Africa: 14.9%, South America: 7.2%, Middle East: 5.9%.

The survey analysis within this SGAC report also shows that the regional distribution of survey respondents aligned closely with the database distribution, suggesting SGAC's regional representation efforts are effective and reflective of its overall membership. The survey data reaffirms SGAC's commitment to inclusivity across these regions.

On the other hand, the geographical distribution of scholarship awardees varies yearly, influenced by sponsorship and partnership dynamics. SGAC aims for balanced regional representation, though this is subject to availability and sponsor requirements. This data underscores SGAC's global reach and its ongoing focus on regional inclusivity across its programmes.

Reference to the same SGAC membership report of 2021, 26.2% of members are based in Europe and the region has a robust presence in SGAC, nearly matching the Asia-Pacific's slightly higher representation of 26.4%. This strong European presence indicates that SGAC effectively engages with young professionals and students across Europe.

However, there is no explicit breakdown by individual European countries in the report, so any potential geographical gaps within the EU are not directly identifiable. Without specific intra-European data, gaps within the EU cannot be confirmed from this report.

The consortium also paid special attention to researching existing related projects and their outcomes for this analysis. For this, the STRARS*EU report on the existing curricula and courses[5] has drawn the attention of the consortium when researching the topic of geographical distribution and gaps in space education in Europe.

[4] Space Generation Advisory Council. (2022). *Membership Report 2021*. Vienna, Austria: Space Generation Advisory Council. Retrieved from Space Generation Advisory Council website: https://spacegeneration.org

[5] The report is not publicly available

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The said report by the STARS*EU consortium in 2022, examines the geographical distribution and gaps within Europe's space education sector and includes some critical insights, such as:

1- **Distribution of Space Education Programmes:** Space education programmes are concentrated in a few key countries such as France, Germany, Italy, the United Kingdom, Netherlands, and Spain. These nations host many specialized programmes across various domains, like engineering, space sciences, and Earth observation. This concentration indicates a gap, as many Eastern European countries and smaller EU nations have limited or no access to dedicated space education, which impacts student mobility and inclusivity within the EU +direct correlation with a) ESA centre and b) national space agency (differentiating between research active, e.g, DLR and CNES, vs admin, e.g., UKSA).

2- **Accessibility and Language Barriers:** Programmes taught in English are prevalent in larger EU countries, making them accessible to a wider range of European and international students. However, courses conducted in local languages (e.g., in Poland and Italy) may limit access for international students, contributing to immobility.

3- **Regional Gaps and Imbalance:** Countries with emerging space sectors, especially in Eastern Europe and parts of Southern Europe, lack substantial offerings in space-related education, leading to regional skill disparities. This gap often compels students from these areas to relocate to other European nations with more developed space programmes, indicating limited local education opportunities.

While the European space education landscape is extensive and fosters some mobility, particularly in well-established programmes in aerospace engineering, there remain accessibility challenges. These relate to language, funding, and the uneven distribution of programmes.

Student mobility

In reference to the SGAC membership report 2021, patterns that could relate to student mobility and the influence of mobility programmes in certain regions are indirectly reflected, though it doesn't provide direct data on mobility programmes or their impact, and here are some comprehensions that can be inferred:

1- **High membership in countries with strong mobility programmes:** Countries like India, the United States, Italy, France, and Germany have high SGAC membership. This may correlate with strong academic exchange programmes, such as Erasmus+ in Europe, or other regional and international mobility initiatives that promote cross-border education in space-related fields. For example, Erasmus+ has boosted general mobility and collaboration among European universities, which may contribute to the high European representation in SGAC.

2- **Regional representation and potential mobility influence:** The strong presence in Asia-Pacific (26.4%) and Europe (26.2%) suggests robust academic and professional opportunities in these regions, which may encourage international mobility. European countries, through Erasmus+ and national scholarship programmes, likely facilitate cross-border networking and involvement in organizations like SGAC.

3- **Patterns reflecting emerging mobility opportunities:** SGAC's substantial membership from countries like Nigeria and Colombia hints at increasing mobility options or growth in educational and professional exchange in regions like Africa and Latin America, although these are not yet as structured as European or American programmes. The data imply potential opportunities for SGAC to support or align with these developing mobility trends.

In sum, while the report doesn't explicitly link membership to specific mobility programmes, the high representation in countries and regions with established academic and professional exchange programmes suggests that student mobility likely plays a role in shaping SGAC's geographical membership patterns.

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The ESPI report on space education also provides detailed information about student mobility within the space education sector in the EU. It highlights that space education in Europe offers a wide range of international opportunities, reflecting the broader internationalization of European higher education. The analysis provides several insights on mobility and immobility trends within European space education, though not explicitly tied to specific mobility programmes like Erasmus. Key factors are as follows:

1. **Prevalence of international study options:**
   - Many space-related programmes in Europe, particularly at the master's level, are offered in English, allowing non-native speakers to participate, especially in non-English-speaking countries like Germany, France, and the Netherlands.
   - Mobility-friendly initiatives, such as dual study programmes in Germany, which combine classroom learning with industry experience, further support student mobility within Europe
2. **Country-level variation in mobility:** France, Germany, Italy, Netherlands, and the UK lead in offering a wide variety of space-related educational programmes in English, creating major hubs in Paris, Toulouse, and London. Countries like Spain and Italy also host multiple programmes but with less emphasis on English-language instruction and fewer dual degrees, which may limit accessibility for international students.
3. **Internships and industry collaboration:** The report highlights that internships and industry partnerships are more common in programmes related to aerospace engineering and multidisciplinary studies. This aligns with mobility trends as these programmes often involve cross-border partnerships and international internships, encouraging students to gain experience outside their home countries
4. **Immobility factors and challenges:**
   - The juridical, economic, and social sciences space-related programmes are less represented and are mostly taught in the national language, which potentially creates mobility barriers for international students interested in these fields.
   - The cost of education plays a role in immobility, with limited financial aid reported for space-related programmes. Only 21% of students received scholarships, primarily from their home country or government, which may hinder cross-border student movement.

A review of the STARS*EU Report Student Mobility and Immobility Trends and the survey notes that well-established space education hubs in Western Europe attract international students due to robust networks, advanced resources, and established industry ties. Programmes aligned with EU-funded mobility schemes (like Erasmus) enhance movement within the EU but primarily benefit countries with existing, well-developed infrastructure in space education. Students from countries with fewer space programmes experience immobility due to limited national support and the high cost of studying abroad. While scholarships exist, they are often limited and insufficient to support widespread mobility across the EU. The report suggests expanding regional access to space education, particularly in underrepresented areas, by investing in specialized programmes and leveraging partnerships with established institutions. This approach could reduce immobility, support regional skill-building, and strengthen the overall competitiveness of the EU space sector.

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3.2 ASTRAIOS Produced Data Analysis

3.2.1 Web-Catalogue on space-related curricula and courses offered in EU-27 & UK in 2023

During the first year of the project implementation, specifically within WP1000, a Structured data set of Higher Education Institution (HEIs) and other institutions/organizations and offered space-relevant curricula/courses was curated. To complete this, a thorough analysis of the space-related educational programmes and their courses at the Bachelor, MSc, PhD, and continuing education (CE) levels was completed. Courses and educational standards of 132 Degree Programmes (DPs) at Bachelor (25 DPs) and Master (107 DPs) levels, 19 PhD programmes, and 60 CE courses were selected and analysed. Thematic diversity, space sectors, and geographic coverage were the main criteria used to select the DPs and courses. Gathered DPs have been mapped across 28 knowledge domains (KDs) and 105 knowledge areas (KAs) identified in this report and across the different segments of the value chain of space activities relevant to the three space sectors: upstream, midstream, and downstream.

The diversity of KDs and KAs highlights the interdisciplinary nature of the space sector education programmes that cover a wide range of scientific knowledge, and technological skills. Most of the analyzed Bachelor DPs are related to the upstream sector, whereas the Master and PhD DPs are equally related to the downstream and upstream sectors. Some of the gathered DPs focus on understanding Earth's environment, atmospheric monitoring, and climate change using space-related technologies. Yet, the lower representation of these KDs suggests a potential need for increased emphasis on these areas in the context of space-related educational programmes. Similarly, the low occurrences of space safety and space traffic management KAs suggest that space systems engineering KD receives less attention in the gathered space education at the Master level. Some of the analyzed DPs offer a diverse range of elective courses to develop transversal skills (leadership, entrepreneurship, communication, or presentation skills) and include internships either as compulsory or optional activities. The PhD programmes analysed share a common emphasis on developing not only discipline-related skills but also transversal skills such as effective communication, teamwork, and project management skills.

This activity successfully resulted in the production of the ASTRIAOS Web-Catalogue on **space-related curricula and courses offered in EU-27 & UK in 2023.** Further details about the web catalogue accumulation, formulation and offered features are available in the ASTRAIOS deliverable D1.1: Structured data set of Higher Education Institution (HEIs) and other institutions/organizations and offered space-relevant curricula/courses.

The following paragraphs provide a detailed mapping and analysis focused on the main objectives of this report.

1- **Mapping geographical distribution of offered curricula**

Main findings

- Countries like the **UK, Netherlands, and France** dominate space-related education offerings.
- Underrepresented countries include **Romania, Portugal, Luxembourg, Bulgaria**, and others from Eastern and Southern Europe.
- **Master-level programmes (80%)** are more prevalent than Bachelor-level programmes (20%).
- Countries such as **Romania, Bulgaria, and Portugal** show fewer DPs related to space education.
- Domains like **Hydrology, Marine Science, and Agricultural Science** are rarely associated with analyzed programmes, indicating gaps in curriculum diversity.

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The analysis highlights that the UK, Netherlands, and France dominate in the availability of degree programmes (DPs) within the European space education landscape. Smaller EU countries in size and population (e.g., Eastern European nations like Bulgaria, Poland, and regions in Southern Europe) are less represented, especially in high-demand sectors such as aerospace and downstream fields like Geographic Information Science and Remote Sensing. These gaps could hinder regional talent development and leave countries reliant on external expertise (risk of **brain drain**) and similarly, limited programmes in Southern and Eastern Europe could exacerbate skill shortages in these regions. This imbalance reflects limited space-related educational resources and opportunities in certain countries, potentially leaving their talent pools underdeveloped in a field crucial to modern technology and security.

2- Student mobility and immobility characteristics

Main findings

- **Mobility Challenge 1:** Lack of scholarships for Bachelor programmes (only 36% provide them).
- **Mobility Challenge 2:** Limited availability of joint programmes (8% for Bachelor, 19% for Master).

Mobility programmes within Europe offer students from underrepresented countries the chance to study in advanced environments, gaining marketable skills in sectors like aerospace engineering, Geographic Information Science, and Remote Sensing. The emphasis on these fields allows students to access specialized knowledge, internships, and practical experience unavailable in their home countries, making them highly attractive in the global economy. However, the mobility of students from less represented countries may lead to retention issues as they pursue jobs in host countries rather than returning home, perpetuating the skill deficit in underrepresented regions.

3- Key mobility and immobility trends: factors of curricula, location, economics, and culture

Main findings:

- **Attractive curricula**: Focus on cutting-edge domains like aerospace engineering and remote sensing draws students to programmes in Western Europe.
- **Economic efficiency**: Tuition fee disparities and scholarship availability play a critical role in student decisions.
- **Cultural aspects**: Language barriers and limited joint programmes restrict mobility for students from non-English-speaking countries.

It is noticeable that programmes offering in-demand knowledge domains (KDs) and knowledge areas (KAs) like aerospace engineering, environmental sciences, and data science tend to attract students globally, especially to countries with established programmes. In contrast, countries with limited KDs relevant to space technology see fewer incoming students. When assessing the economic efficiency parameter, it is apparent that higher tuition fees for international students in several countries can deter mobility. However, scholarships and financial aid (available in about 36% of Bachelor's and 53% of Master's programmes) improve accessibility, drawing talent even from economically constrained regions. On the other hand, countries with well-established industries in upstream (e.g., aerospace) and downstream (e.g., Geographic Information

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Science) space sectors provide better professional integration for students, making them popular destinations. Conversely, regions without strong space sectors struggle to attract or retain students interested in these fields. While exploring the web-catalogue, there are several main figures and data we can access and form a better understanding in relation to geographical coverage of offered curricula and student mobility-specific patterns. Figure 2 below is a word cloud generated by the catalogue when the filter is set for offered curricula in the 28 countries (EU27+UK) of the project. The word cloud clearly indicated that the UK has the majority of space related offered curricula with 19 DPs, followed by the Netherlands with 13 DPs, France with 12 and Italy with 10, while Poland with 9 DPs in the 5th place. The less represented countries offering space curricula are Sweden and Romania with 2 DPs each, Slovenia, Lithuania and Croatia with 1 DP each.

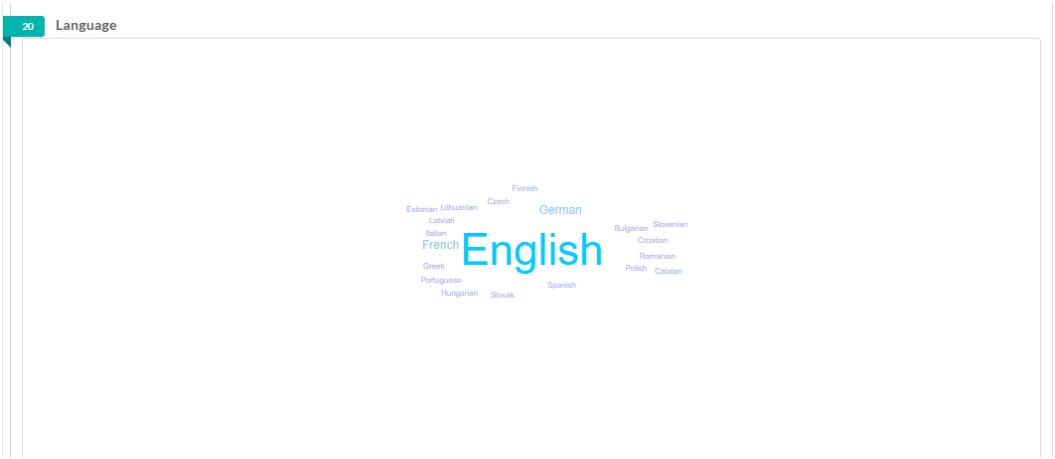

Figure 2: ASTRAIOS Web-Catalogue – Word Cloud of Countries Offering DPs

Language plays a crucial role, with most programmes being taught in English (Figure 3 below), a significant factor in student choice. Nevertheless, some programmes still rely on national languages (e.g. French, German, Spanish, Greek, Italian, Polish, Bulgarian, Portuguese, Czech, Romanian and others), which could limit the attractiveness of certain countries. A word cloud generated on the web catalogue shows that there are DPs taught at the Bachelor and Master's level in **20 different languages** in the EU and UK, from which the majority are instructed in English, followed by French, German, Spanish, Greek, Italian, and Polish. On the other hand, the available 16 PhD programmes in the catalogue are all taught in English.

Figure 3: ASTRAIOS Web-Catalogue – Word Cloud of Educational programmes' language of teaching

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The ASTRAIOS web-catalogue further provides information on tuition fees for EU and UK students for the academic year 2023 for space-related degree programmes across the EU-27 and the UK. These fees pertain to full-time programmes and some universities include details on offered discounts as well. When reviewing the data with a mobility angle, we notice that in the majority of the degree programmes at the bachelor's and Master's levels have no tuition or other costs that may apply for EU and UK students (19) from the 64 DPs which include information about tuition fees for EU and UK students, while there are 17 entries which provide not information. The provided information on the tuition fees shows a wide range with the lowest fees being EUR 226 for a Master of Aeronautics and Astronautics at the Technische Universität Berlin and the highest fees being EUR 27,750 for the BEng Aerospace Engineering at the University of the West of England. When cross-checked with the available information on tuition fees for international students, the lowest fees are at EUR 243 for a Master in earth and planet sciences, environment: fundamentals of remote sensing (FRS) at the Institute de Physique du Globe de Paris (IPGP) and similarly for a Master in Space Science and Technology at the PSL Université Paris, while the highest fees being at EUR 13,200-13,400 for Master of Science in Space Sciences and Astronomy at L-Università ta' Malta (UM), a Bachelor in Environment, Sustainability and Climate Change at the University of Wales Trinity Saint David, and a Master in Aeronautics and Astronautics at Czech Technical University in Prague.

A closer look at the European country-specific tuition fees, we can elaborate on the following:

- **Austria:** Public universities typically charge around €726.72 per semester for non-EU students, while EU students often benefit from waived or minimal fees.
- **Belgium:** Tuition fees vary by community (Flemish, French, German-speaking) and institution, generally ranging from €835 to €4,175 per year for EU students.
- **Bulgaria:** Tuition fees for EU students at public universities range from €300 to €1,500 per year, depending on the programme and institution.
- **Croatia:** Public universities charge tuition fees for EU students, typically between €800 and €2,500 per year, varying by programme and institution.
- **Czech Republic:** EU students studying programmes in the Czech language typically do not pay tuition fees at public universities. Programmes offered in English or other foreign languages may have tuition fees ranging from €1,000 to €15,000 per year.
- **Denmark:** Higher education is free for EU students, whereas non-EU students face tuition fees between €6,000 and €16,000 annually.
- **Estonia:** Tuition fees for EU students at public universities range from €1,600 to €7,500 per year, depending on the programme and institution.
- **Finland:** EU students enjoy free tuition, while non-EU students are charged between €6,000 and €18,000 per year.
- **France:** Public universities charge EU students as low as €170 per year for bachelor's programmes and €243 for master's programmes. Non-EU students face higher fees, approximately €2,770 for bachelor's and €3,770 for master's programes.
- **Germany:** Most public universities do not charge tuition fees for EU students, though a semester contribution of €150 to €300 may apply.
- **Hungary:** Tuition fees for EU students vary depending on the institution and programme, generally ranging from €1,000 to €3,000 per year.

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- **Ireland:** EU students typically pay a student contribution fee capped at €3,000 per year, with no additional tuition fees.
- **Italy:** Tuition fees range from €900 to €4,000 per year for EU students, varying by institution and programme.
- **Latvia:** Public universities charge tuition fees for EU students, typically between €1,500 and €6,000 per year, varying by programme and institution.
- **Lithuania:** Tuition fees for EU students at public universities range from €1,000 to €5,000 per year, depending on the programme and institution.
- **Netherlands:** Statutory tuition fees for EU students are approximately €2,209 per year, while non-EU students may pay between €6,000 and €15,000 annually.
- **Norway:** Public universities offer free education to all students, regardless of nationality, though a small semester fee is required.
- **Poland:** Public universities in Poland often offer free tuition for EU students, while non-EU students may be required to pay fees ranging from €2,000 to €4,000 per year.
- **Romania:** Public universities charge tuition fees for EU students, typically between €500 and €2,000 per year, depending on the programme and institution.
- **Slovakia:** EU students enrolled in programmes taught in Slovak may study for free at public universities. Programmes in other languages may have tuition fees ranging from €1,000 to €5,000 per year.
- **Slovenia:** EU students generally do not pay tuition fees for full-time studies at public universities. Part-time studies and programmes in foreign languages may have associated fees.
- **Spain:** Tuition fees for EU students range from €750 to €2,500 per year, depending on the region and programme.
- **Sweden:** EU students are exempt from tuition fees, whereas non-EU students are charged between €7,500 and €25,500 annually.
- **United Kingdom:** Undergraduate tuition fees for UK and Irish students are set to rise following Brexit. Also, EU students are generally classified as international students and may face higher fees, often exceeding £10,000 per year.

Figures 4 and 5 are tag word clouds generated on the Web catalogue showing the available information in relation to tuition fees for EU and UK students, as well for international students. It is worth noting that the available information on the ASTRAIOS web catalogue is based on the disclosed information publicly available on the official websites of the universities.

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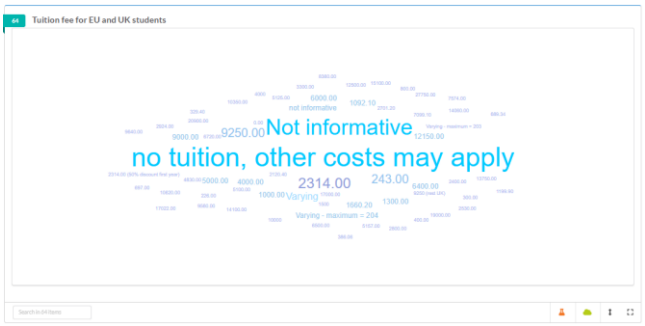

Figure 4: ASTRAIOS Web Catalogue - Tuition fee for EU and UK students

Figure 5: ASTRAIOS Web Catalogue - Tuition fee for EU and UK students

3.2.2 The EU Space Sector Demographics Report and Database

Within WP1000 of the ASTRAIOS project, an **EU Space Sector Demographics Report and Database** was prepared which examined the European space workforce from December 2022 to December 2023. It analyzed over 170,000 LinkedIn profiles from 1,800 companies alongside established industry surveys to provide insights into workforce scale, growth, skills, education, and demographics. The report highlights sector growth, skill trends, gender diversity, educational attainment, and workforce movements, aiming to inform decision-making in policy and education for improved alignment with industry needs.

Key Findings from this report have further been compiled into the useful set of **EU & UK Factsheet on Space Skills & Workforce in 2023** which systematically explore the distribution of space-related curricula across the EU-27 countries and the UK, providing a standing-alone factsheets per EU country and the UK, and also a general factsheet summarizing the overall EU-27 and the UK.

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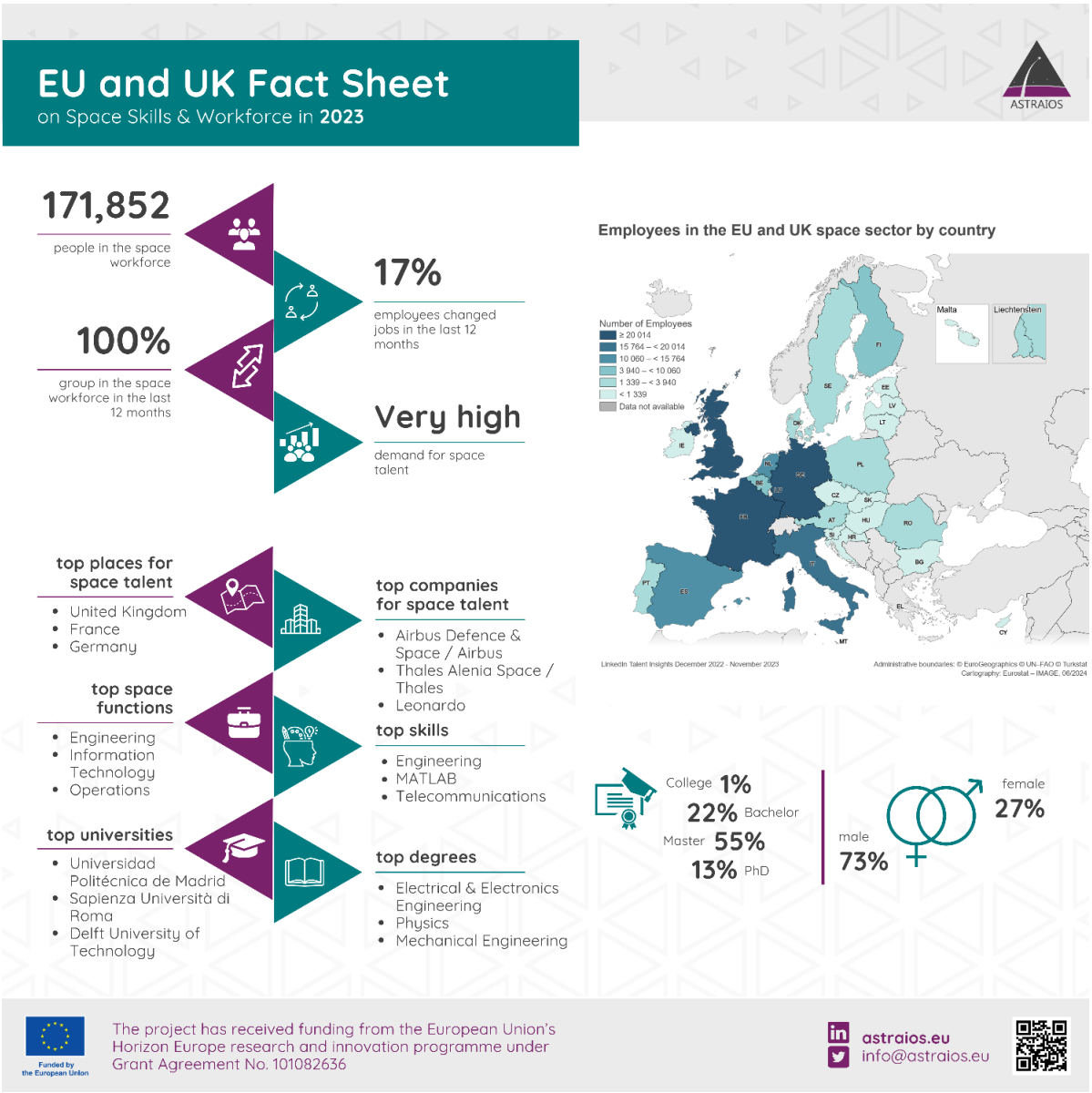

Figure 6: EU & UK Factsheet on Space Skills & Workforce in 2023

The analysis of the general factsheet on EU and UK-level data regarding space skills and workforce development is presented in Table 1. The findings emphasize the need for targeted policies to enhance regional balance in educational offerings, financial incentives to improve access, and cultural and informational initiatives to address barriers to student mobility.

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Table 1: Analysis of the general factsheet on EU and UK-level data

	Geographical gaps	Identifying underrepresented regions	Student mobility and immobility characteristics	Key mobility and immobility trends: factors of curricula, location, economics, and culture
Overall EU and UK	Uneven geographical distribution of educational offerings in space-related disciplines. Larger urban centers, particularly in the UK and more developed EU member states, show a concentration of institutions offering advanced curricula in space sciences and engineering. In contrast, smaller or economically weaker regions in both the UK and EU often lack specialized programmes, indicating a regional imbalance in accessibility to space-related education.	The document identifies several underrepresented regions, particularly in Eastern Europe and rural parts of the UK. The scarcity of institutions providing space-related education in these areas correlates with their lower levels of industrial activity and research infrastructure in the space sector. Addressing these gaps would require targeted investments and policy interventions to encourage educational institutions to develop such curricula in these regions.	Student mobility trends indicate that a significant number of students from underrepresented regions migrate to urban and developed regions to pursue specialized space-related studies. However, economic barriers, lack of awareness, and cultural factors contribute to high immobility rates among students in some regions, particularly in less affluent EU countries and parts of the UK.	The key trends in mobility reflect the influence of economic disparities and the geographic concentration of institutions with advanced curricula. Students from economically weaker regions face challenges such as higher costs of relocation and insufficient financial aid. Culturally, language barriers and the allure of studying in globally recognized institutions also shape mobility decisions, favoring regions with a long-standing reputation in space studies.

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Following the analysis of the EU and UK Factsheets, a thorough look and study of the country-specific factsheets and individual country data was completed, and we can further highlight the following key understandings:

On underrepresentation by country:

- Southern Europe (e.g., Greece, Portugal): Limited space education infrastructure and fewer specialized programmes compared to Western European countries.
- Eastern Europe (e.g., Romania, Bulgaria): These regions show a significant gap in access to advanced space education and technology programmes.

On workforce impact: brain drain and brain gain

- Brain drain:
  - Eastern Europe: Countries like Poland and Hungary experience significant brain drain as professionals migrate to Western Europe for better opportunities.
  - Southern Europe: Similar trends in countries like Italy and Spain, where talent moves to Northern European hubs.
- Brain gain:
  - Western Europe (e.g., Germany, France): These countries attract talent due to established industries, ESA facilities, and funding availability.
  - UK: Post-Brexit, the UK has faced shifts in mobility patterns but continues to be a significant player in brain gain due to its global programmes.

On student mobility patterns:

- High mobility: Germany, France, and the UK see high student inflows due to attractive curricula and funding opportunities.
- Low mobility: Countries like Croatia and Slovakia show lower participation rates, often due to limited institutional ties with major space agencies.

On mobility and immobility trends:

Curricula attractiveness:

- Germany and France lead with specialized and diverse programmes in satellite technology, space robotics, and astrophysics.
- Underrepresented regions often lack the variety and depth needed to attract international students.

Economic factors:

- Higher living costs in Western Europe deter students from lower-income countries unless scholarship programmes are available.
- Eastern European students often seek tuition-free or subsidized education, influencing their destination choices.

Cultural aspects:

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- English-taught programmes in the Netherlands and Scandinavian countries attract broader international participation.
- Language barriers in countries like Italy and Spain reduce their appeal to non-native speakers.

These Observations help us infer that the geographical disparities in the European space education system highlight the need for targeted strategies, such as expanding funding and partnerships in underrepresented regions to reduce brain drain, enhancing mobility programme accessibility for economically weaker regions, and developing more unified language of taught programmes in underrepresented countries to attract a diverse student base.

3.2.3 LinkedIn Talent Insights Analysis on Education and Movement

LinkedIn Talent Insights is a platform which allows someone to explore information for large groups of LinkedIn users, for example: company, location, skills, educational background, roles, etc. In work package 1000 we analysed the LinkedIn profiles of 170,000 people likely to be working in the space sector in Europe. We have further explored LinkedIn Talent Insights data by setting parameters to look at everyone in our LinkedIn dataset compiled in WP1000, who graduated within the last 2 years.

LinkedIn data has some limitations, such as the overrepresentation of some groups (e.g. men, people under 35, those with a university background), and underrepresentation of others (e.g. women, those working in Eastern Europe). However, it offers valuable insights on broad mobility trends. Further discussion about the strengths and limitations of LinkedIn Talent Insights can be found in the report EU Space Sector Demographics Database.

The data that we extracted and related provides information on which country the recent graduates were in 12 months ago, and what country they are in now, mainly checking on the mobility of fresh graduates. Sankey diagrams have been created for 26 EU countries and the UK to help the analysis showing the flow of movement and brain gain/drain trends. A Sankey Diagram is missing for Malta due to the lack of data availability. The diagram presented in Figure 7 shows where the graduates were one year ago, and currently residing in France, showing where they moved from after graduation to either grab attractive job opportunities or continue further education. The Full set of Sankey Diagrams are available in Appendix D. The diagrams not only show intra-European mobility but also provide a deeper understanding about **international brain gain and drain dynamics** within the space sector. Key observations on flows and their contextual implications for international mobility include:

1- Countries with strong brain gain (major attractors)

These countries experience high inflows of talent relative to their outflows, highlighting their ability to attract graduates.

- **France – brain gain analysis**: France attracts the largest share of graduates, making it the most popular destination. Major sources of graduates:
- **Italy**: Significant outflow of Italian graduates to France, indicating stronger opportunities in France's space sector.
- **Spain**: A large proportion of Spanish graduates also move to France.
- **Netherlands, Belgium, and Germany**: France also pulls graduates from countries with relatively balanced space industries, indicating its competitiveness.

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- **Internationally,** France is a major global hub for the space sector, largely due to organizations like the **European Space Agency (ESA)** and **CNES** (National Centre for Space Studies), headquartered in Toulouse.
    - **North Africa (e.g., Morocco, Algeria)**: Proximity and historical ties with Francophone countries make France a natural destination for North African talent.
    - **Asia (India, China)**: India and China have growing space industries, but graduates may move to France to leverage advanced European technology and research.
    - **United States**: Although the US is a competitor, collaboration between NASA and ESA attracts some US graduates to France.

- **Germany – brain gain analysis**: Germany attracts a significant number of graduates from:
    - **Poland**: High inflow of Polish talent to Germany highlights economic disparity.
    - **Romania, Bulgaria, and other Eastern European countries**: Germany draws graduates from these regions, reflecting its industrial and technological appeal.
    - **Southern Europe**: Graduates from Italy and Spain frequently move to Germany, showing similarities with France.
    - **Internationally**, Germany attracts talent due to its leading aerospace companies (e.g. Airbus, OHB SE) and research institutions. International brain gain sources are:
        - **Eastern Europe (Ukraine):** Historical collaboration in space science leads to inflows of Eastern European scientists.
        - **Asia (China, India):** Germany's engineering excellence attracts graduates globally.
        - **Developing Economies (Brazil, South Africa):** Emerging space sectors often collaborate with Germany, leading to talent inflows.

- **United Kingdom – brain gain analysis** Despite Brexit, the UK attracts talent from:
    - **Southern Europe**: Graduates from Spain and Italy move to the UK.
    - **Poland and Romania**: Eastern European countries also send talent to the UK.
    - **Luxembourg and Belgium**: The UK attracts graduates from smaller, neighboring countries as well.
    - **Internationally,** Despite Brexit, the UK remains competitive internationally due to organizations like the **UK Space Agency** and private-sector giants like **Inmarsat**.
        - **Commonwealth countries (India, Australia, Canada)**: Historical ties and language alignment make the UK a key destination.
        - **United States**: Strong collaborations between UK space firms and NASA or private US companies attract some American talent.
        - **Eastern Europe**: Similar to Germany, the UK pulls graduates from this region.

2- **Countries facing brain drain (major sources):** These countries lose more graduates than they attract, indicating weaker domestic opportunities.

- **Italy – brain drain analysis**: Italy experiences significant outflows to:

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- **France**: The largest destination for Italian graduates.
- **Germany and the UK**: Secondary destinations for Italian graduates.

- **Spain – brain drain analysis**: Similar to Italy, Spain loses many graduates to:
  - **France**: A significant portion of Spanish talent moves here.
  - **Germany**: The second most common destination for Spanish graduates.
- **Eastern European countries (Poland, Romania, Bulgaria) – brain drain analysis**: The outflows indicate a stark disparity in space-sector opportunities between Eastern and Western Europe. These countries lose graduates primarily to:
  - **Germany**: The largest destination for talent from Eastern Europe.
  - **France and the UK**: Secondary destinations for Eastern European graduates.

3- **International brain drain:** While the EU has strong mobility within its borders, some countries lose significant talent internationally, reflecting broader global trends.

- **Brain drain to the United States:** The US is a dominant player in the global space sector, housing organizations like **NASA, SpaceX, and Blue Origin**. It draws top talent from across Europe, including:
  - **France and Germany**: These countries often lose high-caliber graduates seeking opportunities in cutting-edge research and private-sector roles in the US.
  - **UK**: The UK's space professionals are likely to move to Silicon Valley or other US hubs due to lucrative opportunities.
  - **Eastern and Southern Europe**: These regions lose talent not only to Western Europe but also to the US, where engineers and researchers seek higher salaries and advanced resources.
  - **Brain Drain to Canada:** It attracts European talent due to Partnerships with ESA (e.g., the Canada-European **Space Cooperation Agreement**) and due to demand for skilled engineers in sectors like satellite communication and space robotics.
- According to the data, **France and Germany** are losing skilled workforce to Canda and contribute skilled professionals to Canada's expanding space industry.
- **Brain drain to Asia (China and India):** some European graduates move to growing space economies like China and India, especially for strategic collaborations or projects (e.g., China's **Belt and Road Initiative** in space technology).
- Countries losing talent to Asia: **Eastern and Southern Europe**: Due to economic disparities, professionals from these regions may explore opportunities in growing Asian economies.

4- **Countries with balanced mobility**

Some countries experience a balance between inflows and outflows, indicating relatively stable mobility.

- **Luxembourg:** It attracts talent from smaller countries like Belgium and Eastern Europe while also losing talent to larger economies like France and Germany. Its niche space sector may explain why it can attract and retain talent at a balanced rate. Luxembourg remains a small but stable hub in the European space ecosystem.
- **Netherlands:** The Netherlands shows both inflows and outflows. Inflows from smaller countries (e.g., Belgium) are balanced by outflows to major players like France and Germany. Its strong academic and

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research landscape ensures a steady exchange of talent and this way it maintains its competitiveness in the space sector.

5- Countries with limited mobility

Some countries exhibit minimal inflows and outflows, suggesting stability or insulation from the broader EU mobility trends.

- **Sweden and Norway:** These countries see little movement of graduates. This may indicate strong domestic retention due to high living standards and attractive opportunities or a smaller pool of graduates overall, and this way these countries prioritize retention of local talent.
- **Switzerland:** Limited movement in and out reflects its smaller population and highly specialized space sector. Switzerland focuses on a stable and self-contained workforce.

Regional Focus: Impact of Brain Drain

International brain drain disproportionately affects certain different European regions. If we take a closer look into **Eastern Europe**, countries like **Poland, Romania, and Bulgaria** not only lose talent to Western Europe but also to the US and Canada, where salaries and resources are more competitive. This talent outflow exacerbates regional inequality and slows the development of local space sectors, making it harder for these countries to build independent capabilities in space technology. On the other hand, in **Southern Europe**, countries like **Italy, Spain, and Greece** suffer from a "double drain," losing talent to both Western Europe and non-European countries, leading a persistent talent outflow, due to limited domestic job opportunities. These countries become reliant on foreign expertise in space initiatives. Taking a closer look at **Western Europe**, it is noticed that **France and Germany**, while benefiting from intra-European mobility, experience talent loss to global players like the US and Canada. The impact of these losses are offset by inflows from less-developed European regions, making the impact less critical. However, competition with the US could hinder Europe's global competitiveness.

Summary of the Emerging Patterns

- **Southern Europe's outflow**: Italy and Spain lose a significant number of graduates, reflecting a broader challenge for Southern European economies to retain space-sector talent.
- **Eastern Europe as a source region**: Countries like Poland, Romania, and Bulgaria act as talent suppliers to Western Europe, reinforcing regional disparities in opportunities.
- **France as a top magnet**: France dominates as the destination of choice for space-sector graduates, benefiting the most from intra-EU mobility.
- **Balanced players**: Countries like the Netherlands and Luxembourg maintain balanced mobility flows, demonstrating competitive space industries despite their smaller size.

The trends captured by the Sankey diagram highlight the dominance of **France, Germany, and the UK** as top destinations for recent graduates, benefiting from **brain gain**, while **Italy, Spain, and Eastern Europe** serve as significant contributors of talent, suffering from **brain drain**. This reinforces the need for underperforming regions to strengthen their space industries to retain talent and reduce disparities across the EU.

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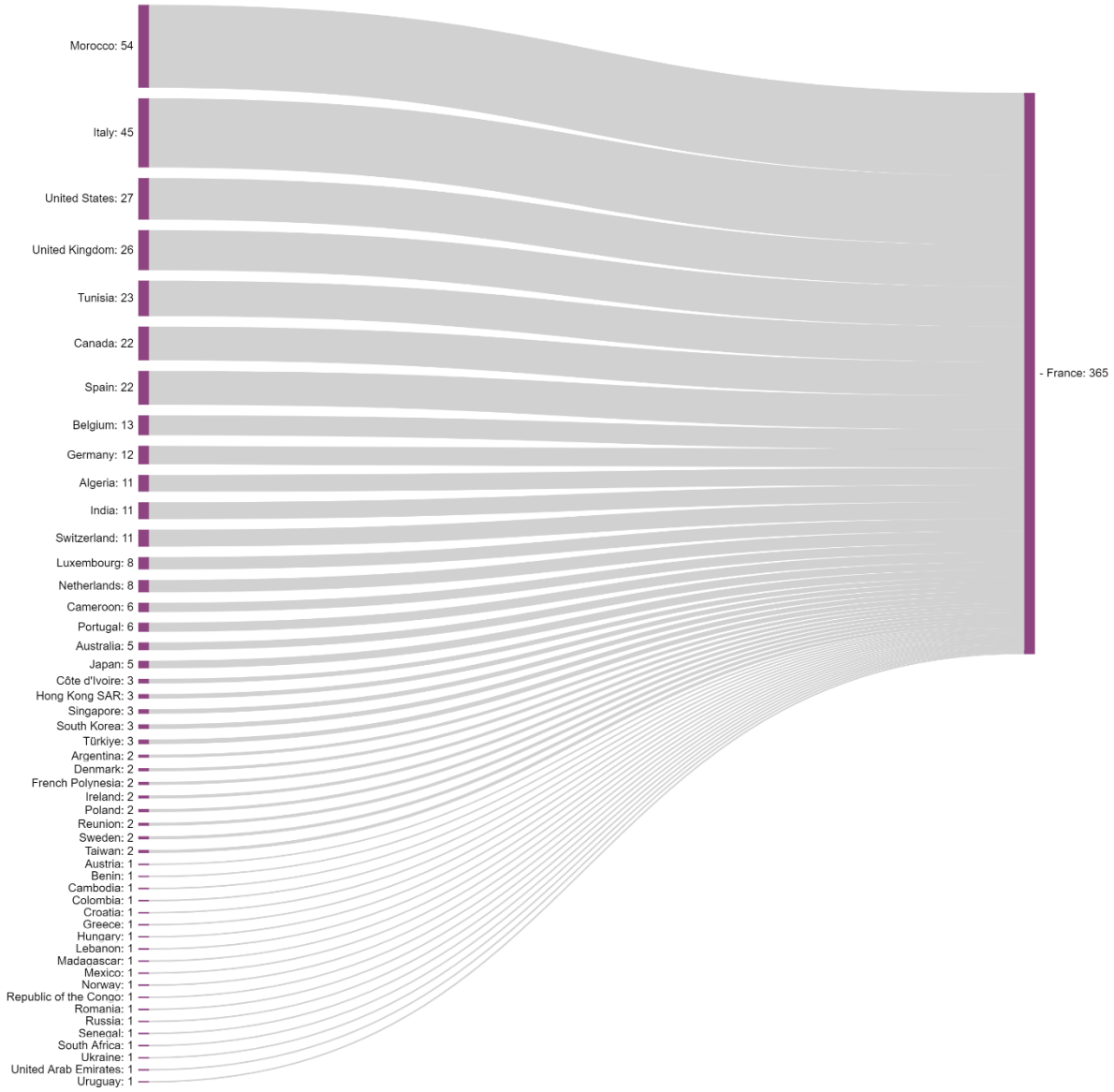

Figure 7: Graduates' Movement during the past two years

When the data was specifically checked for Migration outwards the EU and UK, the analysis also shows further movement patterns within Europe and the UK and from Europe to other continents – Figure 8. The diagram tracks migration flows of recent graduates in the space sector over the last two years. It categorizes destinations into **EU-27 + UK**, where most movements occur within this group, and **North America, Asia, Africa, Other Europe, South America, Oceania, and Antarctica**, representing international destinations. A total of 1,178 graduates remained within the EU + UK, while others with a total of 401 entries in the data migrated to non-EU destinations.

The movement patterns shown in this diagram highlight and reinforce some of the already identified brain drain/gain phenomena in the previous sections. Further analysis for the major eye-catching figures of the outflow movement include:

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1. **Outflows to Asia with 149 graduates,** receives the largest share of EU talent outside Europe, with its growing space industries, particularly in **China**, **India**, and **Japan**, which are increasingly attractive destinations. Movement to Asia likely reflects growing opportunities in emerging Asian markets and partnerships and collaborations with European space programmes. Graduates from France, UK, Germany and a minority of eastern and southern Europe, where domestic opportunities are limited, are contributing to this outflow.
2. **Outflows to North America with 112 graduates,** primarily the **United States** and **Canada** is the **second-largest destination** for EU talent. The United States, with its robust private and public space sector (e.g., **NASA, SpaceX, Blue Origin**), is a major draw. Canada benefits from ESA partnerships and its growing need for skilled professionals in aerospace engineering and satellite technology. Highly skilled professionals from **France (majority), Germany, Italy**, and **Spain** dominate this outflow, seeking advanced research and higher salaries.
3. **Outflows to other Europe (Including Russia and Türkiye) with 82 graduates** reflects strong aerospace industries in these regions. Collaboration between European space agencies and their counterparts in Russia (e.g., Roscosmos) likely drives some of this movement. Graduates from Italy, Germany, UK, and some eastern European countries find regional opportunities with non-EU neighbors more accessible.
4. **Outflows to Africa with 33 graduates** remain modest but notable, possibly tied to Collaborative initiatives like ESA's partnerships with African nations and Francophone graduates moving to African countries due to language and cultural ties, with contributors including **France**, **Belgium**, UK and **Spain**, which have historical and economic ties with African nations.
5. **Outflows to South America with 14 graduates,** is the smallest but visible flow to, which may be tied to niche projects or regional collaborations. Brazil, with its developing space programme, is a potential attractor. Graduates from **Spain** and **Portugal**, given linguistic and cultural ties, are contributors.
6. **Outflows to Oceania with 10 graduates** are minimal and likely project-specific and Australia's growing space programme could be a factor. Graduates from countries like France, Italy, Spain and the UK, are the contributors.
7. **Antarctica with 1 graduate** is a very interesting figure to stand at, as this singular outflow may reflect specialized research opportunities in Antarctica, such as satellite ground stations or remote scientific studies. This person has moved to Antarctica from Germany.

Summary of Continental Trends

Asia is emerging as a critical competitor for talent with its rapidly growing space capabilities, while North America continues to exert a strong pull, attracting high-caliber professionals for advanced research and private-sector opportunities. Other European countries outside the EU reflect strong regional collaborations, drawing talent from nearby EU nations, whereas Africa and South America represent smaller but growing destinations, influenced by collaborations and historical ties. Oceania and Antarctica show niche or project-based movement, reflecting specific research or exploration efforts. For the EU, these trends highlight the challenge of talent drain, with increasing competition from Asia and North America for highly skilled space professionals. To mitigate this, the EU can strengthen partnerships with these regions to maintain connections to the outflowing workforce while addressing regional disparities, particularly in Southern and Eastern Europe, to enhance domestic opportunities and reduce outward migration.

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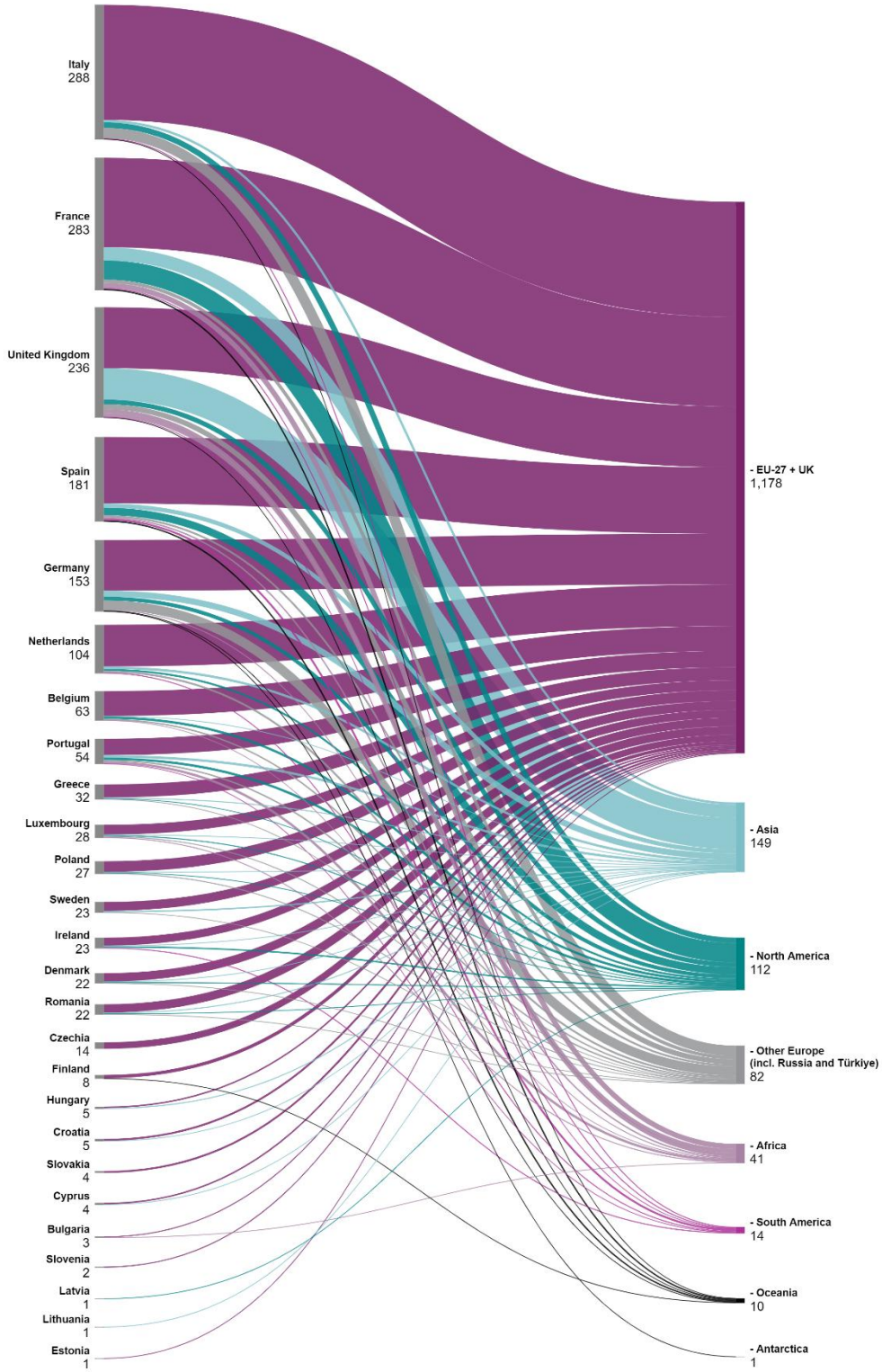

Figure 8: Workforce Migration Outwards Internationally

A third Sankey diagram was generated presenting the talent inflows from various continents to the EU and UK, highlighting the regions and countries within Europe that attract the most workforce from outside the

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continent – Figure 9. A total of **1,236 professionals** are accounted for within the EU and UK with key external sources of talent including **Asia (307), North America (171), Other Europe (135)**, and smaller contributions from **South America (30)** and O**ceania (23)**. Within the EU, **Germany, France, Belgium, and the UK** are once again the top destinations for incoming professionals.

The inflow from Asia is seen to be the largest non-European contributor to the EU's workforce, with **Germany** as the primary European destination, reflecting its strong demand for engineering and technical talent. **France and** the **United Kingdom** also draw talent from Asia, likely due to robust space-sector partnerships and research opportunities.

North America with 171 inflows is the second-largest external contributor. The United States and Canada send skilled professionals to Europe, likely as part of research exchanges or collaborative projects, with **Germany**, **France, UK and Spain**, which are leading hubs for global space research and development.

Other Europe (incl. Russia and Türkiye provide an inflow of 135 graduates, which contributes significantly**. Germany** and **France** receive a large portion of this inflow due to geographical proximity and collaborations. **Belgium** also benefits, likely linked to ESA operations. This indicates to be a key driver for talent migration from Eastern Europe and nearby non-EU countries with developing space industries.

South America makes a modest but visible contribution with 30 inflows. **Spain**, **Portugal**, and **France** are the primary destinations, likely due to linguistic and historical ties. European partnerships with South America on satellite programmes and Earth observation missions are thought to be the drivers of this movement.

Oceania with 23 inflows, is a smaller source of talent. Destinations towards Europe include the **United Kingdom**, **Germany**, and **France**, reflecting shared language ties with the UK and strong research partnerships.

It is believed that the key drivers for these inwards movement are the Collaborative agreements between Australia and ESA, in addition to talents seeking advanced research opportunities in Europe.

When examining closely the data of the talent movement patterns within the EU and UK, the numbers show that **Germany** is the top destination for incoming talent with 328 inflows, reflecting its robust engineering and space sectors, with incoming talents from Asia, North America, and Other Europe. **France** shows to be the second-largest destination, benefiting from its leadership in aerospace and strong ESA presence, with 261 significant inflows from **Asia**, **North America**, and **Africa** reflecting France's global partnerships. Belgium attracts a surprising volume of talent, likely due to ESA headquarters and its role in European space policy with 250 inflows. Lastly, the UK remains competitive, attracting talent from **Asia** and **North America**.with **237 inflows.**

Summary of Trends

Asia and North America are the largest contributors of talent to the EU, reflecting strong collaborations with European space programmes and shared interests in advanced space technologies. Germany, France, Belgium, and the UK emerge as the primary destinations for non-European professionals, underscoring their leadership and influence within the European space industry. While smaller contributions from South America and Oceania demonstrate the global reach of Europe's space sector, these flows are less significant compared to the major contributions from Asia and North America.

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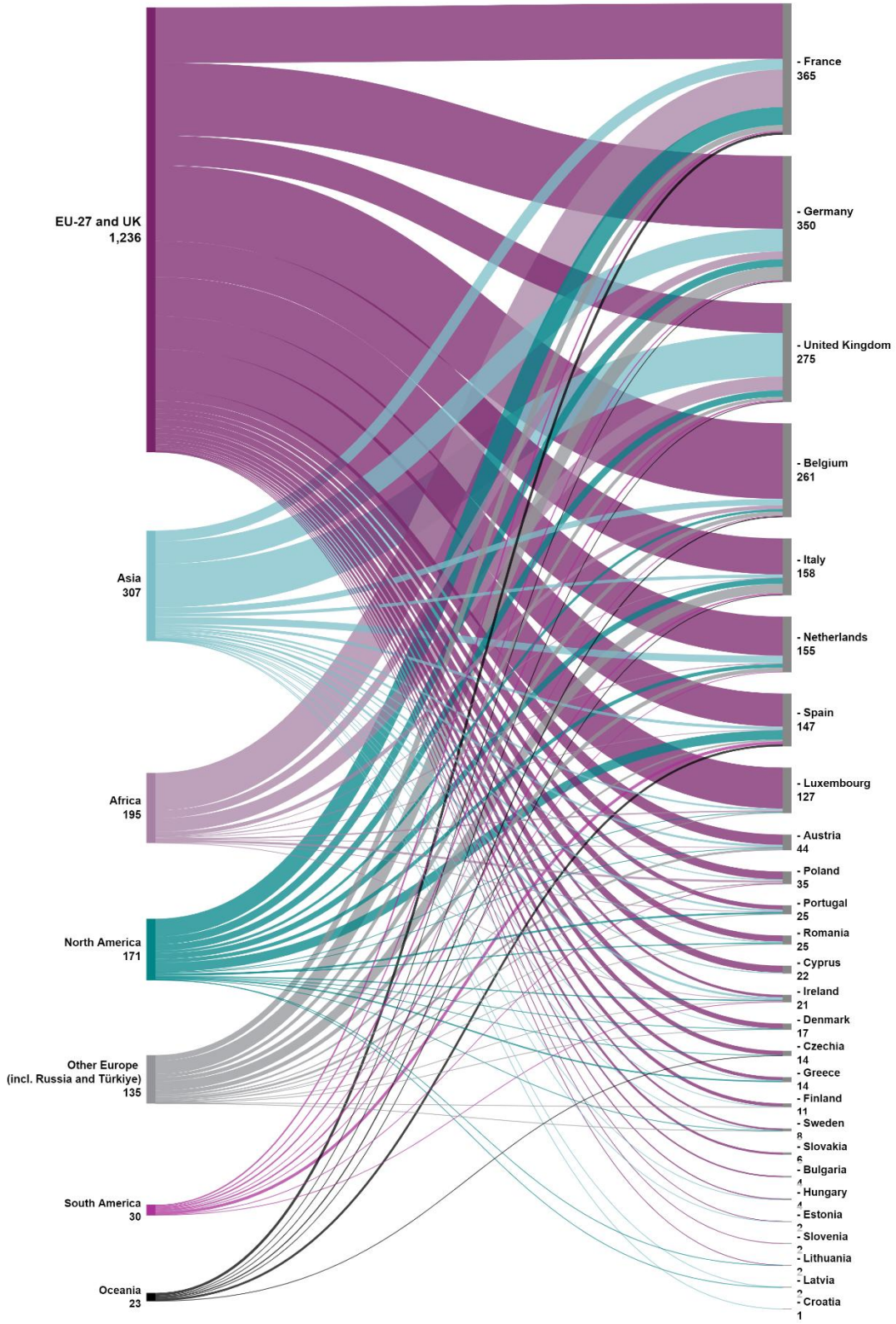
Figure 9: Workforce Migration Internationally Inwards to Europe and UK



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3.2.4 Existing Mobility Programmes – ERASMUS

An Analysis on the Existing Mobility Programs (ERASMUS) has been prepared. It provides a comprehensive analysis of the Erasmus+ program's mobility trends spanning the academic years 2013–2014 to 2022–2023.

The analysis focuses on identifying geographical patterns and demographic insights derived from mobility data encompassing 28 European countries, with an additional "Other" category capturing non-EU participants.

The complete analysis report is available in Appendix G.

3.2.5 UK Focus - UKSEDS Survey

UKSEDS[6], or the UK Students for the Exploration and Development of Space, is the United Kingdom's national student space society. Established in 1988, it supports students and enthusiasts across the country by organizing space-related projects, hosting conferences and workshops, and conducting outreach activities to inspire and educate. UKSEDS builds connections within the UK space community and internationally. Membership is free and open to students of all disciplines, providing opportunities to engage in various initiatives and events. During 2024, UKSEDS organized a Survey for its members on Diversity & Advocacy Survey. The survey, conducted in Q3 2024, collected data on general demographics, education, and career status, in addition to the mobility-related questions. The target audience was members of UKSEDS, the UK Student Space Society, but it was open to any student to complete. This means that many of the students who responded are likely to currently be studying in the UK. The survey was promoted on LinkedIn, Facebook, Twitter, and Instagram and received 222 responses. The ASTRAIOS team has secured access to this survey and collected data for analysis of the UK students' mobility patterns. A summary of the received data is included in Appendix C.

Going through the received information through this survey, we can analyse the following related to UK Student Mobility Trends and Internships:

1. **Patterns in student mobility**
   - **Limited internship participation**:
     - A significant 63% of respondents reported no prior internship experience in the space sector, indicating an untapped potential for engaging students in this field.
     - Only 7% participated in internships abroad, reflecting barriers such as cost, lack of opportunities, and awareness issues.
     - Gender disparities exist: 33% of women completed UK-only internships compared to 21% of men, potentially indicating a gendered approach to accessing local opportunities.
   - **Sources of internship opportunities:** Networking and university career services play crucial roles in finding internships, accounting for 48% of the reported methods. Online and space-specific job portals are also significant (36%), but approaches like reaching out directly to a company are underutilized (2%).
   - **Preferred destinations for internships:** The UK dominates as the preferred location for internships, likely due to familiarity, reduced costs, and existing professional networks. Outside the UK, Europe and North America are attractive for their advanced space sectors, with Germany, France, and the USA leading in specific domains like satellite manufacturing and space exploration.
2. **Barriers to mobility**

[6] UKSEDS Front Page - UKSEDS

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- **Systemic challenges**: Limited regional opportunities (28%) and lack of awareness (26%) highlight structural issues in how opportunities are distributed and communicated. Financial constraints (12%) disproportionately affect students from less affluent backgrounds, restricting their ability to participate in international programmes.
- **Cultural and institutional barriers**: Language barriers (24%) and cultural differences (10%) are notable, with students expressing a preference for English-speaking or culturally familiar countries. The need for visa sponsorship (12%) and security clearances (11%) particularly impacts international students, narrowing their employment scope.

3. **UK students' mobility for internships and jobs**
   - **Career aspirations in the space sector**: 55% of respondents are open to internships in both the UK and abroad, but a significant proportion (37%) are highly interested in careers outside their home country. Regions like Europe and North America remain prominent, driven by the presence of leading organizations such as ESA and NASA and the promise of advanced projects and better compensation.
   - **Specific country preferences**: Germany and France are praised for ESA collaborations and satellite manufacturing, while the USA is valued for its leadership in space exploration. Interest in emerging markets like India and China indicates a growing appreciation for their advancements in innovative solutions and space programmes.
   - **Barriers to international work**: The cost of relocation (32%) and personal commitments (26%) are significant barriers, suggesting a need for financial and logistical support systems. Competitive job markets in the UK (31%) and a lack of relevant openings (14%) deter students from pursuing local careers, pushing them to seek opportunities abroad.
4. **Trends in mobility and immobility**

Mobility among UK students in the aerospace and space sectors is characterized by significant aspirations but limited realization due to systemic and individual barriers. Data from the survey highlights the complexity of trends driven by curriculum appeal, financial constraints, and cultural factors. Table 2 provides a detailed analysis and representation of the responses received on the mobility drivers and barriers for the UK students.

Table 2: Mobility Drivers and Barriers for UK students

Drivers of mobility	Barriers to mobility
Academic and curricular attractiveness: o Countries associated with well-regarded space programmes (e.g., ESA in Europe and NASA in the USA) are the most attractive. o **Interest in ESA Countries:** § Germany: Recognized for satellite manufacturing and sustainability efforts. § France: Praised for ESA headquarters and established aerospace sector. § Spain: Valued for advancements in astrobiology.	**Limited regional opportunities** with 28% of respondents highlighting the scarcity of opportunities in their local regions as a primary barrier to internships or job placements.

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o **USA:** Cited for leadership in space exploration and cutting-edge technology**.** A significant 17% of students listed North America as their preferred destination. o **Australia:** Seen as promising due to projects like the Square Kilometre Array.	
Economic opportunities o **Cost of Relocation:** § A substantial 32% of respondents identified relocation expenses as a significant barrier, limiting participation in international internships and jobs. o **Compensation and job market:** § Countries with competitive pay structures, like the USA and Germany, appeal to students seeking financial stability alongside career growth. o **Emerging startups:** § Scotland and the UK are recognized for zero-debris initiatives and startup culture. Approximately 30% of respondents preferred the UK as their primary career destination.	**Awareness gaps** with 26% lacking awareness about available programmes and opportunities, pointing to inefficiencies in communication and outreach efforts by organizations.
Cultural and language compatibility o **English-speaking countries dominate preferences:** USA, UK, Canada, and Australia: Together account for a significant proportion of preferences due to ease of communication and cultural familiarity. o **Language barriers:** 24% of students indicated that language difficulties deter them from	**Financial constraints** with 12% noting financial challenges, including internship costs and relocation expenses. These constraints disproportionately affect students from economically disadvantaged backgrounds.

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pursuing opportunities in non-English-speaking countries. o **Warm climates:** Specific mentions of Australia and countries in Southern Europe suggest climate influences preferences for work destinations.	
	Institutional barriers with Visa requirements (7%) and security clearance needs (11%) adding bureaucratic hurdles, limiting accessibility to global opportunities.

A further detailed look at the information received reveals that from the survey participants, 55% expressed an interest in careers either in the UK or abroad and 37% rated themselves at 4 or 5 on a scale of interest in pursuing a career outside their home country, signalling strong enthusiasm for global mobility. From those who have expressed interest in moving outside the UK for their career, the data shows preference of specific regions, such as Europe (24%) and North America (17%) were the most popular regions, reflecting the dominance of ESA and NASA in the global space sector. A smaller number of respondents have expressed interest in moving to Asia (9%) and Oceania (8%) due to emerging opportunities in countries like India, Japan, and Australia.

The overall data demonstrates that mobility among UK students is driven by a combination of attractive academic programmes, economic opportunities, and cultural alignment. However, systemic barriers such as financial constraints, limited opportunities, and institutional challenges hinder mobility, creating a gap between aspirations and realizations. Addressing these barriers through targeted initiatives could significantly enhance participation in mobility programmes and help students capitalize on global opportunities in the space economy.

3.2.6 Analysis of Surveys

This section delves into the responses received from two surveys undertaken by the ASTRAIOS consortium. The surveys' statistical analysis has been performed using both quantitative and qualitative analysis approaches, depending on the nature of the question. The raw data from the received surveys has been exported to .xls files for analysis, which can be found in Appendices E and F.

The following subsections elaborate on the answers received per survey, analysing each question's replies, opinions, and perspectives expressed, which in turn provide a better understanding of the existing geographical curricula gaps and mobility patterns.

The analysis of the "ASTRAIOS Survey on Career Paths" is an initial analysis, as the survey is still running, and the input of received survey responses will be further analysed for other deliverables in work package 3000.

Additionally, the ASTRAIOS project also exploited different virtual events to further collect insights related to the movement of students and professionals in the space sector within the EU27 and the UK. These events included: the EU Space Networks Monthly Teleconference meeting on May 12th 2024 and 2024 Women in Aerospace Europe Symposium which took place virtually from 13:00-14:00 CEST every day over 5 days from

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May 13 to 17, 2024 and focused on uncovering industry skills with the moto *"Find your space in aerospace: Uncovering Industry Skills 2024".*

During the EU Space Networks Meeting, four quick polls were run. Each question received a different number of answers/votes. The attending audience a majority MSc holders (59%) and the remaining 41% were PhD. holders. Of the 22 votes received, 86% have completed a degree in their home country, and 38% have not moved countries for a job. This indicates that the majority of the participants in this meeting have pursued their education and career within their home countries, considering that 50% were PhD. holders.

On May 13, 14, and 15, ASTRAIOS project team were speakers and moderators in several sessions during the Women in Aerospace Europe Symposium 2024. The sessions delved into the mid-career landscape within the aerospace industry exploring strategies for addressing skill gaps, sector mobility, career breaks, continuous learning, and transferable skills. During these sessions, several polls (mentimeters) were organized. Key responses from the participants in these sessions reveal that the majority of the participants were from Germany, Italy, France, the Netherlands, UK, and Switzerland. Figure 10 below is a snapshot of the live responses received via the mentimeter.

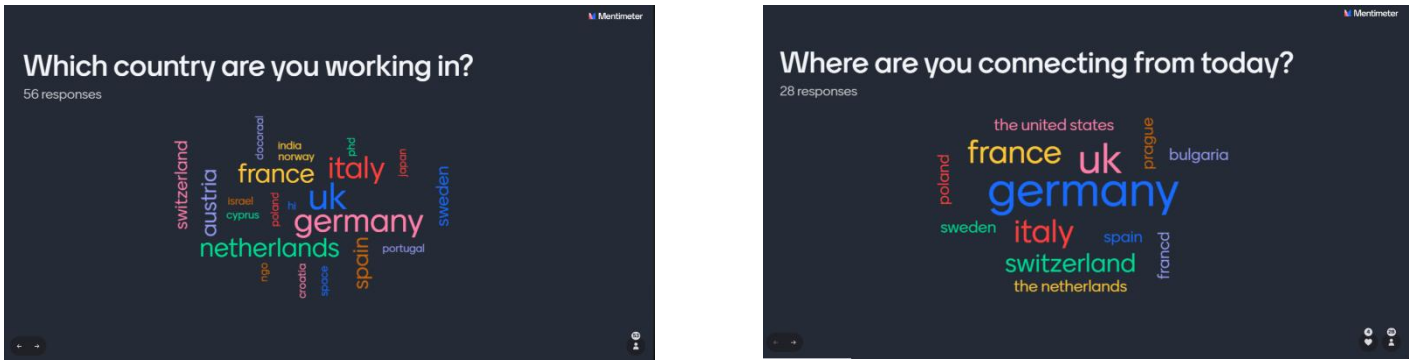

Figure 10: Mentimeter responses on current location

Participants were also asked to specify in which sector they currently work in. Prominent sectors include: Space as the most commonly mentioned field, encompassing roles in satellite communications, space policy, and system engineering. Other specific areas include space health, space robotics, and space manufacturing. Other more specific responses include Aerospace which is closely tied to the space industry, with overlaps in technology and expertise, in addition to Education and Research indicating that a notable number of respondents are in academic or research-focused positions related to applied mathematics, astrophysics, and earth observation. Cross-Disciplinary Fields include legal, political science, healthcare innovation, and international relations, showcasing the sector's interdisciplinarity, in addition to emerging technologies such as EVTOL (electric vertical takeoff and landing) and remote sensing are also highlighted. Areas like material science, composite materials, and biomechanics appear, emphasizing innovation-driven roles. **Other Industries** that respondents also mentioned include backgrounds in fields like retail, public administration, and consulting, reflecting the diversity of career transitions.

The word clouds below in Figure 11 indicate the diversity of sectors individuals currently work in who have responded to the mentimeter.

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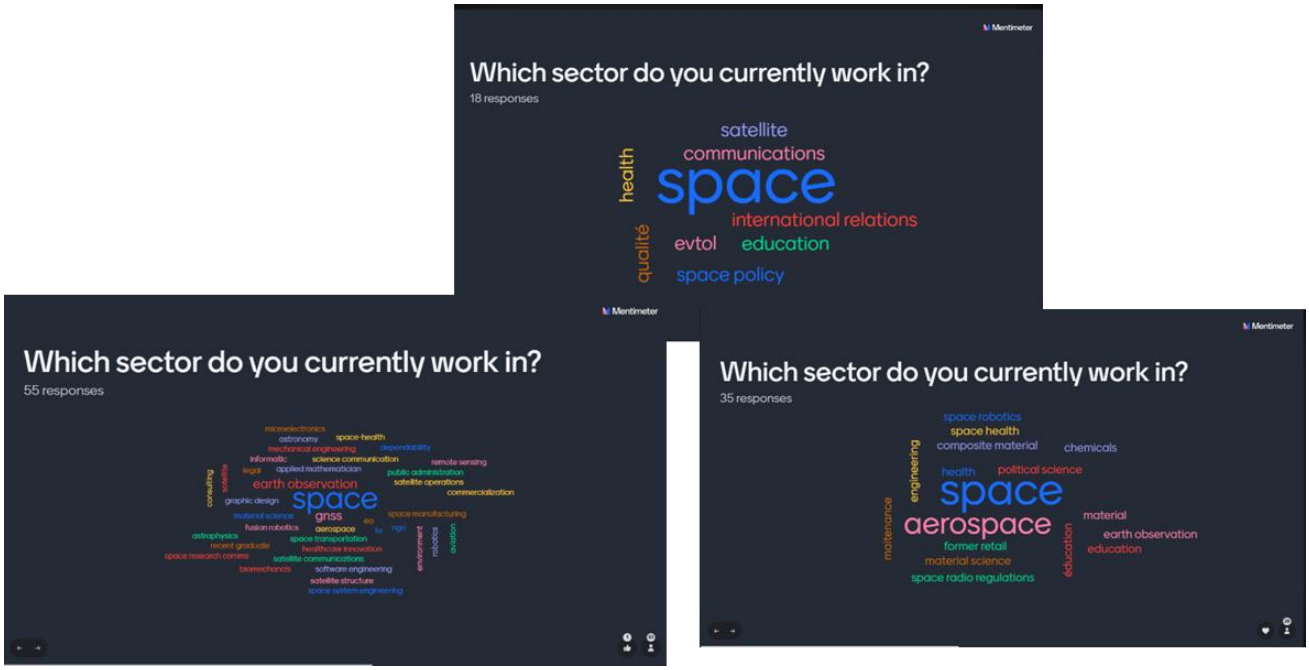

Figure 11: Mentimeter responses on Current work Sector

The challenges faced by individuals transitioning into the space sector were also questioned. These include a lack of industry-specific skills, experience, and knowledge of space-related standards, alongside outdated qualifications or skills mismatches. Many struggle with limited networking opportunities and connections within the sector, which is a critical barrier to entry. Age-related concerns, biases favoring those already in the sector, and nationality restrictions further exacerbate the issue. Additionally, career transitions are hindered by challenges in aligning previous experience with sector demands and perceptions of overqualification. Economic barriers, such as low starting salaries, unpaid internships, and limited funding opportunities, make the industry less accessible, while fears of negative work-life balance in startup-like environments deter some candidates. Knowledge gaps about the ecosystem and a lack of clear pathways into the sector also frustrate aspiring entrants. Addressing these issues requires targeted reskilling programs, improved networking and mentorship platforms, increased awareness of non-traditional career pathways, better entry-level opportunities with fair compensation, and advocacy to reduce systemic barriers such as nationality restrictions. These measures are essential to creating a more inclusive and accessible space sector.

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3.2.6.1Mobility and soft skills Survey Results and Analysis

Key Figures of the Survey

- 3 sections with a total of 22 questions
- **Only section 1 is relevant and utilized for analysis in this report**
- Time required to fill out the total survey: 20 minutes
- Tool: EC Europa – EU-Survey Online Survey tool
- Total number of filled and analysed Surveys for this report: 142
- Launched online on ASTRAIOS platforms: September 8, 2024
- Survey closed on: November 15, 2024
- Disseminated and filled randomly by participants during these significant events: The **VIIth Space Resources Conference – Towards Artemis Generation (Krakow, May 2024)**, **the 11th International Systems & Concurrent Engineering for Space Applications Conference (Strasburg, September 2024),** **and** **the International Astronautical Congress (Milan, October 2024).**

A total of 142 questionnaires were filled, from which 33 were students, 20 student/young professionals, 41 young professionals, and 48 Senior professionals.

Overall, the responses highlight diverse representation of seniority level, gender representation and geographical coverage, which also includes other international areas outside Europe. Figure 12 provides a snapshot of the respondents' gender distribution while Figure 13 provides an overview of the survey participants' seniority level.

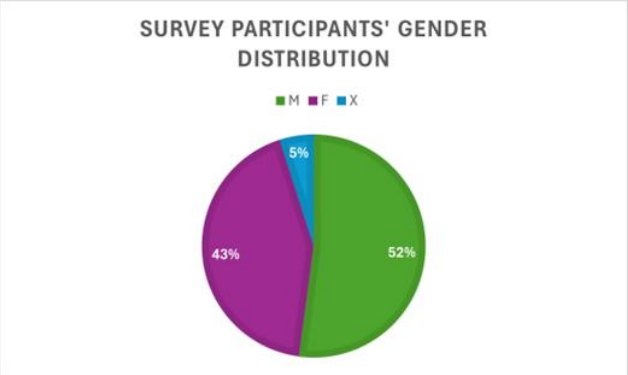

Figure 12: Survey Participants' Gender Distribution

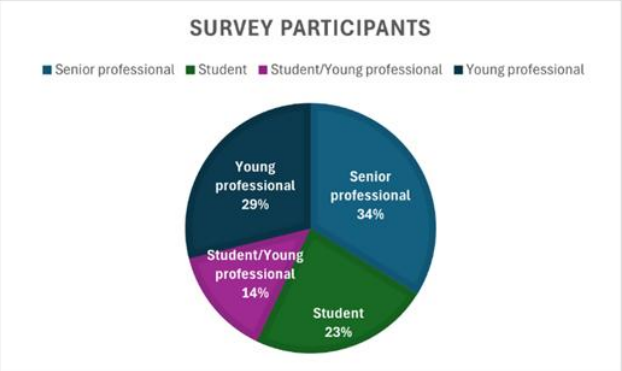

Figure 13: Survey Participants' Seniority Level

When cross-checking the respondents' seniority level and their gender, it was noticeable that for female respondents, the distribution of the respondents' seniority level was relatively equal with a slightly higher percentage of respondents being young professionals, while students and senior professionals were closely the same percentage. On the other hand, when we check the male respondents' seniority level, the majority were students with 65% while the senior participants came second with 56% and the remaining participants also came relatively equal. Lastly, those who expressed having X gender (total of 7 respondents), 2 are students, 1 is a student/young professional, and 3 are young professionals. This distribution is depicted in Figure 13.

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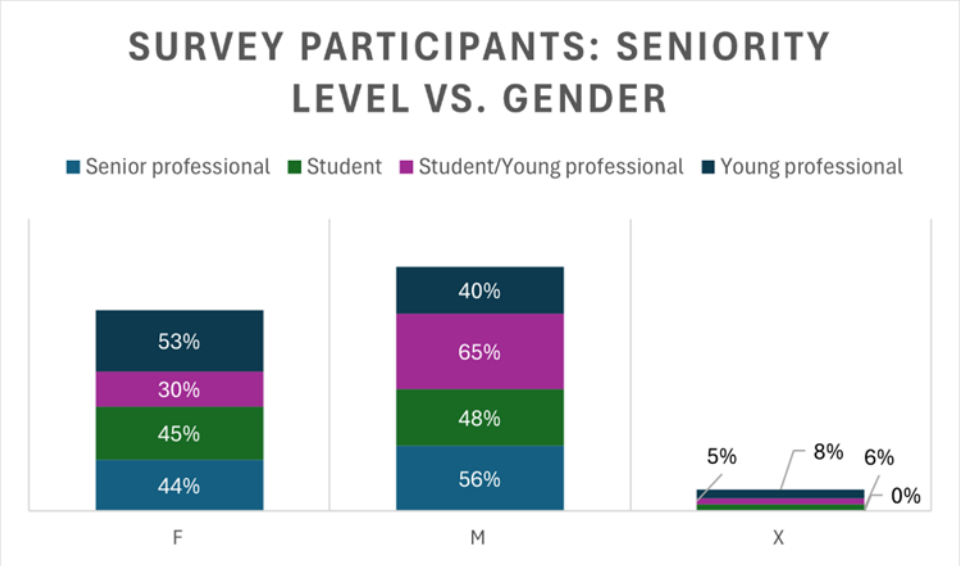

Figure 14:Survey Participants: Seniority VS. Gender

Moving on to verifying the overall geographical coverage of the survey participants and their country of origin, the received responses show a diverse and wide geographical coverage, with the top five responses received from the United Kingdom with 21 responses, followed by Poland and Italy with 16 responses from each country, 14 responses from France, and Germany with 8 responses. Even though the survey was widely promoted online via the ASTRAIOS website, social media accounts, and the partner's contacts, these numbers may have been impacted due to the fact that the survey was distributed and disseminated at international and European events in Poland, Italy, and France during which the possibility of having local participants is higher than usual. Having said this, it is interesting figure to notice the international responses outside the EU and UK and other associated countries (Ukraine and Turkey) which represents a total of 29 responses from Australia, Canada, India, Iran, Japan, Mexico, New Zeeland, Rwanda, South Africa, Uganda, and USA.

Further analysis is provided in section 4 about interesting figures and their movement internationally inwards and outwards of Europe.

Figure 15 below provides an overview of the geographical coverage distribution of the survey participants based on their country of origin.

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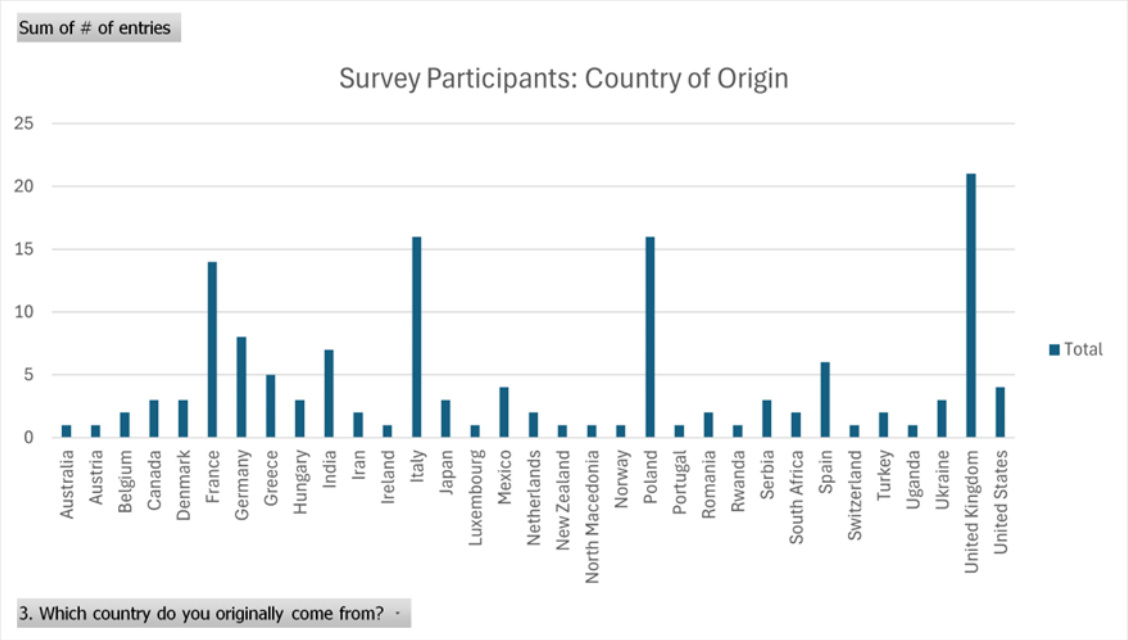

Figure 15: Survey Participants' Country of Origin

The survey also posed questions related to location and field of study. The data shows that 96 of the survey respondents have a Bachelor of Science degree, 45 have earned a Master of Science, and 33 have completed a PhD.

A closer check of the information reveals distinct patterns in the distribution of specializations across countries. For **BSc students**, Aerospace-related fields dominate, with Aerospace Engineering being a popular choice in countries like the UK and Italy. Other notable specializations include Aeromechanical Engineering and Aerospace Vehicles Engineering, with smaller student counts. However, the degree programme with the highest number of entries in BSc students is **Physics** with 13 respondents, indicating to be a strong foundational background, introducing broad principles to prepare students for a variety of engineering pathways.

For **MSc students**, Aerospace and Aeronautics fields also take precedence, particularly in regions known for advanced engineering programmes such as France and Germany. Specializations like Space Studies, Aeronautical Engineering, Aerospace (Propulsion), and Aeromechanical Engineering are highly represented. These trends indicate a strong geographical alignment of engineering specializations with countries renowned for their aerospace and engineering industries. MSc programmes are tailored toward specific expertise, making them more niche and research-oriented. The shift from general to specialized aligns with the increasing need for domain-specific skills in industries like aerospace and engineering.

France dominates in MSc-level aerospace and advanced propulsion engineering, indicating strong postgraduate research opportunities. **The UK** features prominently in both levels for general aerospace engineering. **Germany** attracts MSc students with specializations in engineering fields aligned with its industrial base.

This analysis highlights a progression from general to specialized education as students advance from BSc to MSc levels and underlines the role of country-specific strengths in defining unique trends in specialization. It is worth noting that these results are based on the survey distribution at the specific events mentioned above which impacts on the results based on the participants of these events only.

A further details check of the survey participants' educational level and background,

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For **PhD**. students, a total of 33 have provided details about their field of study and location. Figure 14 provides a tree map illustration of the distribution of specializations in the relevant countries. Interestingly, the only field of study which is reported more than once in the same country is Astrophysics in France. The remaining fields of study have been only filled once in the survey and vary widely from engineering specializations to Space Policy. From these 33 PhD holders/current students only 14 have included about their prior studies and which include: Aerospace Engineering, Molecular Biology, Space management, Space studies, Energy/mechanical engineering, electronics, Astrophysics, Astronautics and Space engineering.

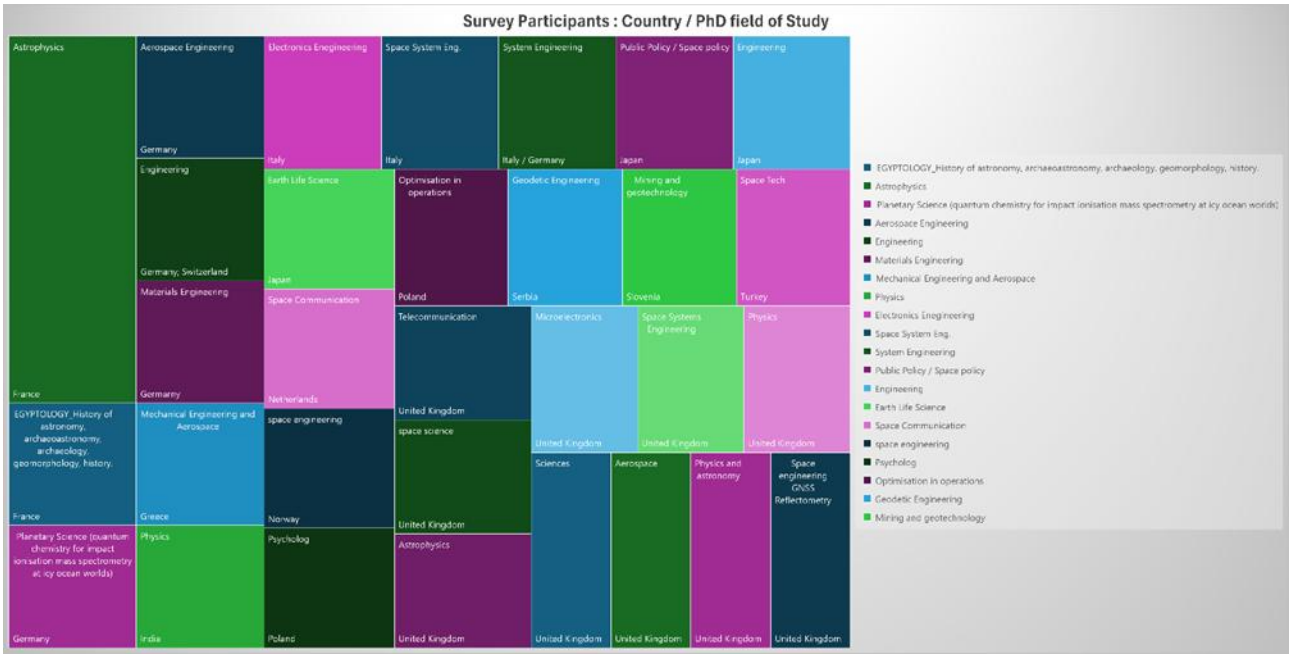

Figure 16: Survey Participants' Country/PhD Field of Study

The survey further explored the movement of the survey participants by posing several questions related to their location, study, and country of origin. When asked about their current location for study or work compared to their country of origin, key trends reveal that Some countries (e.g., Germany, United States, and France) show a high count of participants who have either remained or traveled. The United Kingdom has a notably high number of participants categorized under "remained," which might indicate that a significant portion of survey participants from this origin stayed in their home country. Also France and Germany have notable counts in the "remained" category, but with more balanced proportions compared to those who have traveled. Countries like India and Poland have a higher proportion of participants who traveled compared to those who remained, displaying a tendency toward travel. The results are depicted in Figure 17 with the bars representing two categories: "travelled" (light purple) and "remained" (dark purple).

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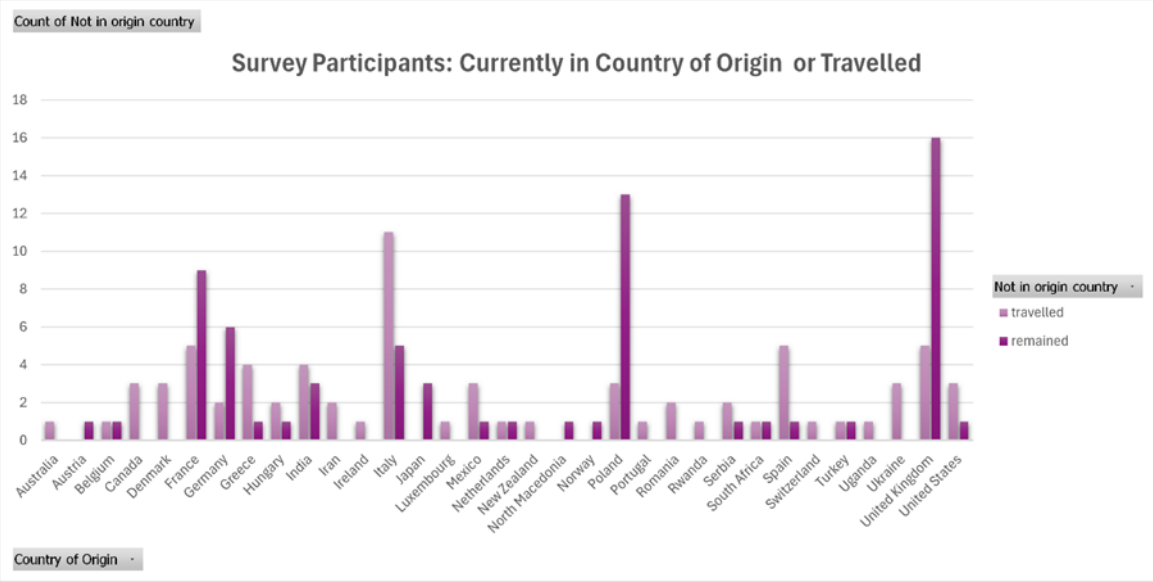

Figure 17: Survey Participants: Currently in Country of Origin or Travelled

When checking the movement patterns of survey participants based on their country of origin and their current location (e.g., for work or study), the results reveal that from the survey participants, France and Germany are the biggest hubs for relocation. This is considering that from the 28 survey participants who currently live in France, only 9 are originally from France and from the 19 who are currently in Germany, 6 are originally from Germany. Other origins currently studying/working in France include Romania, Germany, and the United Kingdom, and from Poland, Romania, and France in Germany, reflecting intra-European movement.

It is noticeable that the data indicates a mix of countries of origin, with a significant portion of participants coming from the United Kingdom. With 25 survey participants who are currently based in the UK, 16 are originally from the UK, indicating a strong trend toward staying within the UK for work or study. Other notable countries of origin currently residing in the UK include India, Poland, and Romania. Poland shows a large number of participants currently based there. Most of them are originally from Poland, but there are smaller proportions of participants from nearby regions like Ukraine and Iran. The Netherlands has participants from a mix of countries of origin, including Germany, Poland, and the UK, highlighting intera- European migration. Participants in the survey who are currently studying/working in Italy, predominantly comes from Ital with a minor representation from Hungary.

Other non-European countries represented in the survey include USA, India, Australia, Canada and Japan. The majority of participants based in the US are originally from the United States, but there are also participants originating from countries like India, Mexico, and Canada. Participants currently based in India are predominantly of Indian origin, with little diversity in countries of origin. Participants based in Australia include those from Australia and other countries like the United Kingdom. Participants of Canadian origin are currently based in Belgium and Germany, whereas, participants of Japanese origin have stayed in their home country with only 1 participant who is currently based in Italy. A description of the results in shown in Figure 18 with the bar chart.

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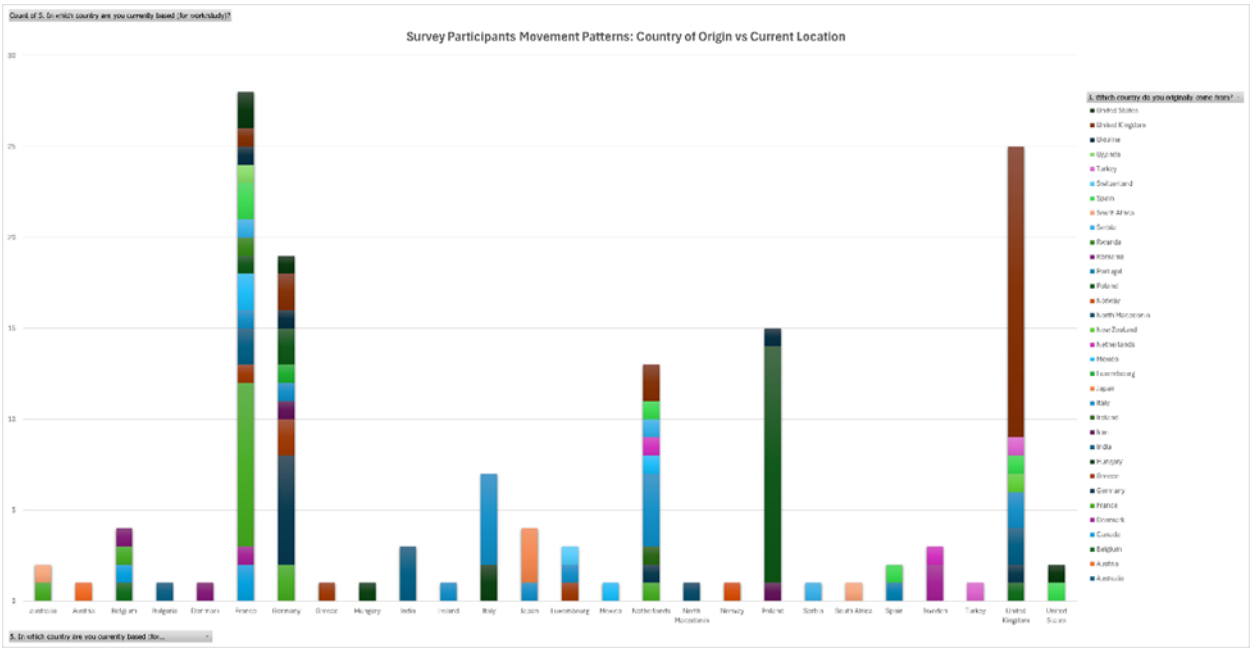

Figure 18: Survey Participant Movement Patterns

General Observations:

- Countries like the United States, United Kingdom, Germany, and France show a strong presence of participants who remain in their country of origin.
- The UK, Germany, and the Netherlands are notable destinations for international participants, especially from Europe and countries like India and Poland.
- Significant movement is observed among European countries, such as participants moving between France, Germany, Romania, and Poland.
- Many participants from India are based abroad, particularly in the United Kingdom, the United States, and other global hubs.
- Countries like Japan, Italy, and Australia show limited diversity in terms of the origins of participants currently based there.

The survey also posed a question on whether the survey participant has earned a degree in a country other than their native country, and the figures show that professionals from European countries from France, Germany, Poland, Netherlands, and the UK have higher rates of studying in their own country rather than moving out to pursues their studies, compared participants from Austria, Hungary, Ireland, Luxembourg, Serbia, Spain, Turkey, and Ukraine who have pursued degrees in countries other than their native countries. Related to survey participants outside of Europe, the data shows that most participants have pursued their education outside their native countries such as, India, Canada, Uganda and Rwanda. It is noticeable that participants from Greece, Italy, and Mexico spread equally in their native countries and outside their countries.

Most countries exhibit a balance between participants studying domestically and abroad. However, in some nations like the United Kingdom, more participants obtain degrees domestically compared to abroad, reflecting a strong national education system and less incentive for outward mobility. Countries such as India, Turkey, and Poland show growing participation in studying abroad, reflecting increased globalization and accessibility of higher education opportunities. Figure 19 provides a graphical illustration of the received

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responses, with the orange bars referring to the survey participants who have earned degrees other than in their native counties (1) and the blue bars referring to the survey participants who have not moved countries to earn a degree.

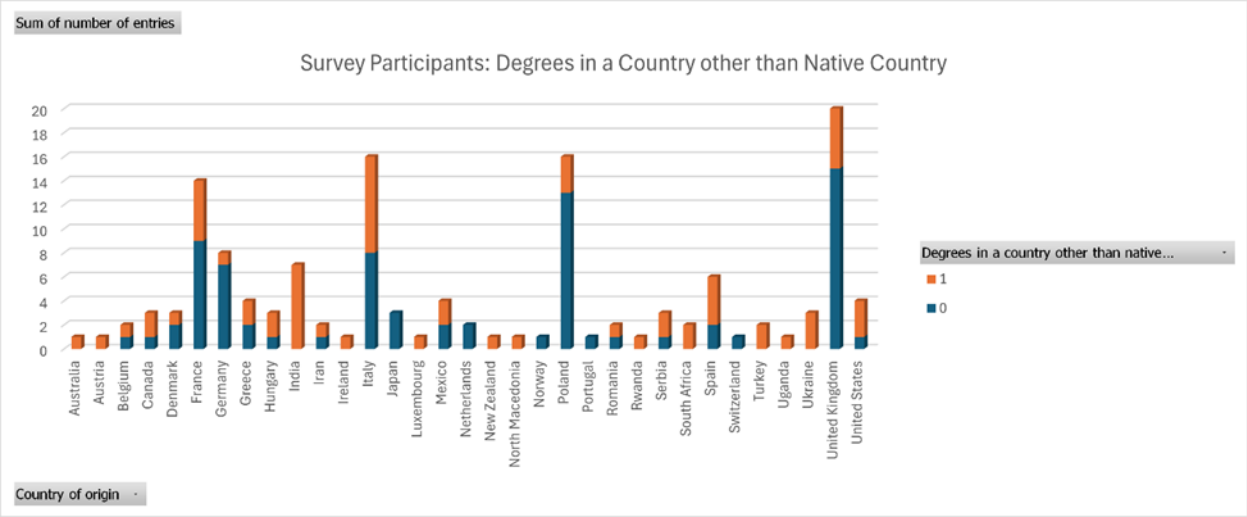

Figure 19: Survey Participants' Degrees in a Country other than Native Country

The reasons survey participants moved to a different country for their studies were also investigated and the data is summarized in Figure 20 which illustrates the received responses. We notice that the primary motivation for moving countries for studies abroad (29 responses) is that participants found the programme to align with their career interests. This highlights the importance of tailored academic programmes that address specific career goals. 15 participants stated that the specialization they sought was not available in their home country, showcasing gaps in home education systems for niche or advanced fields of study. 7 participants moved abroad to increase their future job prospects, indicating mobility driven by career aspirations rather than purely academic reasons. Other secondary motivations included securing a scholarship with 7 participants expressing it. The proximity of a programme to their home country influenced only 1 participant, suggesting that geographic proximity is less critical compared to programme quality or financial aid. Other factors expressed by 5 participants could include personal factors such as family migration, cultural experiences, or language preferences. The information received provides a general implication that institutions that design and market career-oriented programmes are more likely to attract international students. Scholarships and financial incentives remain a critical enabling for studying abroad, particularly for those from lower-income backgrounds. If education offerings in specialized fields are enhanced in some countries, this can reduce the outflow of students seeking niche disciplines abroad. While proximity is a minor factor, it could still be relevant for regional collaborations.

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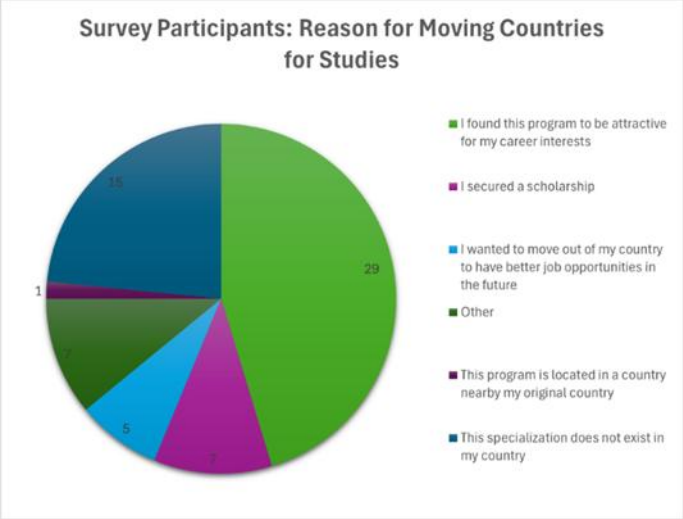

Figure 20: Survey Participants' Reason for Moving Countries for Studies

Based on the replies received, the below-produced bar chart depicts survey participants categorized by their years of professional experience. The largest group of participants (48) falls into the "Junior" category (0–4 years of professional experience). This reflects a high participation rate among early-career individuals, likely due to their desire for further education, career advancement, or international exposure. The second-largest group (39) consists of "Mid-career" professionals with 5–14 years of experience. These individuals may seek international education for career shifts, advanced knowledge, or leadership opportunities. A notable number of participants (35) belong to the "Senior" category (15+ years of experience). This indicates that seasoned professionals also value international education, possibly for lifelong learning, skill enhancement, or networking in specialized fields. Only 20 participants have no professional experience mostly related to the fact that they are currently students.

Figure 21: Survey Participants' Years of Professional Experience

The survey also asked the participants about the number of times they have moved countries for study or training purposes. The responses received show that the majority of the respondents have moved countries 1-2 times. This largest group of participants (71) has moved 1–2 times for study or training, indicating that short-term or occasional mobility is the most common trend. This aligns with the structure of many academic exchange or mobility programmes like Erasmus+. A smaller but significant portion (29 participants) has moved 3–5 times, reflecting individuals who may pursue multiple international opportunities, either as part of their

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education or for additional training. Only 9 participants reported moving 5 or more times, indicating that frequent international mobility is rare and likely limited to highly specialized individuals or those in programmes that require extensive international exposure. 33 participants reported never moving to another country for study or training. These participants are those who are currently studying in their home country. Also, this suggests a segment of individuals who either rely on local educational opportunities or face barriers to international mobility.

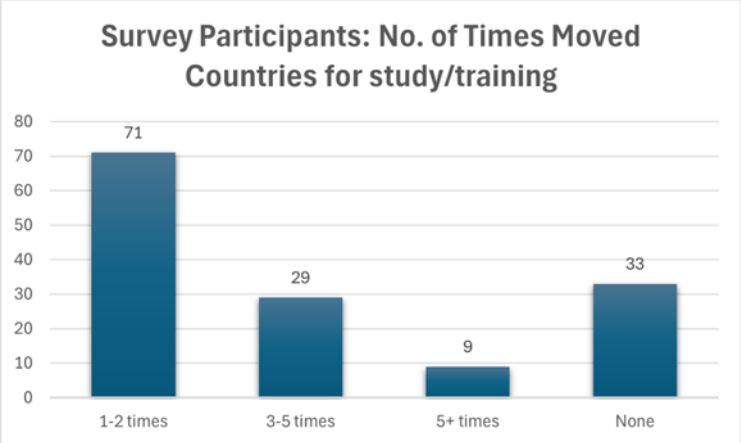

Figure 22: Survey Participants of Times Moved Countries for Study/Training

Overall, the data indicates that most participants engage in occasional mobility, with a smaller segment pursuing frequent moves or remaining immobile. These insights could inform strategies to expand access to international opportunities and support varied mobility needs.

Survey General Results and Conclusions

The results from this survey reaffirm and provide further granularity to the already established key mobility trends within the EU and UK for space education. Consistent with prior research and reports, the survey highlights the significant concentration of space-related educational opportunities in Western European countries, such as France, Germany, and the UK, which continue to act as major hubs for both academic mobility and workforce attraction.

The survey echoes existing data on "brain drain" from underrepresented regions in Southern and Eastern Europe, where the lack of advanced programmes and limited local opportunities compel students to relocate to Western Europe. This aligns with documented mobility patterns showing students from these regions migrating to pursue education and employment in more resource-rich countries. For instance, the dominance of France, Germany, and the UK in attracting talent through specialized Master's and PhD programmes underscores their leadership in creating academic ecosystems that align closely with industry needs.

Additionally, the survey reinforces the importance of factors such as English-taught programmes, financial aid availability, and the presence of internships in driving student mobility.

The progression from general foundational studies at the BSc level to more niche and specialized disciplines at the MSc and PhD levels also aligns with known patterns of skill development in the space sector. The survey results demonstrate how students gravitate toward countries and institutions offering advanced, industry-relevant specializations, particularly in aerospace engineering and space science.

Overall, the survey results not only confirm established mobility trends within the EU and UK but also provide deeper insights into the nuanced drivers and barriers shaping these patterns.

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3.2.6.2ASTRAIOS Survey on Career Paths

Key Figures of the Survey

- 1 section with only 8 quick questions
- Time required to fill the survey: 5 minutes
- Tool: EC Europa – EU-Survey Online Survey tool
- Total number of filled and analysed Surveys for this report: 46
- Launched on June 15th 2024, for dissemination in various events
- **Survey currently open for further collection of data and analysis for other WP3000 tasks**.
- Disseminated and filled randomly by participants during these significant events: **the 1st International Workshop on AI for Space Safety & Sustainability (June 2024), the Space-Comm Expo Ireland (Glasgow, September 2024), and the International Astronautical Congress) (Milan, October, 2024).**

A total of 46 surveys were filled until November 7th 2024.

The survey responses reveal interesting insights into the demographics, experience, and career patterns of participants. Starting with gender identification, males dominate the responses with 27 participants, followed by 17 females and 2 individuals identifying as non-binary. This indicates a clear gender imbalance, though there is notable female participation.

Analysing the age range of respondents, the majority fall within the younger brackets. Specifically, 20–29 years accounts for the largest share with 20 surveys, while the 30–39 age group closely follows with 16. Respondents in older age groups diminish significantly, with only 5 participants aged 40–49, 4 aged 50–59, and a single respondent aged 60+. This suggests that the workforce is skewed toward younger individuals, highlighting the presence of early-career professionals.

Geographically, the majority of participants were born in Europe, with 26 respondents, making it the most represented continent. Asia follows with 6, while the Americas, Oceania, and Africa contribute smaller shares with 3, 2, and 2 respondents, respectively. Interestingly, 7 respondents classified themselves as belonging to the "Other" category, pointing to possible diverse or mixed origins. Those who were born in Europe, 5 are from Italy, 3 from Germany and France each, 2 from Poland, and 1 from Netherlands, Czechia, Cyprus, Ireland and Spain. Europe's dominance in the responses suggests a concentration of individuals from this region who have attended the above-mentioned events.

When it comes to work experience in the space sector, the responses are again skewed toward early-career professionals. A significant portion, 17 participants, reported having 0–2 years of experience, while another 11 respondents have worked for 3–5 years. The numbers decline as experience increases, with 7 respondents having 5–10 years of experience, 6 having 10–20 years, and only 5 reporting over 20 years in the sector.

Relocation patterns for work indicate that nearly half of respondents, 19 individuals, have never relocated. Among those who have, 16 reported relocating once, while only 7 have relocated twice, and an even smaller group of 4 participants have moved three or more times. This limited geographic mobility may be due to the fact that the majority of survey respondents are young professionals

Lastly, career breaks, whether for parental leave or other reasons, appear to be relatively uncommon, again mainly due to the fact that the survey respondents are young professionals. A dominant 36 respondents

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reported having never taken a break and have either 0-2 years or 3-5 of work experience, while only 6 had taken a career break once and 4 had done so multiple times.

Overall, the survey data paints a picture of a youthful, predominantly European space sector workforce who have filled the survey, with limited gender diversity and mobility. Most participants are at the early stages of their careers and have not experienced significant breaks or relocations, indicating a stable and regionally concentrated professional landscape.

Figure 21 provides a summary of the demographics and mobility responses received.

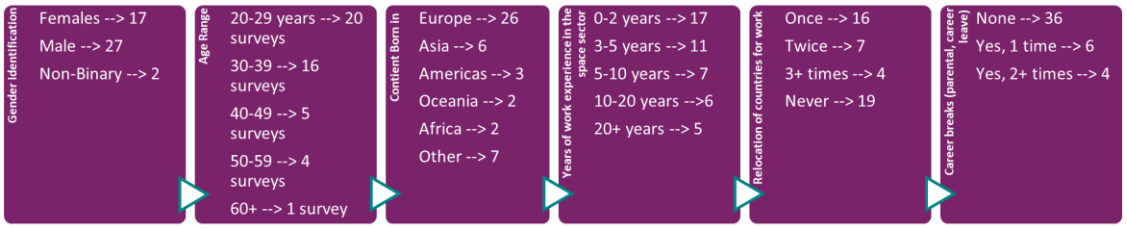

Figure 23: Survey Participants' Summary of Demographics and Mobility

The distribution of survey participants and their educational backgrounds at BSc, MSc and PhD levels was also addressed in this survey. Figure 24 illustrates a visual chart of the distribution of Bachelor of Science (BSc) degrees among survey participants from various countries, offering insights into the academic backgrounds of individuals pursuing different career paths. A notable highlight is the dominance of the UK, which has the largest number of participants compared to all other countries. This suggests a higher level of representation in the survey from the UK, as well as a broad diversity of degrees among its participants. In terms of degree popularity, fields like Engineering with its different subspecialisations is widely represented across multiple countries. In contrast, specialized degrees such as Kinesiology and Medical Biophysics and Public Health and Development Sciences have limited representation, suggesting they are niche fields with fewer participants.

Country-specific patterns also emerge from the data. For example, The UK, Italy and Germany show a significant concentration of participants with degrees in engineering and physics, which might reflect strong educational or industrial focus in these areas. Meanwhile, countries with fewer participants, such as Lebanon, Czechia, and Ireland, display limited diversity in degree representation, potentially due to smaller sample sizes. A detailed look into the specializations, shows that 21 of the BSc degree level holders, have studied an engineering degree, 12 of those being from the UK.

Finally, while countries like India, Canada, and Australia show a relatively balanced distribution of participants across different degrees, their overall numbers are significantly lower than those of the UK. To provide deeper

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insights, future analyses could normalize the data to reflect proportional representation relative to the population size or total survey participants in each country.

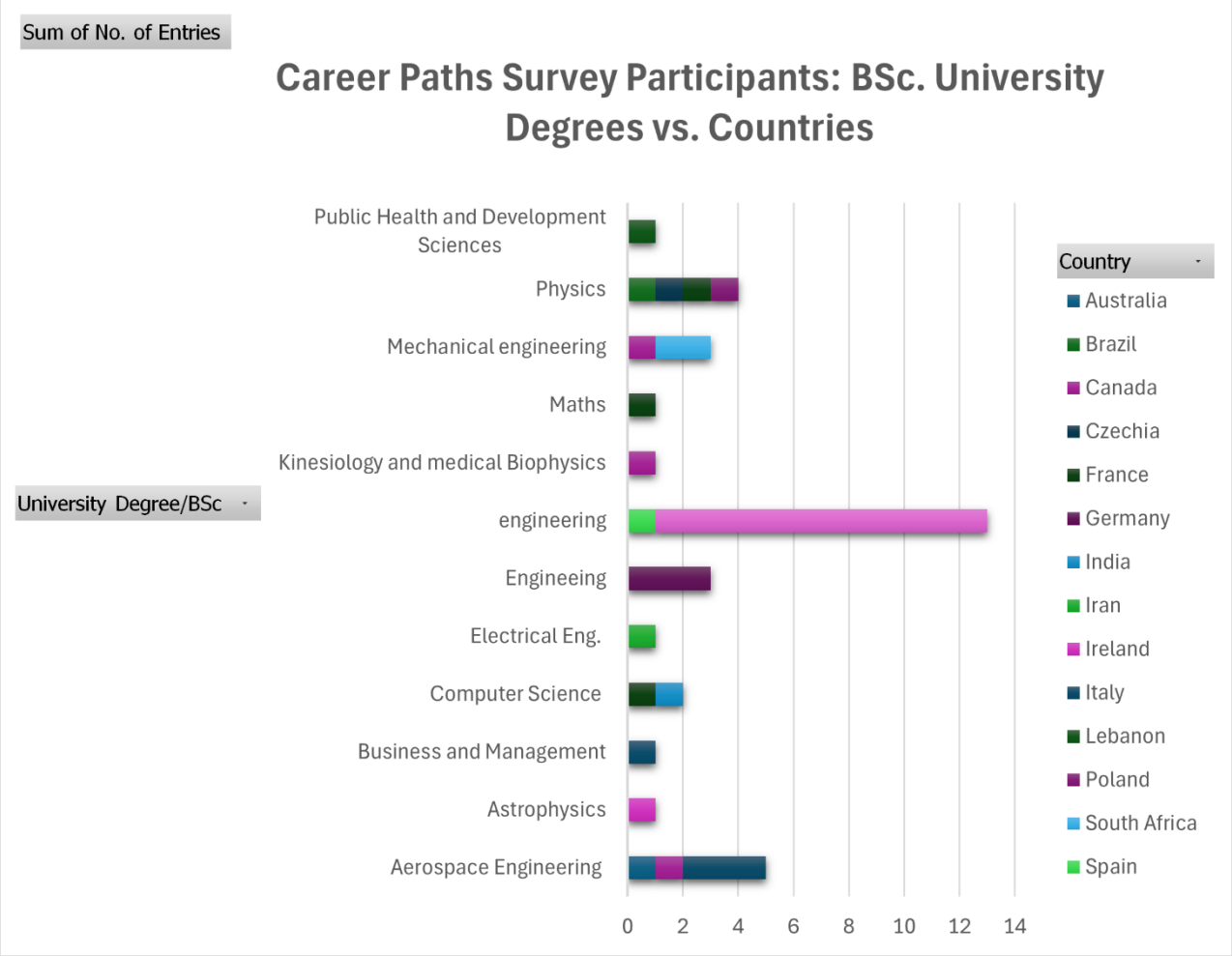

Figure 24: Career Paths Survey Participants: BSc University Degree vs. Country

MSc university degrees among survey participants from various countries was also received and analysed. The United Kingdom stands out with the highest number of participants, showcasing a wide variety of degrees, including engineering, business (MBA), Mathematics and Physics.

Other countries such as France and Germany also display significant representation, with France showing a particular emphasis on engineering and space studies degrees. Countries like the United States, Italy, and India exhibit a moderate range of MSc specializations, including fields like astrophysics, neuroscience, and computer sciences. Some nations, such as Cyprus/USA, Canada, and Brazil, have fewer participants, reflecting a more limited degree variety.

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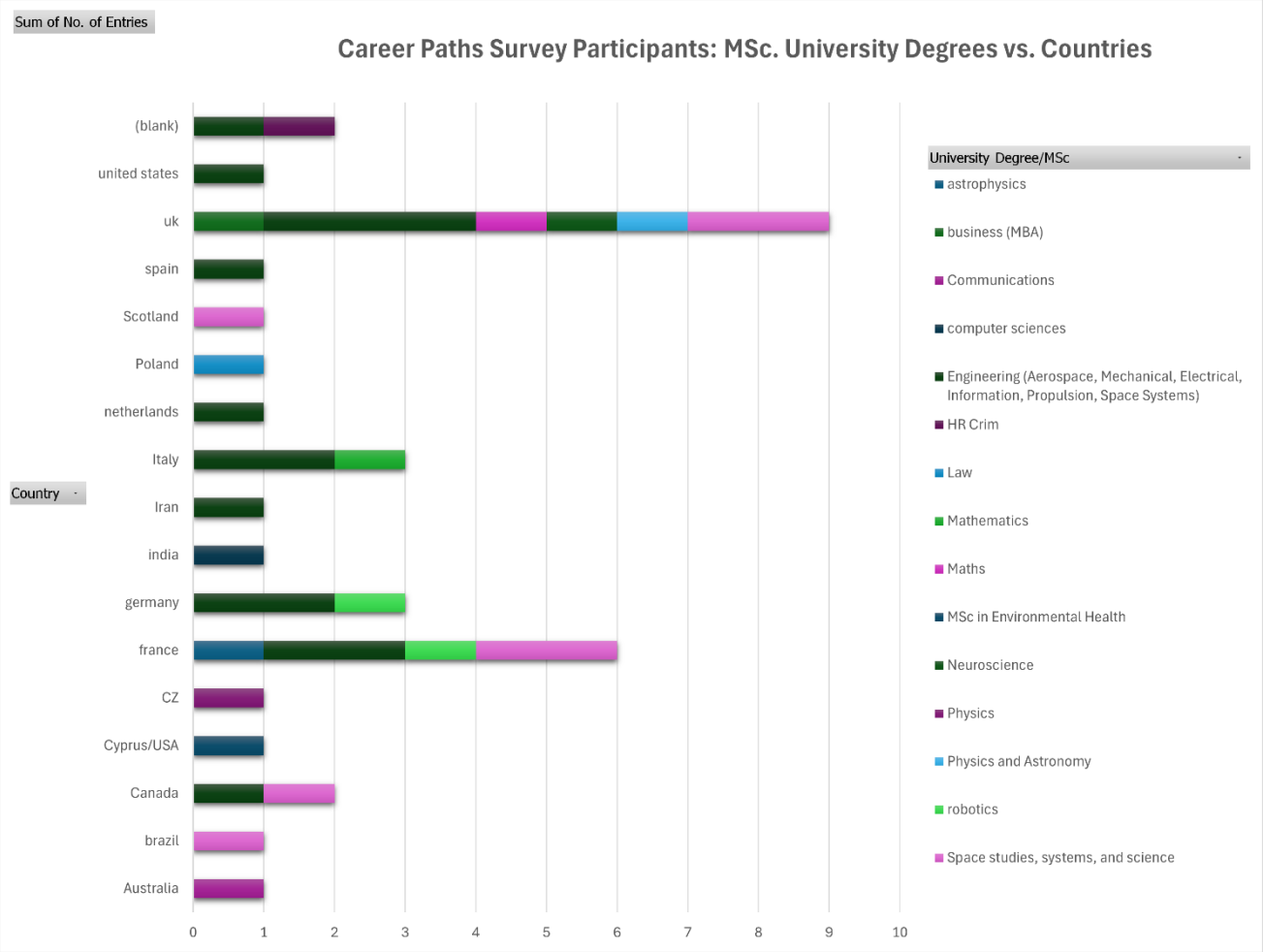

Figure 25: Career Paths Survey Participants: MSc University Degree vs. Country

Ph.D. degrees and specializations among survey participants was also examined across various countries. Once again, the United Kingdom is the most represented country, featuring a broad range of disciplines, including aerospace engineering, astrophysics, and applied mathematics. This diversity indicates the UK's prominence in fostering advanced academic and research-oriented careers within the survey participants.

Italy also has a notable presence, primarily in fields like aerospace engineering and astronomy, emphasizing its focus on technical and space-related research areas. Canada shows some representation, with participants concentrated in applied mathematics and astronomy-related disciplines, reflecting a more specific academic focus.

Other countries, such as Australia, have smaller numbers of participants, with disciplines like aerospace engineering and astrophysics being prominent. Interestingly, there are several blank entries, indicating incomplete data, and inaccurate entries which may affect the overall analysis.

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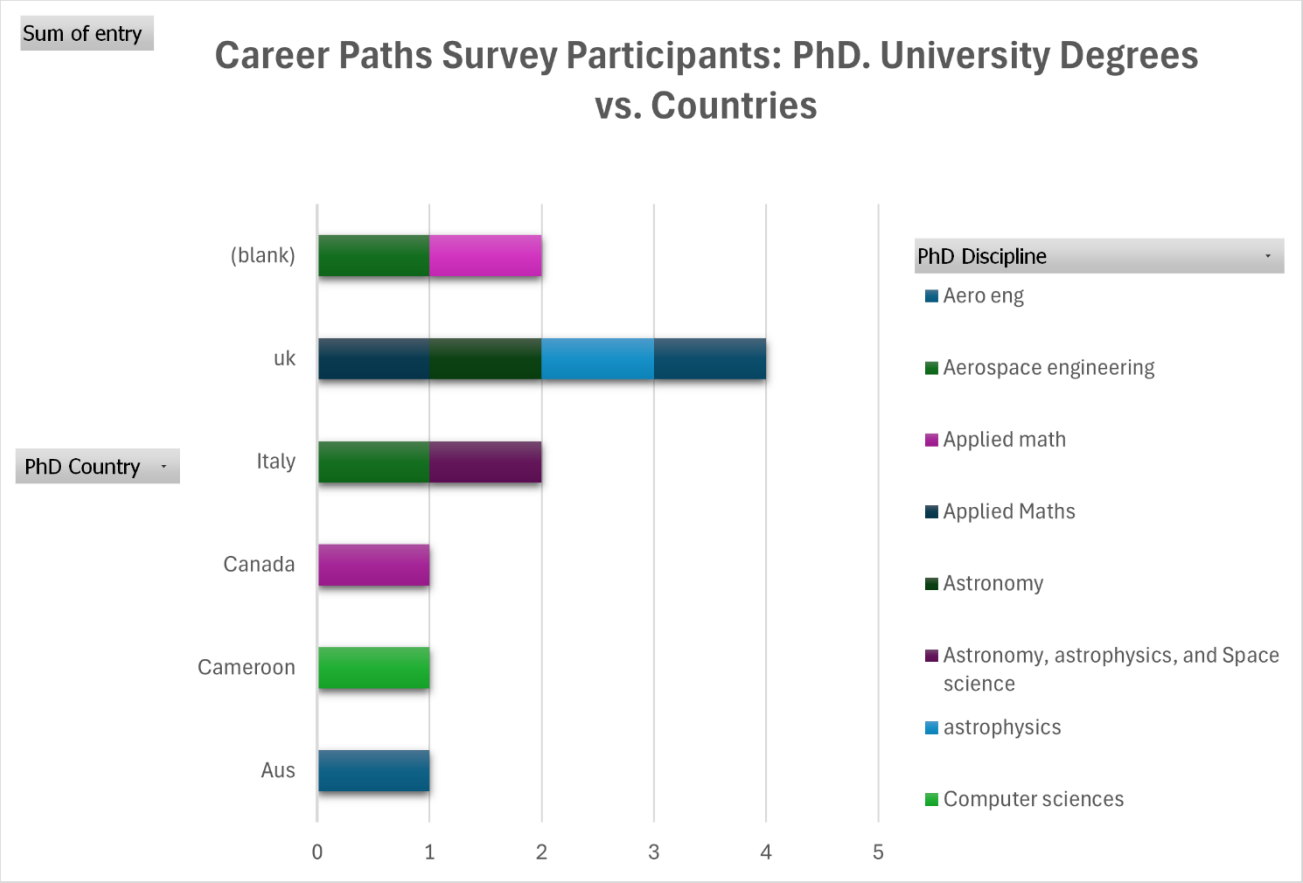

Figure 26: Career Paths Survey Participants: MSc University Degree vs. Country

Overall, the survey results reveal a UK dominance in the survey respondents, which may be highly related to in which events the survey was distributed and to the small sample size of the analysed data. Further collection of data is underway, for analysis in WP3000, which will help in forming a more detailed analysis and results from this survey.

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4. DISCUSSION ON GEOGRAPHICAL GAPS

The analysis of geographical gaps in space education across the EU and UK reveals a persistent and significant disparity in the distribution of programs and opportunities. This imbalance is particularly evident when comparing the concentration of space-related educational infrastructure in Western Europe with the limited offerings in Eastern and Southern Europe. The findings from the ASTRAIOS project, including data from surveys, web catalogues, and LinkedIn Talent Insights, reinforce existing observations on the uneven accessibility of space education and the challenges it poses for the development of a balanced and equitable space sector.

Concentration of Programs in Western Europe

France, Germany, and the UK dominate the space education landscape, hosting the majority of degree programs and research opportunities thanks to established institutions, substantial funding, and strong industry ties in areas like aerospace engineering, satellite technology, and astrophysics. France stands out as a global hub for aerospace and space research, supported by institutions like CNES and ESA facilities. Germany excels in engineering-focused programs, attracting students worldwide through its robust industrial ecosystem. The UK, despite Brexit, remains a key player with advanced programs and strong international connections. These countries attract talent not only from within the EU but also globally, driving a "brain gain" that bolsters their competitiveness while deepening regional disparities across the EU.

Underrepresentation in Eastern and Southern Europe

Conversely, Eastern and Southern European countries face a notable shortage of space-related education infrastructure, with nations like Romania, Bulgaria, and Portugal offering limited programmes that often lack the depth and specialization to attract international students. This shortage fuels a "brain drain", as talent migrates to better-equipped countries, further depleting local resources. For example, students from Romania and Bulgaria frequently move to Germany or France for advanced education, while Southern European nations like Italy and Spain, despite having some programs, struggle to retain talent due to limited opportunities in the local space sector.

Mobility Challenges and Accessibility Barriers

Geographical disparities in space education are further exacerbated by barriers that limit mobility for students from underrepresented regions. Economic challenges, such as high tuition fees and limited financial aid, restrict access to advanced programmes in Western Europe. Language barriers also play a role; while many Western European programs are offered in English, local language programs in countries like Poland and Italy reduce accessibility for international students. Additionally, Eastern and Southern Europe lack programs in high-demand fields like space robotics, satellite technology, and astrophysics, further limiting opportunities for students in these regions.

Impact on Workforce Development

The uneven distribution of space education programmes directly impacts the workforce dynamics of the European space sector. Brain drains from underrepresented regions weaken their local industries, forcing these countries to rely on external expertise for space-related projects. Meanwhile, brain gain in Western Europe reinforces their dominance, creating a feedback loop that perpetuates regional imbalances.

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The geographical gaps in space education within the EU and UK are a significant barrier to creating a balanced and competitive space sector. By addressing these disparities through targeted policies and investments, the EU can foster greater inclusivity and ensure the sustainable development of its space industry. Bridging these gaps will not only enhance regional capabilities but also strengthen Europe's position as a global leader in space education and innovation.

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5. Discussion on Student Mobility

The analysis of student mobility within the EU and UK reveals both opportunities and challenges in leveraging mobility to strengthen the space education ecosystem. Mobility trends are shaped by the availability of high-quality academic programs, economic factors, cultural aspects, and institutional structures. While student mobility fosters international collaboration, skill development, and cross-border exchange, it also highlights regional disparities and systemic barriers that hinder the full realization of its benefits.

Key Trends in Student Mobility

1. **Dominance of Mobility Hubs**:
    a. Western European countries, particularly France, Germany, and the UK, remain the primary destinations for students seeking advanced education in space-related disciplines. These countries attract talent due to their:
        i. Strong academic ecosystems with specialized programmes in aerospace engineering, astrophysics, and space sciences.
        ii. Robust industry partnerships offering internships, research opportunities, and career pathways.
        iii. Global reputation and alignment with the European Space Agency (ESA) and other major organizations.
    b. France, for example, is a leading destination due to its advanced propulsion and aerospace programs, while Germany excels in engineering and satellite technology.
2. **Brain Drain from Underrepresented Regions**:
    a. Students from Eastern and Southern Europe often migrate to Western Europe for higher education, as their home countries lack sufficient educational infrastructure and advanced programs.
    b. Countries like Romania, Bulgaria, and Greece exhibit high outward mobility, driven by limited local opportunities. This migration exacerbates talent shortages and hinders the development of regional space industries.
3. **Language and Cultural Factors**:
    a. English-taught programs in countries like the Netherlands, Germany, and Scandinavian nations attract a diverse pool of international students, making language accessibility a key driver of mobility.
    b. Conversely, programs taught in local languages, such as those in Poland and Italy, reduce their appeal to non-native speakers, limiting incoming mobility.
4. **Economic Barriers**:
    a. Financial constraints, including tuition fees and living costs, are significant barriers to mobility. While scholarships are available in some programs, they remain insufficient to meet demand, particularly for Bachelor's level education.
    b. Students from economically weaker regions face difficulties in affording relocation and international education, which restricts their ability to participate in mobility programs.
5. **Mobility Patterns and Drivers**:
    a. The survey results indicate that students often move abroad to pursue specialized programs aligned with their career goals or unavailable in their home countries. Scholarships, internships, and research opportunities are additional motivators.
    b. Career aspirations also play a critical role, with students targeting countries offering robust space industries and better job prospects.

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6. **Challenges in Immobility**:
    a. Immobility remains a concern for students in underrepresented regions due to systemic barriers, such as lack of awareness about international programs, cultural hesitations, and limited regional opportunities.
    b. Regions without strong institutional ties to mobility initiatives, like Erasmus+, are particularly affected.

Impact of Student Mobility

1. **Benefits for Host Countries**:
    a. Mobility strengthens the talent pipeline in Western Europe, particularly in France, Germany, and the UK, which benefit from brain gain.
    b. Incoming students contribute to research and innovation while addressing local skill shortages in advanced fields like satellite technology and remote sensing.
2. **Challenges for Source Countries**:
    a. Brain drain from Eastern and Southern Europe depletes the talent pool in these regions, creating a reliance on external expertise and further widening the regional gap.
    b. Limited return of students to their home countries post-graduation reduces the potential benefits of mobility for underrepresented regions.
3. **Role of Mobility Programs**:
    a. Programs like Erasmus+ facilitate cross-border education and collaboration, enabling students from underrepresented regions to access high-quality education in Western Europe.
    b. However, the reach of such programs is limited by economic and institutional barriers, highlighting the need for expanded access.

Student mobility plays a critical role in shaping the European space education landscape, fostering skill development, innovation, and cross-border collaboration. While the dominance of Western European countries as mobility hubs reflects the strength of their academic and industrial ecosystems, it also underscores the disparities that hinder the growth of underrepresented regions. Addressing the challenges of brain drain, economic barriers, and immobility requires a coordinated effort to enhance accessibility, inclusivity, and regional capacity. By doing so, the EU and UK can leverage mobility as a tool for building a more balanced and competitive space education ecosystem, ensuring long-term sustainability and growth for the European space sector.

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6. INTERESTING FIGURES

This section presents compelling narratives of survey participants whose profiles stand out for their experiences of mobility in pursuit of education and career opportunities. These stories are crafted from the information they provided within the survey on Mobility and Soft Skills and highlight key aspects of their journeys, showcasing the dynamic movement of students both into and out of the EU27 and the UK.

Figure 1 Outwards Movement: An Italian student transitioned from studying Archaeology in the UK to studying for a master's in molecular biology in Australia and then a PhD in Earth Life Sciences in Japan. She moved 5+ times for education, supported by scholarships, and now resides in Japan with 0-4 years of experience.

Figure 2 Inwards Movement: A young professional from Mexico studied Cybernetics and Computer Systems Engineering in their home country before moving to France for further specialization, citing the absence of this field in Mexico. With 1-2 relocations and 0-4 years of professional experience, they now reside in France, focusing on teamwork, adaptability, and problem-solving to advance their career.

Figure 3 Inwards Movement: An early-career professional from Uganda transitioned from Telecommunications Engineering in Uganda to Space Engineering in France. Having relocated 1-2 times, he expresses that this current specialization that he is pursuing does not exist in his country and that the main reason that he moved out of his country

Figure 4 Inwards Movement: A mid-career professional from the United States studied Biology in the USA and then a Master's in Space Sciences in France. Having relocated 1-2 times for education, she now resides in France with 5-14 years of experience.

Figure 5 Movement within the EU: A mid-career professional from Romania moved to Denmark for a Master's in Electronics in Engineering, seeking better job opportunities. Having relocated 3-5 times for studies, he now lives and works in Denmark with 5-14 years of professional experience.

Figure 6 Movement within the EU: A young professional from Serbia pursued Aerospace Engineering in the Netherlands, followed by a specialization in Space Engineering in the same country. Drawn by a programme aligned with their career interests, she relocated 1-2 times and now resides in the Netherlands. Although she lacks professional experience, her academic journey highlights the value of mobility in shaping a career in advanced technical engineering specializations.

Figure 7 Inwards Movement: A student from Rwanda has pursued her bachelor's degree in political science across the USA/UAE. After 5+ moves throughout her lifetime, currently, she resides in France for studies and is supported by a scholarship.

Figure 8 Ukraine: A young professional from Ukraine pursued a bachelor's in law and a master's in public law, both in France. Although they relocated for their studies, they did not move specifically due to academic needs. Currently residing in France, they are in the early stages of their career with no professional experience yet, showcasing the academic mobility within the EU for legal studies.

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7. CONCLUSIONS AND RECOMMENDATIONS

The analysis of space education and student mobility within the EU and UK underscores a complex interplay of opportunities and challenges, with significant disparities in access to programmes across regions. Western European countries, such as France, Germany, and the UK, emerge as dominant hubs for space education, offering well-developed academic ecosystems, robust industry collaborations, and globally recognized programmes. These regions benefit from substantial "brain gain," attracting talent from within Europe and beyond, which reinforces their competitiveness in the global space sector.

Conversely, Eastern and Southern European countries face notable challenges due to limited educational infrastructure and specialized programmes, resulting in a pronounced "brain drain." Students from these underrepresented regions often migrate to Western Europe to access advanced educational opportunities, further exacerbating regional imbalances and skill shortages. Economic barriers limited financial aid, and language accessibility further restrict mobility, particularly for students from economically weaker regions.

Despite these challenges, mobility programmes such as Erasmus+ and the prevalence of English-taught programmes have facilitated cross-border education and fostered international collaboration. However, the findings emphasize the need for targeted interventions to reduce geographical disparities, enhance access to financial support, and improve inclusivity.

As students progress from Bachelor's to Master's and PhD levels, there is a clear shift from general foundational studies to niche and specialized fields, reflecting the growing demand for advanced skills in space-related industries. This progression highlights the importance of aligning academic programmes with evolving industry needs to support innovation and growth.

In conclusion, addressing the geographical gaps and enhancing mobility requires coordinated efforts to expand access to space education in underrepresented regions, reduce barriers to mobility, and promote inclusivity. By fostering a more balanced and equitable space education ecosystem, the EU and UK can strengthen their global leadership in the space sector while ensuring sustainable growth and innovation.

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8. APPENDIX A – MOBILITY AND SOFT SKILLS ONLINE SURVEY

https://ec.europa.eu/eusurvey/runner/ASTRAIOS_Survey_on_Mobility_and_Soft_Skills

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Save a backup on your local computer (disable if you are using a public/shared computer)

ASTRAIOS Survey on Mobility and Soft Skills

Fields marked with * are mandatory.

Disclaimer
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Anonymous mode
The anonymous option has been activated. As a result, your contribution to this survey will be anonymous as the system will not save any personal data such as your IP address.

Analysis of Skills, Training, Research, And Innovation Opportunities in Space

ASTRAIOS

INTRODUCTION:
ASTRAIOS aims at providing an exhaustive **view and understanding of the current and future offer of Space curricula and courses in the EU-27 and the UK**. The project will also characterize the demand from the European Space industry and identify actionable ways towards a better alignment between the **educational offer and the skills required by the future European space industry**.

Every future employee in the space sector will have to have besides **solid core skills**, also **soft skills** that will allow her/him to adapt to changing circumstances in the workplace. This survey will thus aim to **identify** the new way of working (teamwork, interdisciplinary cooperation etc.) and soft skills needed by the sectors and necessary for Europe to remain **competitive**, **innovative**, and **open** to all players in Europe.
The outcome of survey will provides thus clear synergies of expertise, as well as coverage of the "**education and training pipeline**". It is thus best also to reflect on the skills and way of working needed to increase their future employability (and by whom and why).

We would really appreciate it if you could complete the following survey at your earliest convenience.

Thank you in advance for your contribution.
The ASTRAIOS Team
https://www.astraios.eu/

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***Data protection**: This survey will guarantee full confidentiality of the information you provide, and we will only ask for your personal information if you accept to participate. The results of this survey will be used for ASTRAIOS project purposes only. Personal data collected throughout this survey will be handled in accordance with the project's PrivacyPolicy.*

If you have questions about the survey, please contact info@astraios.eu

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Questions on Student/Professional Mobility:

1. I am:

- ○ Student
- ○ Student/Young professional
- ○ Young professional
- ○ Senior professional

2. What is your gender?

- ○ M.
- ○ F.
- ○ X.

3. Which country do you originally come from?

4.A. What is your qualification?

Level	Field of study (subject, specialization)	Country
Bachelor		
Master		
Ph.D.		

4.B. What is your qualification? (In case of double degree)

Level	Field of study (subject, specialization)	Country
Bachelor		
Master		
Ph.D.		

5. In which country are you currently based (for work/study)?

6. Did you get any of your degrees in a country other than your native country?

- ○ Yes
- ○ No

9. Have you got any professional experience?

- ○ No professional experience
- ○ Junior (0-4 years of professional experience)
- ○ Mid-career (5-14 years of professional experience)
- ○ Senior with 15+ years of professional experience

10. During your life, how many times have you moved countries to pursue your studies/training? Please [include/exclude] any secondments, internships and/or exchanges during your degree(s).

- ○ None
- ○ 1-2 times
- ○ 3-5 times
- ○ 5+ times

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11. Do you have any professional experience, in any sector, obtained outside of a degree programme? (e.g McDonald's, Shops, Delivery etc...)

- ○ No experience
- ○ 0-4 years
- ○ 5-14 years
- ○ 15+ years

Questions on the soft skills in the space sector

*** 12. What do you think is /are the most important soft skill/s for professionals in the space sector?**

- ☐ **Communication Skills**: The ability to clearly and effectively communicate ideas, plans, and technical information to diverse teams and stakeholders.
- ☐ **Teamwork and Collaboration**: The ability to work effectively within multi-disciplinary teams, often under stressful and dynamic conditions.
- ☐ **Problem-Solving**: The capacity to think creatively and pragmatically to resolve complex issues that arise during missions.
- ☐ **Leadership**: The ability to inspire, direct, and sustain a team's focus and morale during long-duration missions.
- ☐ **Adaptability and Resilience**: The capacity to adjust to changing circumstances and recover from setbacks without losing momentum.
- ☐ **Cultural Competency**: The understanding and appreciation of cultural differences within international and multicultural teams.
- ☐ **Other**

*** 13. Which soft skills do/will you prioritize in your (current /future) professional career? (please rank them from most important to least important)**

Use drag&drop or the up/down buttons to change the order or accept the initial order.

1. Communication
2. Solution Mindset and problem solving
3. Teamwork and collaboration
4. Leadership
5. Adaptability and resilience
6. Technology and Digital Fluency
7. Prioritisation and Organisation of Work
8. Conflict Resolution
9. Diversity and Cultural Awareness
10. Business Acumen
11. Negotiation
12. Other

13.1. Other - Which soft skills do/will you prioritize in your (current /future) professional career? (please rank them from most important to least important)

*** 14. Which soft skills is/are missing in your educational curricula?**

*** 15. How should space organisations prioritise soft skills training as compared to technical training?**

- ☐ **Equally Important**: Both types of skills are critical.
- ☐ **Technical is More Important**: Focus should remain on technical competencies, with soft skills as a secondary focus.
- ☐ **Soft Skills are More Important**: The technical skills are useless without the ability to communicate and work effectively.
- ☐ **Integrate Both**: Training programs should be designed to integrate soft skills with technical training.
- ☐ **Case-by-Case Basis**: Prioritisation should depend on the specific roles and responsibilities of the personnel.
- ☐ **Others**

*** 16. Which soft skill is most critical for managing international collaborations in space projects?**

- ☐ **Cross-Cultural Communication**: Being able to navigate and respect diverse cultural norms and practices.
- ☐ **Conflict Resolution**: Skills in mediating disputes and finding mutually acceptable solutions.
- ☐ **Negotiation Skills**: Effectively negotiating terms and conditions that satisfy all parties involved.
- ☐ **Empathy**: Understanding and being sensitive to the perspectives and feelings of others.
- ☐ **Others**

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* **17. What is the impact of strong soft skills on a space mission's success or within the space sector?**

- ○ **Critical Impact**: Soft skills directly influence mission success and team well-being.
- ○ **Moderate Impact**: They are helpful but not as decisive as technical skills.
- ○ **Minimal Impact**: Useful but ultimately peripheral to the mission's technical objectives.
- ○ **No Impact**: They do not significantly affect the outcomes of space missions.
- ○ **Other(s)**

* **18. In what phase of a space mission are soft skills most important?**

- ☐ **Pre-launch Planning**: When designing missions and forming teams.
- ☐ **Launch**: During the high-stress period of launch operations.
- ☐ **Mission Execution**: While conducting operations and managing dynamics.
- ☐ **Crisis Management**: When dealing with unexpected challenges or emergencies.
- ☐ **Post-mission Debriefing**: When analysing outcomes and learning from experiences.
- ☐ **Other(s)**

Soft skills related to the Copernicus and Galileo Programmes (if you are concerned)

19. Which soft skill is/are most vital for professionals working on the Copernicus services, which focuses on Earth observation and monitoring?

- ☐ **Analytical Thinking**: Ability to analyse and interpret complex data from satellite imagery.
- ☐ **Collaborative Skills**: Working effectively with international teams across different scientific and technical domains.
- ☐ **Effective Communication**: Clearly conveying findings and implications to policy-makers, scientists, and the public.
- ☐ **Innovative Thinking**: Creativity in applying observational data to solve environmental and societal issues.
- ☐ **Project Management**: Coordinating diverse tasks and teams to meet program objectives and deadlines.
- ☐ **Other(s)**

20. What soft skill(s) do you believe enhances the performance of teams working on the Galileo programme, which is dedicated to global satellite navigation?

- ☐ **Technical Communication**: Ability to explain complex positioning and navigation technologies to non-experts.
- ☐ **Leadership**: Steering project teams towards meeting deadlines and technical benchmarks.
- ☐ **Resilience**: Managing stress and recovery from project setbacks without losing momentum.
- ☐ **Adaptability**: Adjusting to new technological advances and integration challenges.
- ☐ **Interpersonal Skills**: Building and maintaining strong relationships within a diverse, multi-country team.
- ☐ **Other(s)**

21. How should leadership within the Copernicus and Galileo programs foster soft skills within their teams?

- ☐ **Formal Training Programmes**: Offering workshops and courses focused on developing specific soft skills.
- ☐ **Mentoring and Coaching**: Providing one-to-one support to nurture leadership and communication skills.
- ☐ **Team-Building Activities**: Regular activities designed to enhance teamwork and interpersonal relations.
- ☐ **On-the-Job Training**: Integrating soft skills development into daily work tasks and responsibilities.
- ☐ **Performance Feedback**: Incorporating soft skills assessment into regular performance reviews.
- ☐ **Other(s)**

22. In your opinion, which soft skill is/are crucial for dealing with the regulatory and compliance aspects of the Copernicus and Galileo programmes?

- ☐ **Regulatory Knowledge**: Understanding complex international laws and regulations.
- ☐ **Detail Orientation**: Attention to detail in documentation and regulatory filings.
- ☐ **Diplomacy**: Managing interactions with regulatory bodies and stakeholders smoothly.
- ☐ **Problem-Solving**: Identifying and resolving compliance issues before they escalate.
- ☐ **Ethical Judgement**: Maintaining high standards of integrity and compliance under pressure.
- ☐ **Other(s)**

Submit

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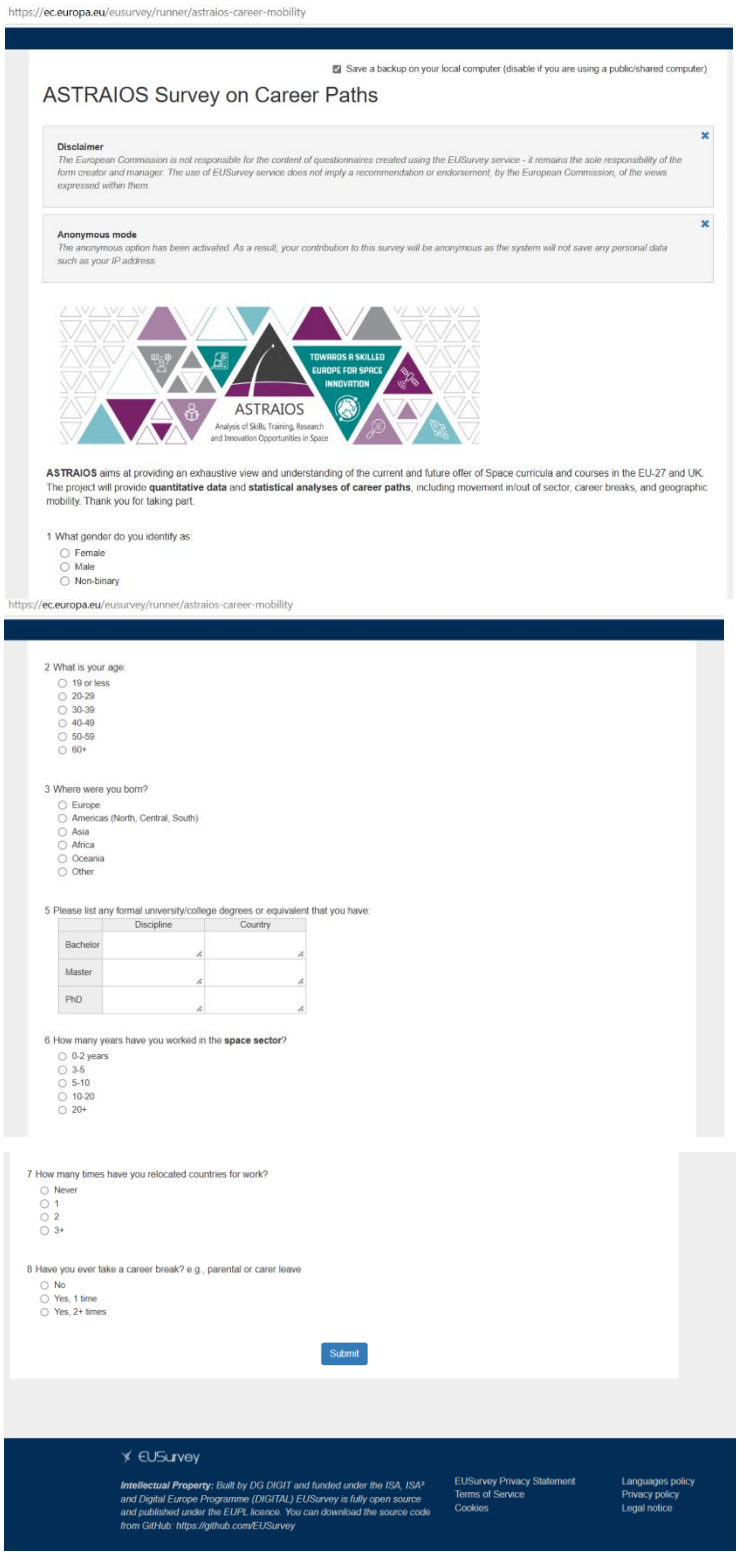
9. APPENDIX B - ASTRAIOS SURVEY ON CAREER PATHS



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10. APPENDIX C - UK SEDS SURVEY

UKSEDS Mobility Survey Summary

Overview

- Results are drawn from the 2024 UKSEDS Diversity & Advocacy Survey.
- The survey collected data on general demographics, education, and career status, in addition to the mobility-related questions.
- The survey was conducted in Q3 2024.
- The survey was promoted on LinkedIn, Facebook, Twitter, and Instagram.
- The target audience was members of UKSEDS, the UK student space society, but open to any student to complete. This means that many of the students who responded are likely to currently be studying in the UK.
- The survey received 222 responses.
- A summary of the relevant responses are below.

Demographics

Gender

How do you describe your gender identity?	%
Woman	47.3%
Man	45.0%
Non - binary	6.8%
Gender Fluid	0.5%
Prefer not to say	0.5%

Age

What is your age group?	%
18 to 24	61%
25 to 34	23%
35 to 44	8%
45 to 54	4%
55 to 64	3%

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Internships

Have you done an internship abroad?

Have you completed any work experience or internships related to the space sector?	Male	Female	All
No	69%	55%	63%
Yes, abroad	7%	9%	7%
Yes, both in the UK and abroad	2%	3%	2%
Yes, in the UK only	21%	33%	27%
Prefer not to say	1%	0%	0%

If you have completed work experience or internships abroad, in which country or countries did you do them?

Country	Number
UK	9
India	7
Belgium	2
France	2
Poland	1
The Netherlands	1
Italy	1
Australia	1
Germany	1
Ghana	1
Pakistan	1
Thailand	1
US	1
Spain	1

If you have completed any work experience or internships related to the space sector, how did you find out about these work experience or internship opportunities?

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If you have completed any work experience or internships related to the space sector, how did you find out about these work experience or internship opportunities?	Number	%
Networking / Personal connection	36	25%
University / Career services	34	23%
Online job portals	30	21%
Space specific job portal	22	15%
Social media	17	12%
I approached a company	3	2%
Student society	2	1%
Airshow	1	1%

If you have not completed any work experience or internships, what are the main reasons?

If you have not completed any work experience or internships, what are the main reasons?	Number	%
Limited opportunities in my region	83	28%
Lack of awareness about available opportunities	77	26%
Lack of relevant skills or experience	60	20%
Financial constraints	37	12%
Visa and work permit issues	21	7%
Did an internship in another sector	5	2%
Did not have time	4	1%
Did not meet age restrictions	4	1%
Other reason	4	1%
Application wasn't successful	2	1%

Would you be interested in completing a work experience or internship in the space sector in the future?

Would you be interested in completing a work experience or internship in the space sector in the future?	Male	Female	All
No	12%	9%	10%

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Unsure	3%	3%	3%
Yes, abroad	1%	6%	4%
Yes, either in the UK or abroad	56%	57%	55%
Yes, in the UK only	28%	26%	27%

Internships abroad

On a scale of 1 to 5, how interested are you in pursuing a career in the space sector outside of your home country?

On a scale of 1 to 5, how interested are you in pursuing a career in the space sector outside of your home country?	Male	Female	All
1	4%	8%	6%
2	11%	11%	12%
3	13%	17%	16%
4	29%	30%	29%
5	43%	34%	37%

What are the most significant barriers you perceive to working abroad in the space sector, if any?

What are the most significant barriers you perceive to working abroad in the space sector, if any?	Number	%
Cost of relocation	123	32%
Family or personal commitments	99	26%
Language barriers	93	24%
Cultural differences	40	10%
Unsure	15	4%
Other	11	3%

In which regions or countries would you be most interested in pursuing a space sector role?

Region	Number	%
The UK	186	30%
Europe	148	24%
North America	109	17%
Asia	58	9%
Australia and Oceania	49	8%

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Middle East	25	4%
No preference	18	3%
South America	16	3%
Africa	15	2%

Please specify the countries where you would like to pursue a role in the space sector, and explain why you are interested in those countries

- A change in environment will help me grow
- Any Country that is apart of ESA
- Any within ESA
- Australia - Square Kilometre Array
- Brazil language and culture
- Canada - best robotics opportunities (IOSM)
- Germany- best in Manufacturing of Satellites components (sustainability)
- Netherlands- best projects from ESA, in my opinion (sustainability and IOSM)
- Spain- best in Europe for Astrobiology, again in my opinion
- Switzerland- in Orbit Services developing really fast
- UK- best for initiating a businesses, or for In Space services
- USA- best in the Space Exploration Development
- Canada, as I am a Canadian citizen
- China, UK and America, because I think these are the top most countries where I can continue my profession in which I'm interested
- Colombia, is my country of origin.
- England
- English speaking, familiar cultural practices, not necessarily good ones but just familiar ones
- EU, I can speak some of the core languages and enjoy the culture, I am a keen follower of ESA missions. USA, similarly I respect the work of NASA. I would love to work in emerging tech leader agencies in Asia and South America
- Europe, Americas, MEA
- European countries, such as Germany, France, etc - interesting lifestyle opportunities and the prospect of learning a new language.
- UAE - Lifestyle choices and other financial factors.
- France
- Genuinely, anywhere I get a good opportunity.
- Germany
- Germany has a lot of good companies and is good at supporting its manufacturing sector, same with France and Spain, though other countries in Europe are catching up and could provide good opportunities

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- Germany, I am currently resident here and would like to stay.
- Germany, United States, Canada, Australia
- Germany, USA, South Korea, Nigeria - i feel that these countries would offer difference experiences and perspectives in space
- Germeny
- Hot countries not escape the rainy uk
- I am interested in the Scottish Space sector as it is starting to evolve and create a sort of new revolution where new companies are emerging, so it would be great for me to contribute my passion for aerospace to this booming sector.
- I am interested in the UK to start my journey and have already started volunteering at one of the space startup. It's fascinating to see how UK is more focused on making difference in order to achieve Zero debris goal to achieve the aim for Climate change.
- I only speak English
- I want to be happy outside of work, so I want to live somewhere warm
- I want to see different approaches on the same industry practises and explore different technologies.
- I would be most interested in working with the USA, UK, canda or european space based organisations as they feel more established to me and more accepting of diverse backgrounds
- I would like to pursue a role in the Middle East because I grew up there.
- I'd like to work in countries in Europe, or India where innovative solutions and new technologies are being developed to support Space sector development. While also following ethics and equality with fair pay.
- Italy (born in Italy), Bangladesh (parents' origin), Middle East (I'm muslim), Germany/Spain (great for space and similar to Italy)
- Japan, due to the culture, and the keen interest in space debris mitigation/removal.
- Japan, Singapore I'm interested in these countries as my culture would definitely not be underepresented in these countries and I'd feel a lot more comfortable
- JSA, Canada, sinc emany opportunities
- Kuwait, because I live here
- Mainly due to more countries meaning more opportunities
- Middle East because pay is significantly better
- My first picks would be English speaking as I do not speak a second language and eliminating the language barrier would help
- Netherlands as I completed my work experience placement there and there is a large space sector presence due to ESA
- Netherlands, ESTEC
- Netherlands, good work life balance
- No language issues

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- Seen opportunities in the countries I ticked that I like. Want to work for a global space cause instead of just National.
- Somewhere with better weather!
- Spain, Italy, France, Germany - Strong ESA links
- The UK as it is home and I am unable to travel very far, and if I were to be able to travel, then France or Germany for ESA
- The UK because it is home
- Germany, France, Spain and Italy because of the presence of ESA
- Canada and USA
- Australia and New Zealand
- Japan, India and China
- The UAE is also a nice place to possibly work"
- "The UK is my home country and would be my first choice for many reasons. The UK Space Agency does seem to have many geological roles, which is my field of interest. However, research or teaching is also an interest. Earth and Planetary Sciences with Astronomy is my degree topic.
- Europe- I have lived in Europe and am familiar with many countries close to home. I have quite a few opportunities in the space sector; this has always been recognised. They also have great space programmes for the future. I've looked at ESA and sentinel Earth observation, and most of the internships are directed at younger people.
- US - they have an abundance of fieldwork and research as well as NASA and space programmes, but I believe you need to be an American citizen."
- The UK is the country of my Alma mater. I have established strong connections through my study and volunteering work. I think it has an exceptional space sector and I am keen on continuing to develop here and establish a footing in it.
- I chose Africa because I aspire to establish a successful space and Astronomy programme in my country Sudan and the whole continent.
- The united states due to the capital being invested in space. Same goes for Europe. My nationality and ethnicity being Indian and the huge potential within their space programmes I would want to pursue an opportunity there
- To be frank I dont mind which State it is I just want to pursue my dream career by becoming an astronomer or by becoming a researcher within data driven astronomy. So that I can understand the universe more fundamentally along with by combining the knowledge of finance and entrepreneurship I can start business within space sector. For me it is important to fulfil the purpose of my life by becoming a space entrepreneur so that I can increase the life of the sun along with help the human civilisation in making mars more habitable. That what matters to me not any specific nation where I might be given a chance.
- U.S - I would like too work for NASA

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- UK - home country, France - ESA headquaters, Italy - connections in the country, Canada - studied there
- UK - where I live and is most convenient. USA - English speaking, probably most similar culturally, better pay, lots of opportunity and biggest space sector. Germany/France - compromise between factors for UK and USA
- UK because it is easy to relocate with my student visa. I would also like to work in USA and Jan due to the space advancements happening there as well.
- UK because it would be the cheapest option. Europe as I would enjoy working in a European country and may find communication and culture easier than other options. North America would only be Canada, language barriers would not be a problem and culture easier to assimilate to.
- UK, Europe and USA because of the opportunity to meet experts who are always ready and willing to share their knowledge and push you to achieve excellence.
- Uk, Europe,japan
- Uk, Greece
- UK, the United kingdom and this is because the UK is now beginning to join the race for space too. Furthermore the UK's favourite space sector is aerospace, we love aerospace here.
- UK, USA, Germany. These three are the top priority for me as there has been a growing environment of companies and startups that is doing work in the space sector related to engineering and science.
- "US and Germany seem to have a far larger manufacturing industry than the UK.
- US offers a diverse range of engineering space jobs that aren't available in the UK and can either be in the government or private ventures. The biggest leaps in Space technology are coming from the USA."
- Usa
- USA - They have NASA!
- Europe - I would like to work in the ESA as they have an interesting lineup of missions
- India - because space is an emerging industry here and they too have interesting missions in the line.
- USA became when I think of the space industry I've always heard about the advancements that have come from USA. Also India because I can speak Hindi so I feel it would make it easier to become closer to locals and people working in the company. I also wouldn't mind Saudi Arabia because my family lives there and I can speak Arabic
- USA, good opportunities and compensation
- USA, huge access to space industry
- USA, NASA

[For international graduate students] What factors are limiting your opportunities in the UK aerospace sector?

What factors are limiting your opportunities in the UK aerospace sector?	Number	%

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A competitive job market	92	31%
A competitive job market	54	18%
Lack of relevant job openings	41	14%
Insufficient professional network	38	13%
The need for visa sponsorship	34	12%
The need for security clearance (any level)	32	11%
Other	3	1%

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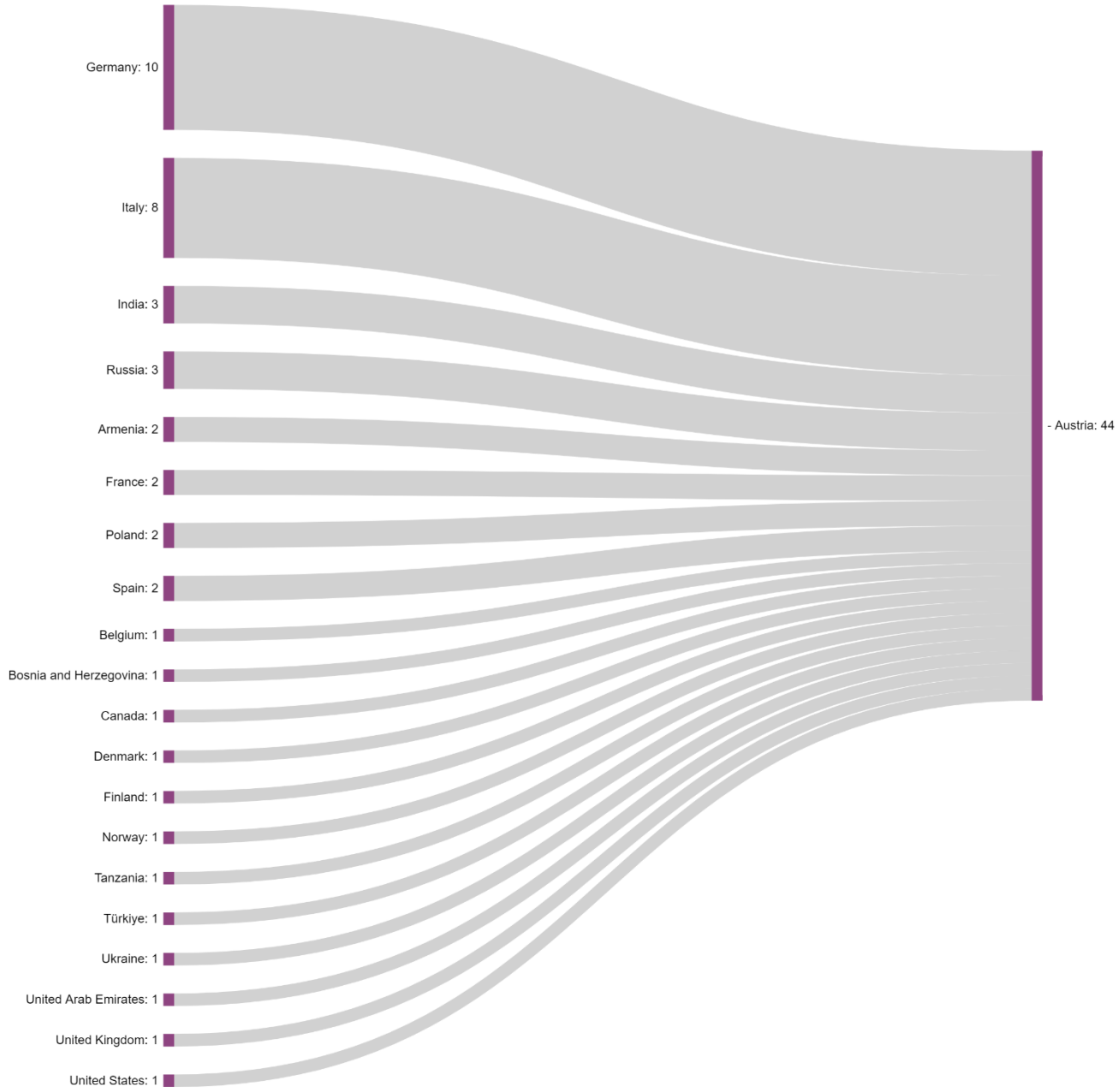
11. APPENDIX D – COUNTRY SPECIFIC SANKEY DIAGRAMS DEPICTING RELOCATION OF GRADUATES DURING THE PAST 1 YEAR

Austria



Belgium

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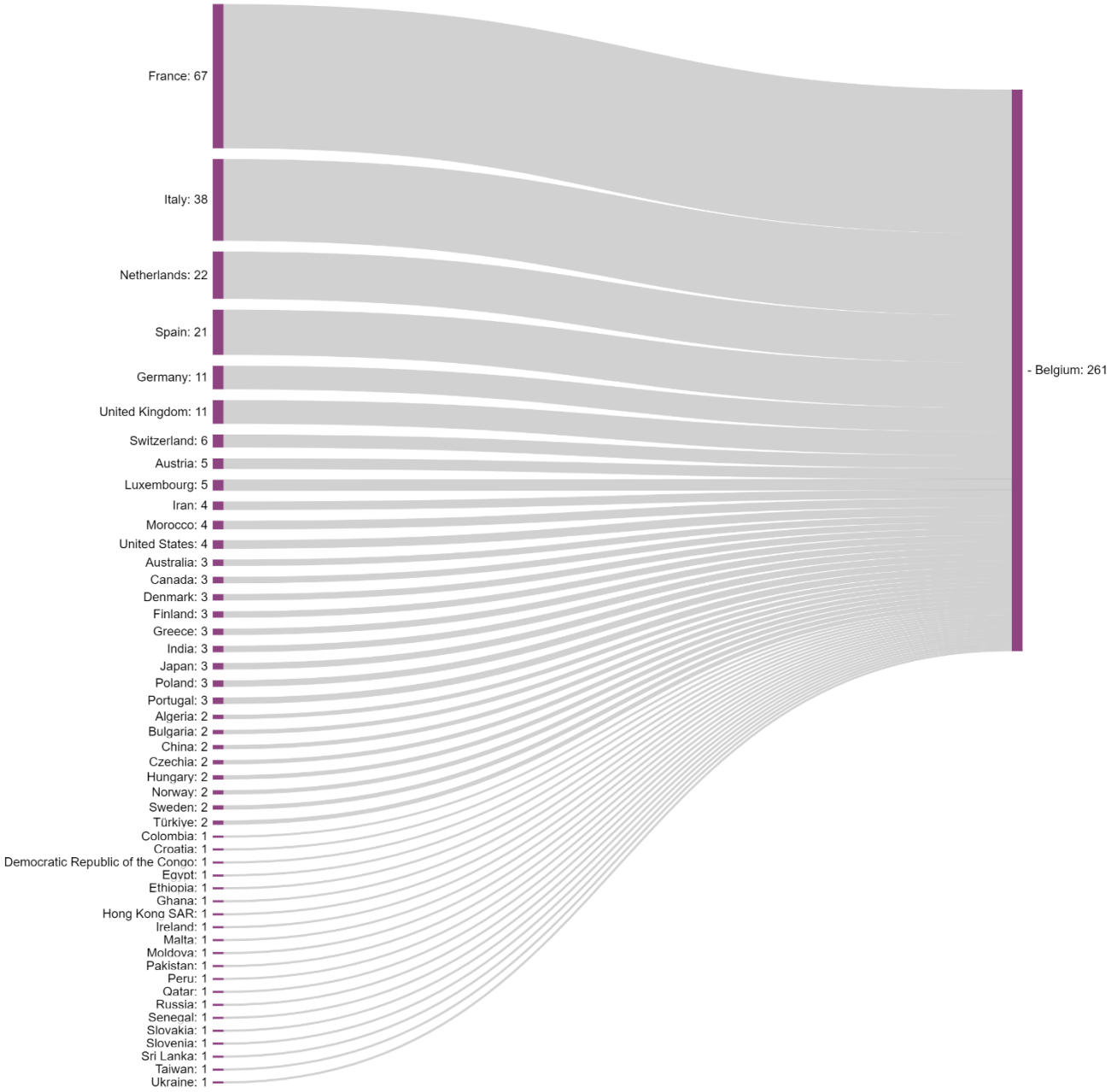

Bulgaria

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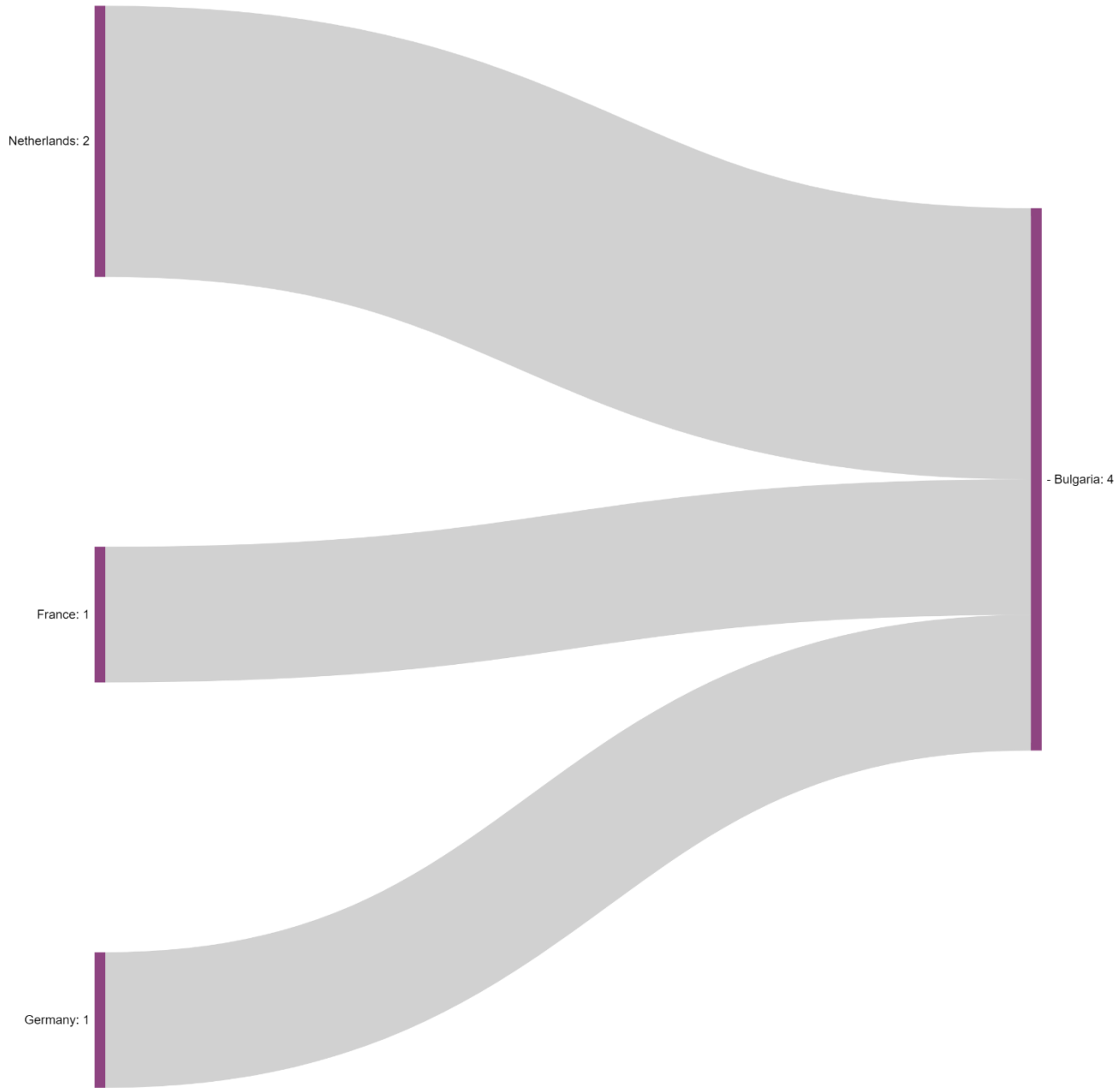

Croatia

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Cyprus

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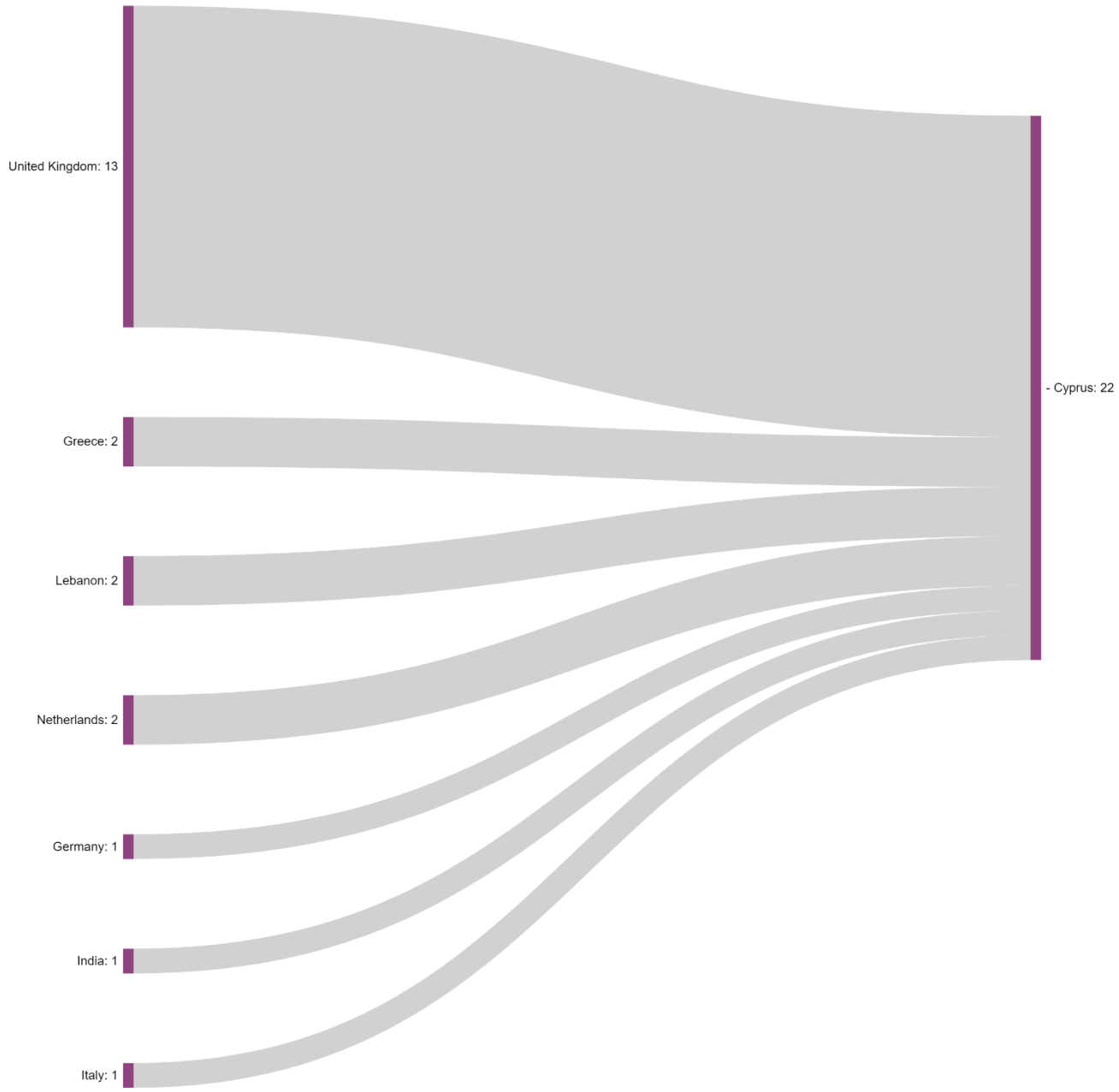

Czechia

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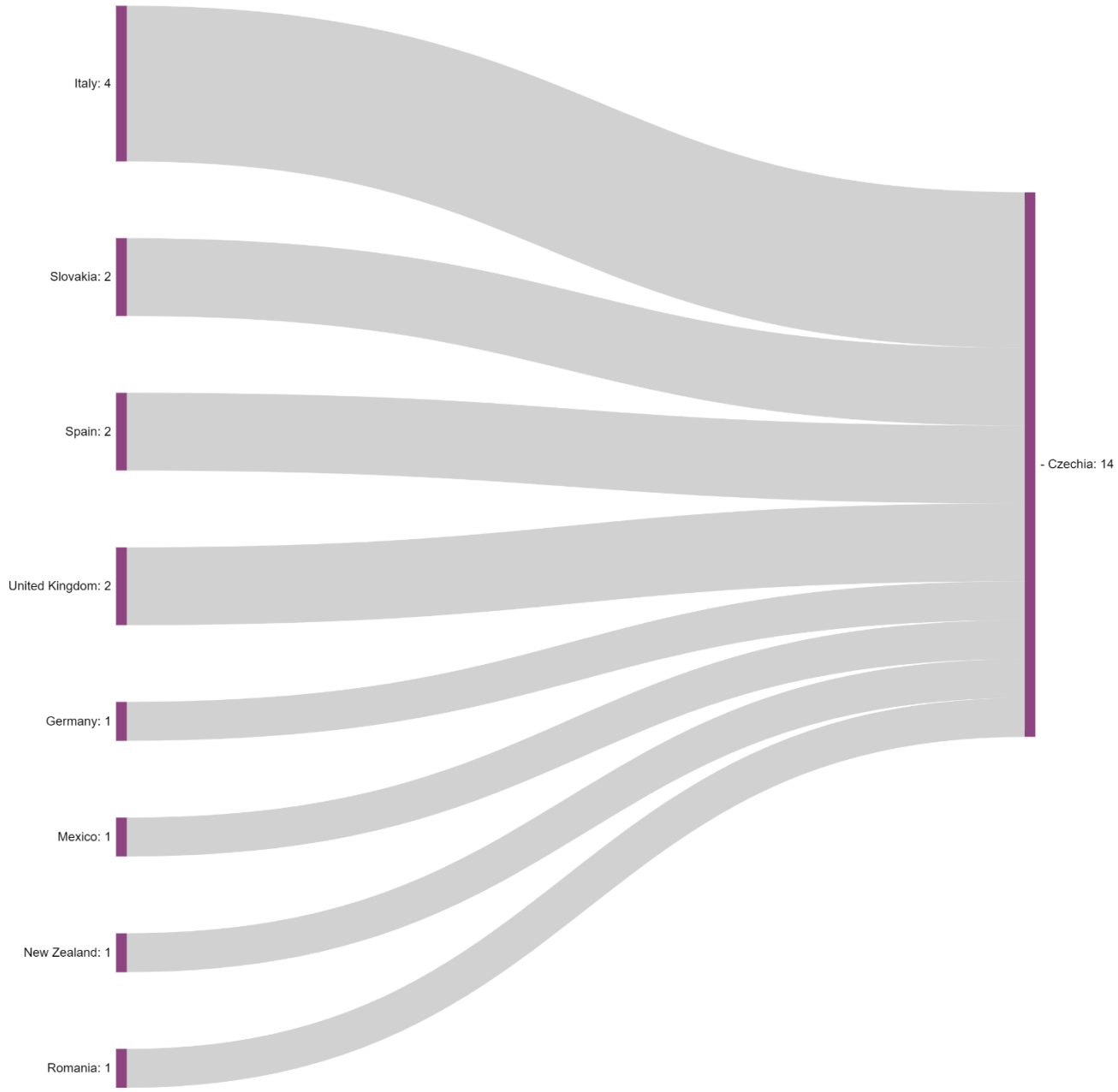

Denmark

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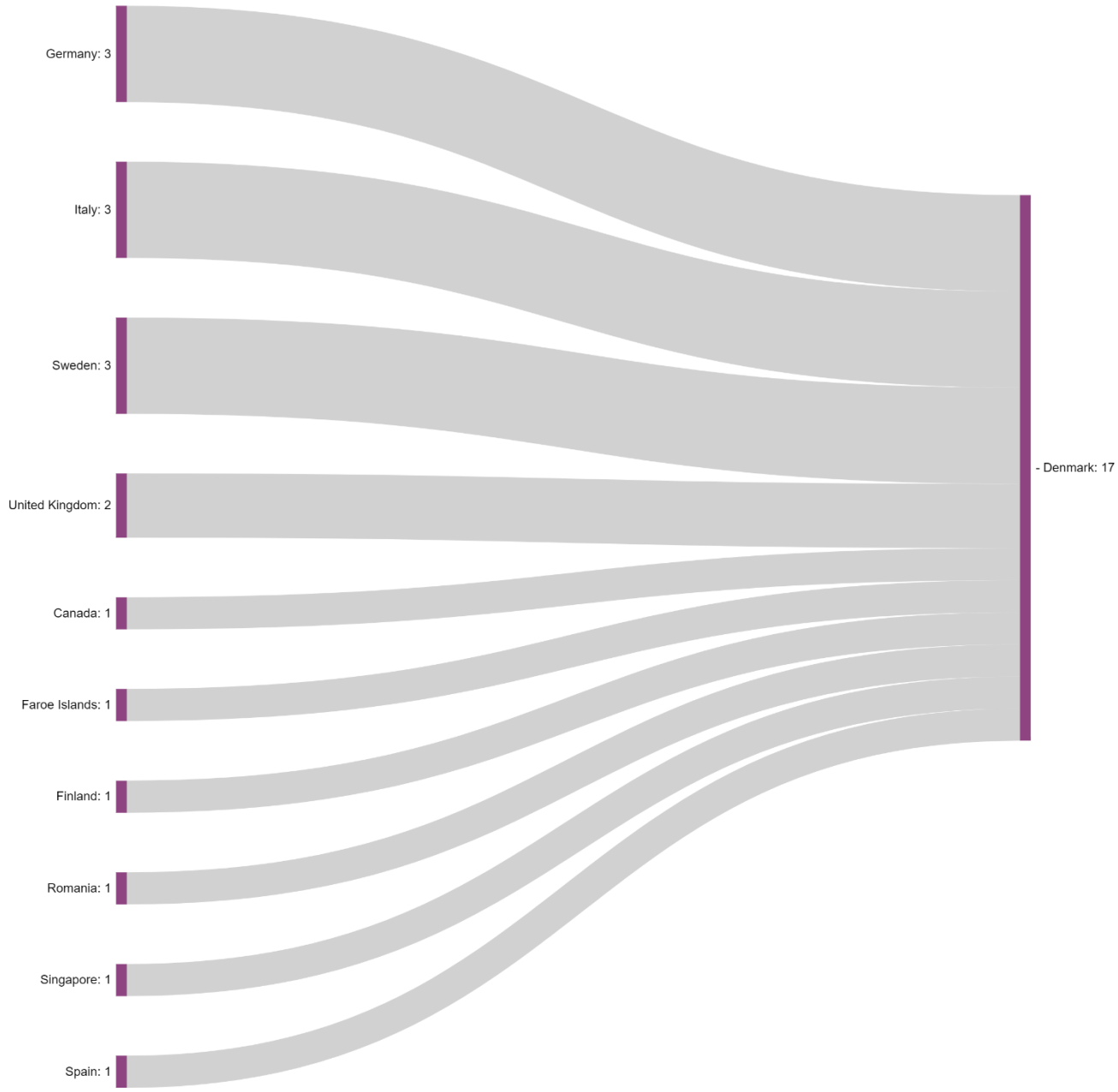

Estonia

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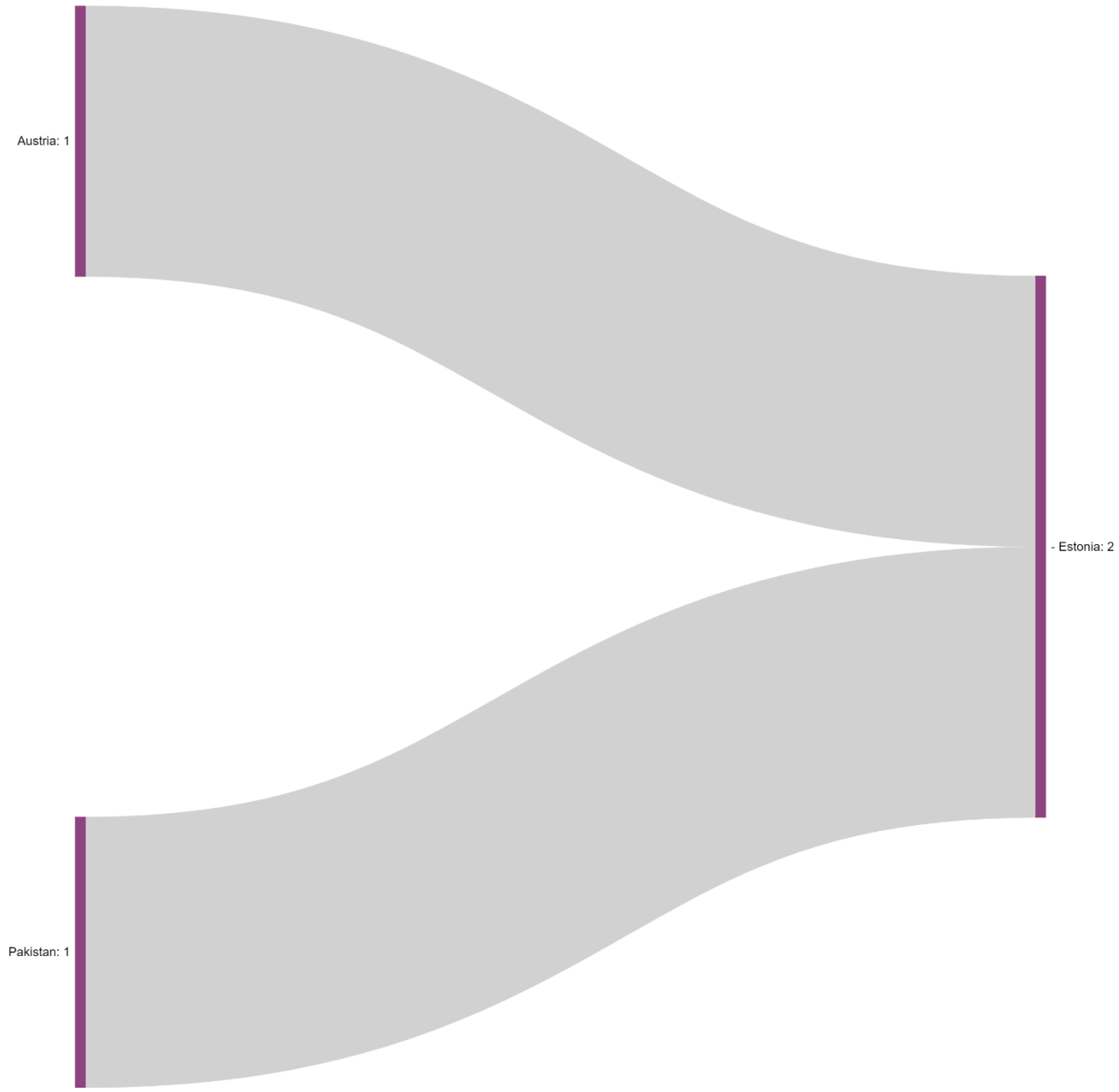

Finland

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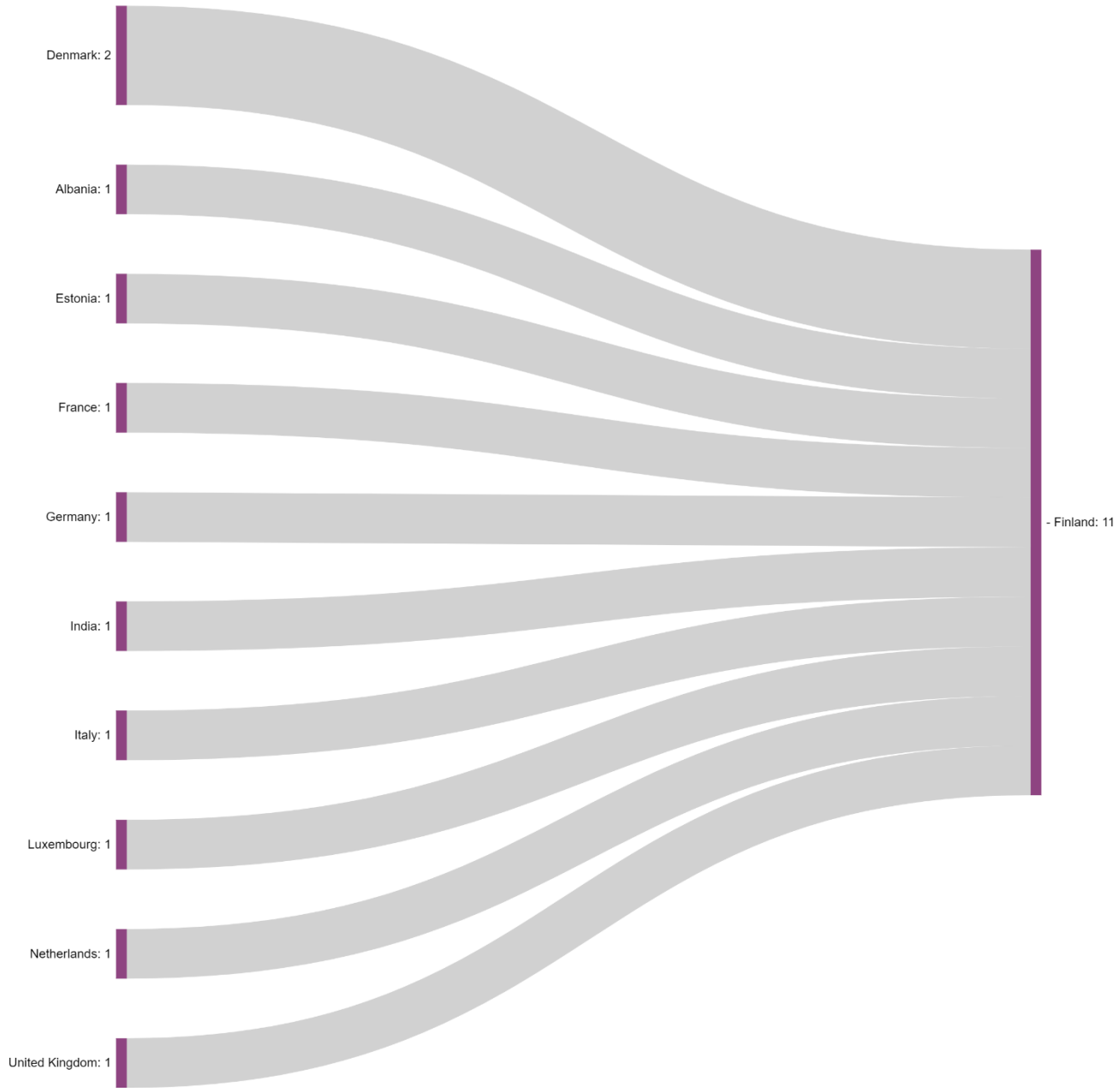

France

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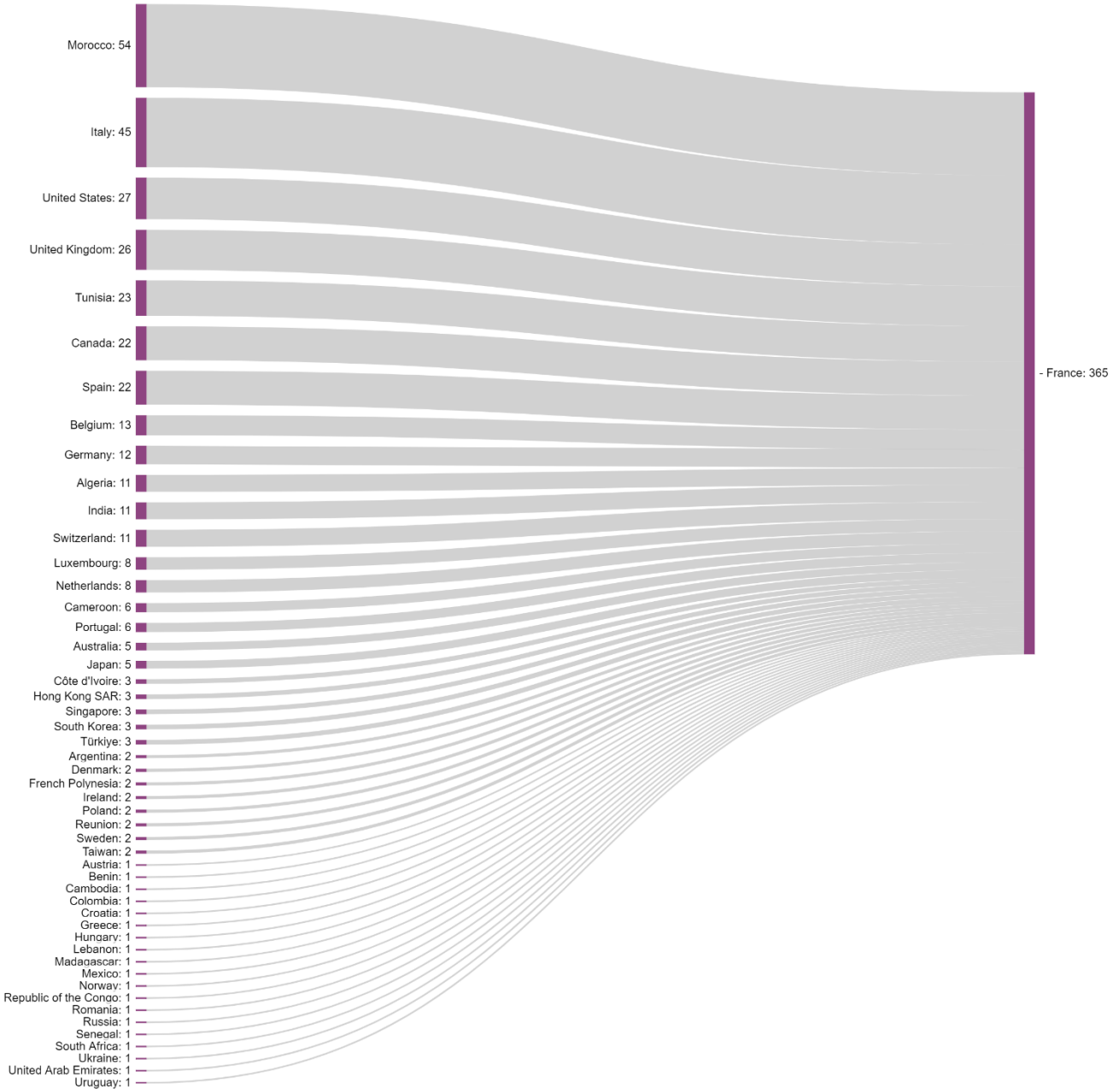

Germany

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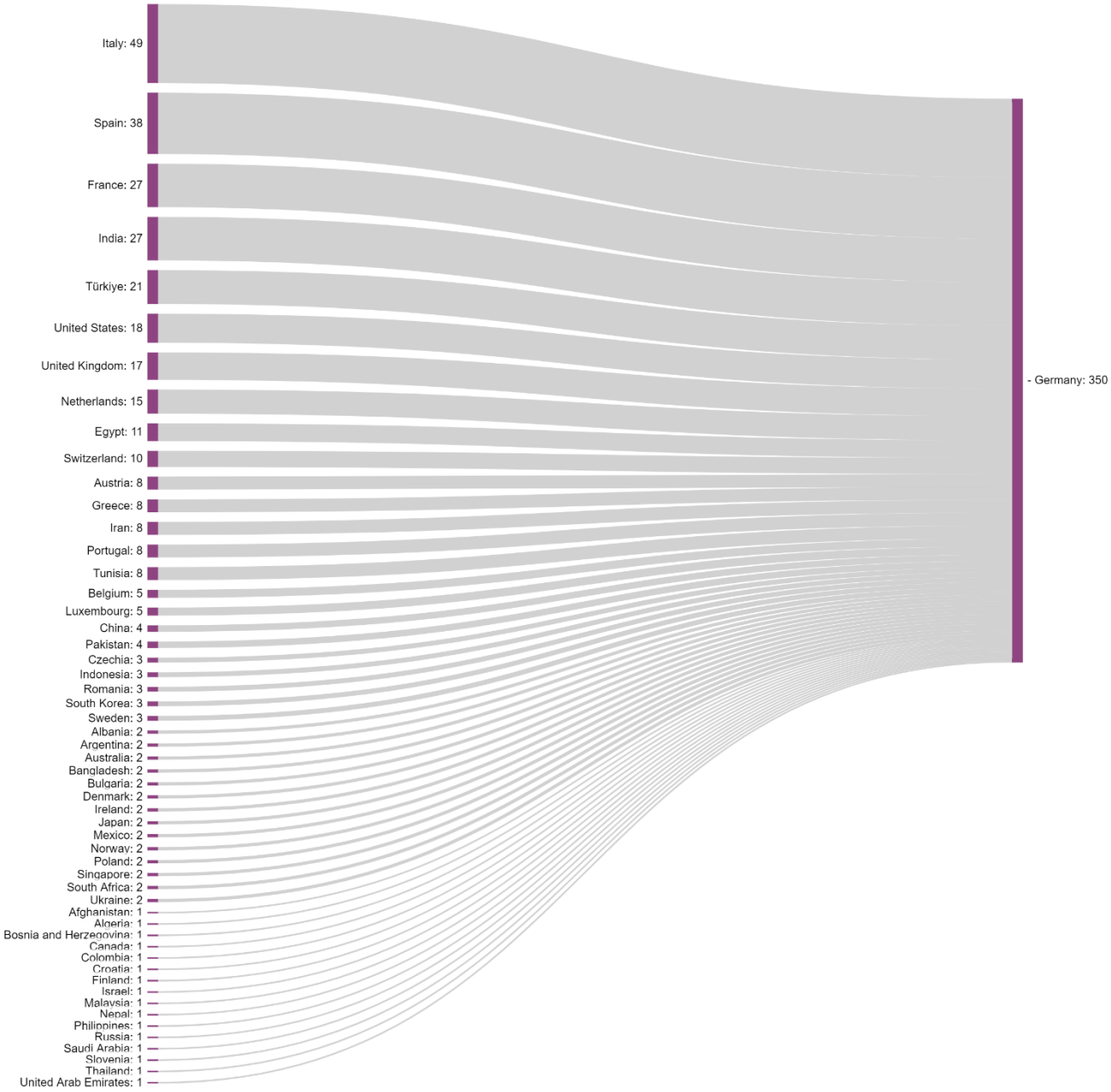

Greece

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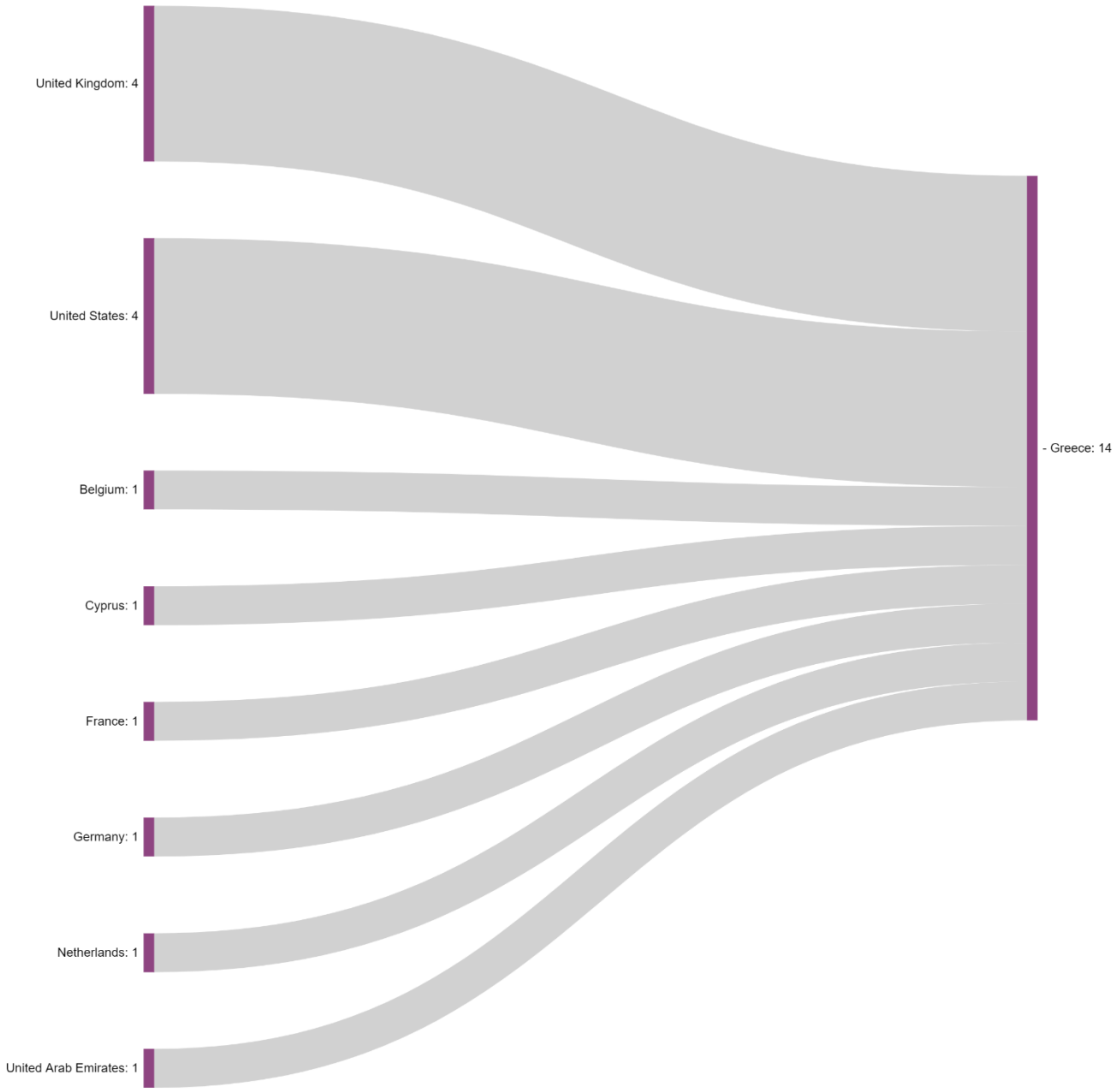

Hungary

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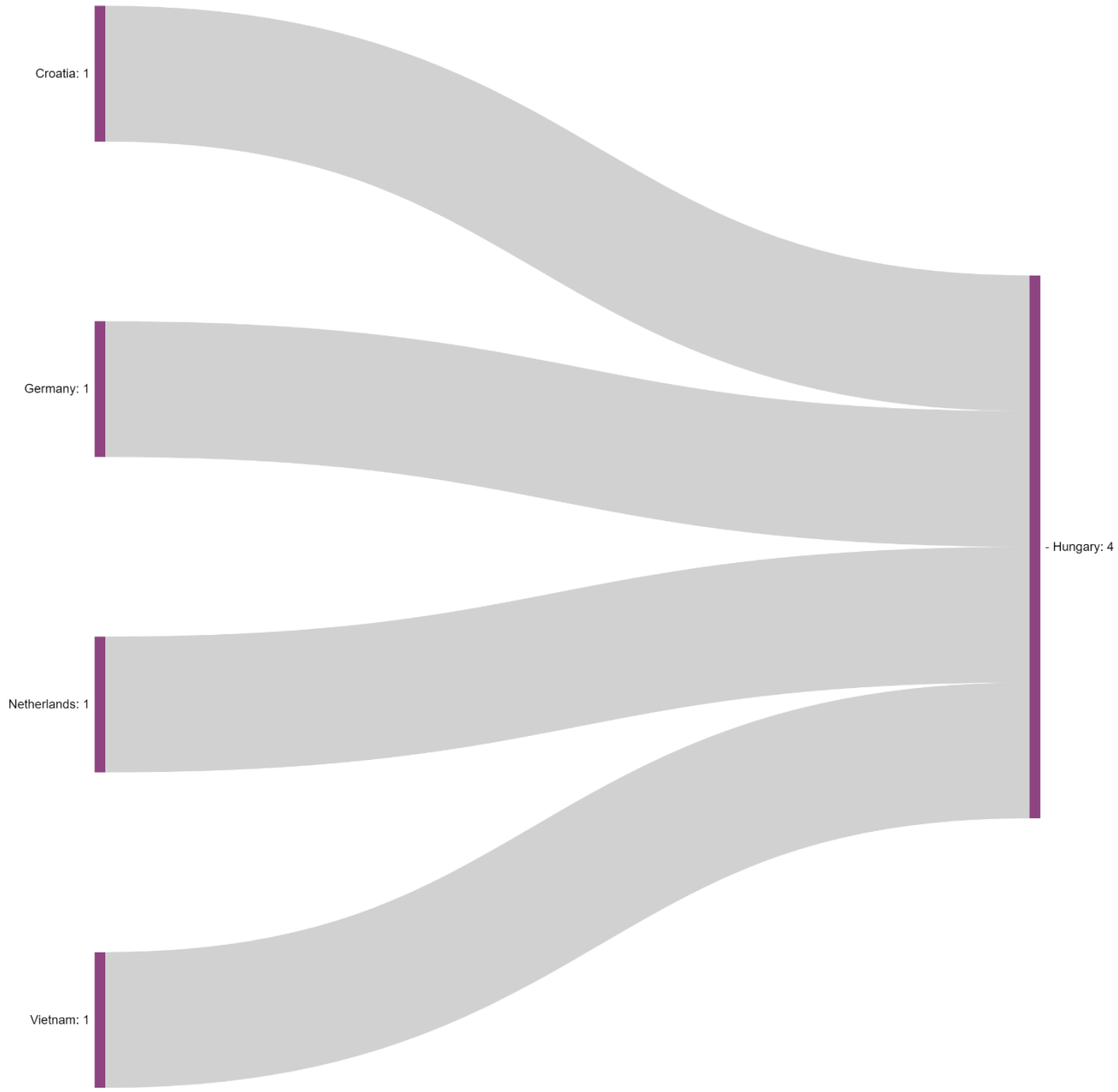

Ireland

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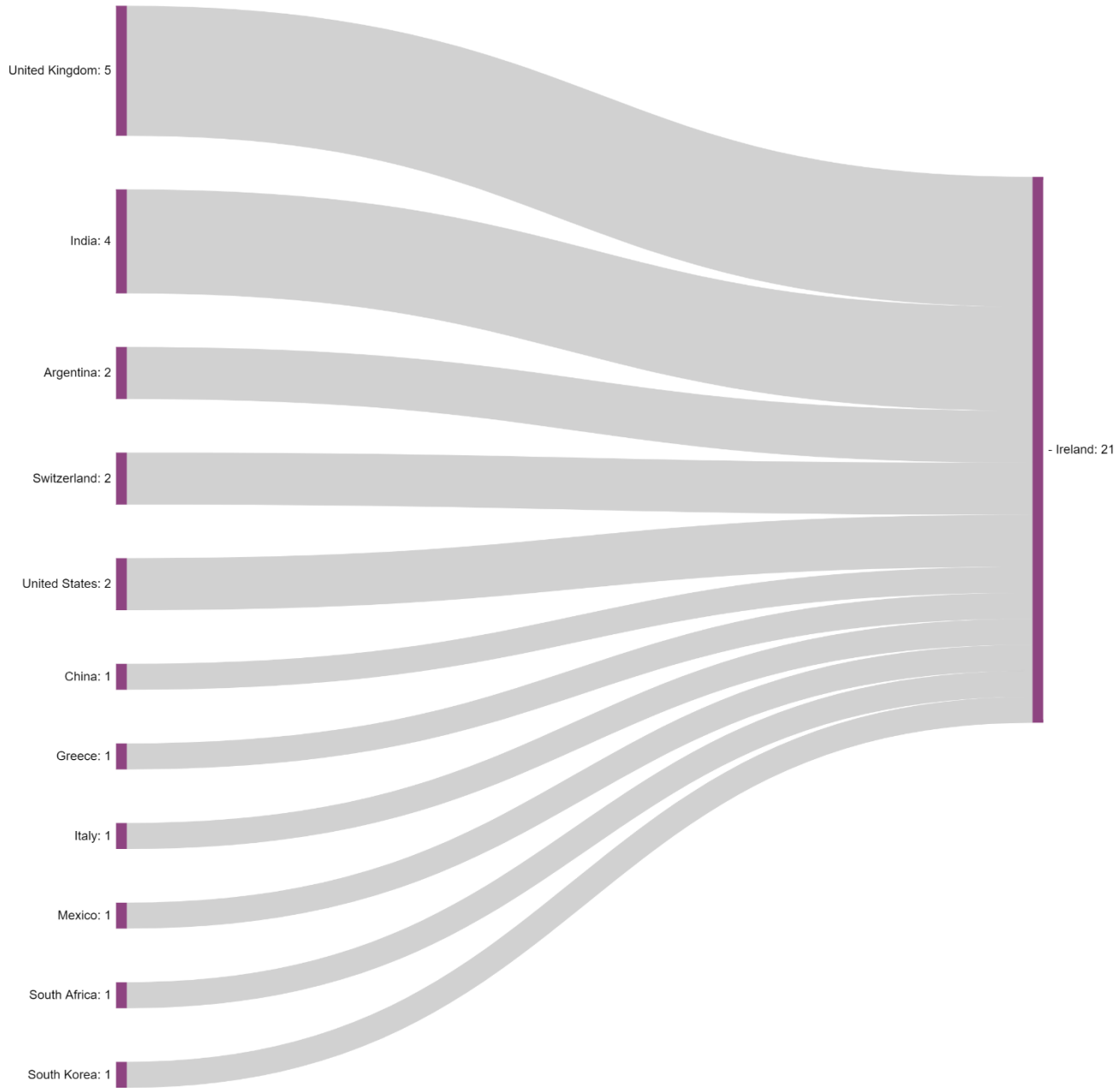

Italy

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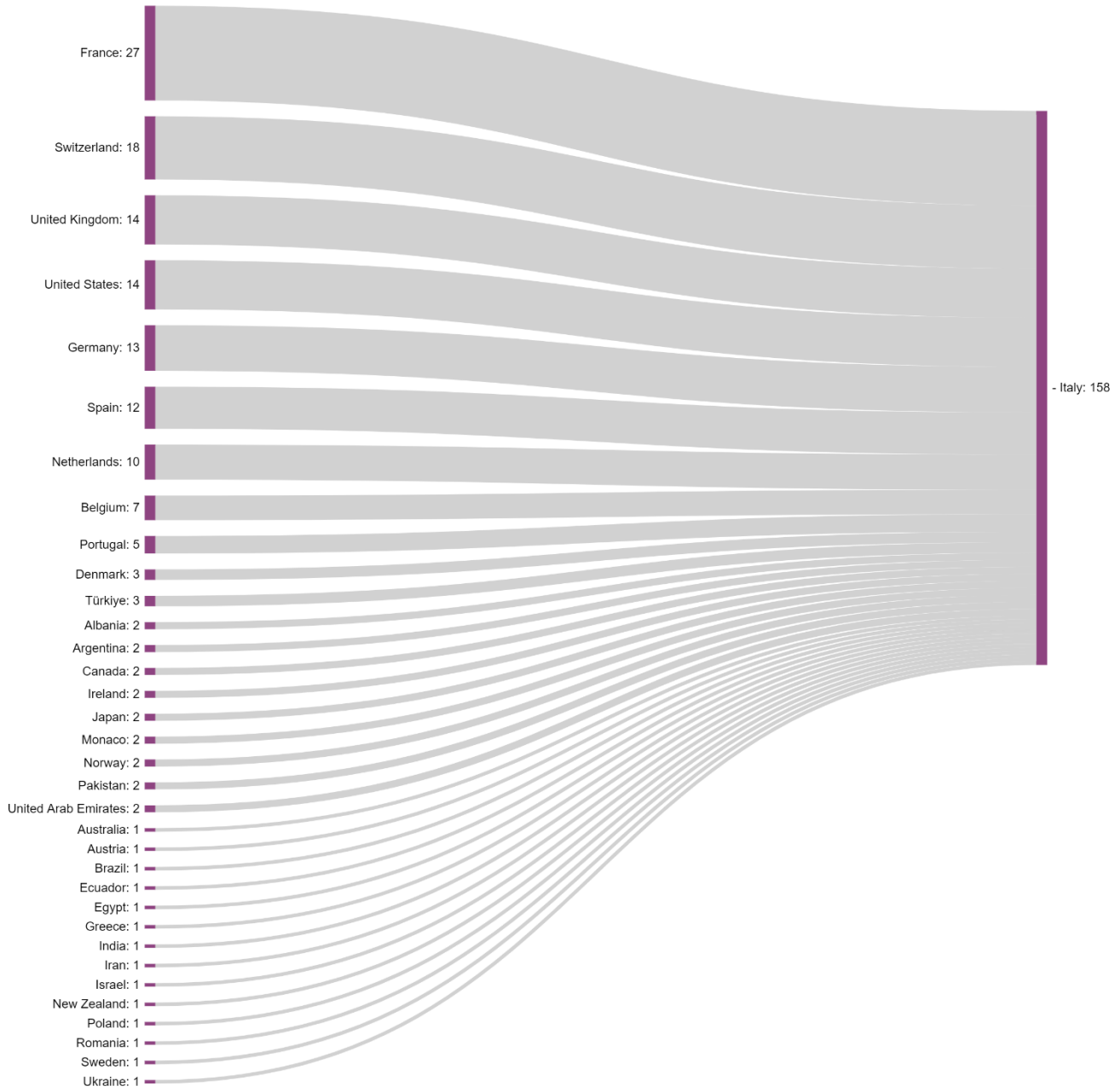

Latvia

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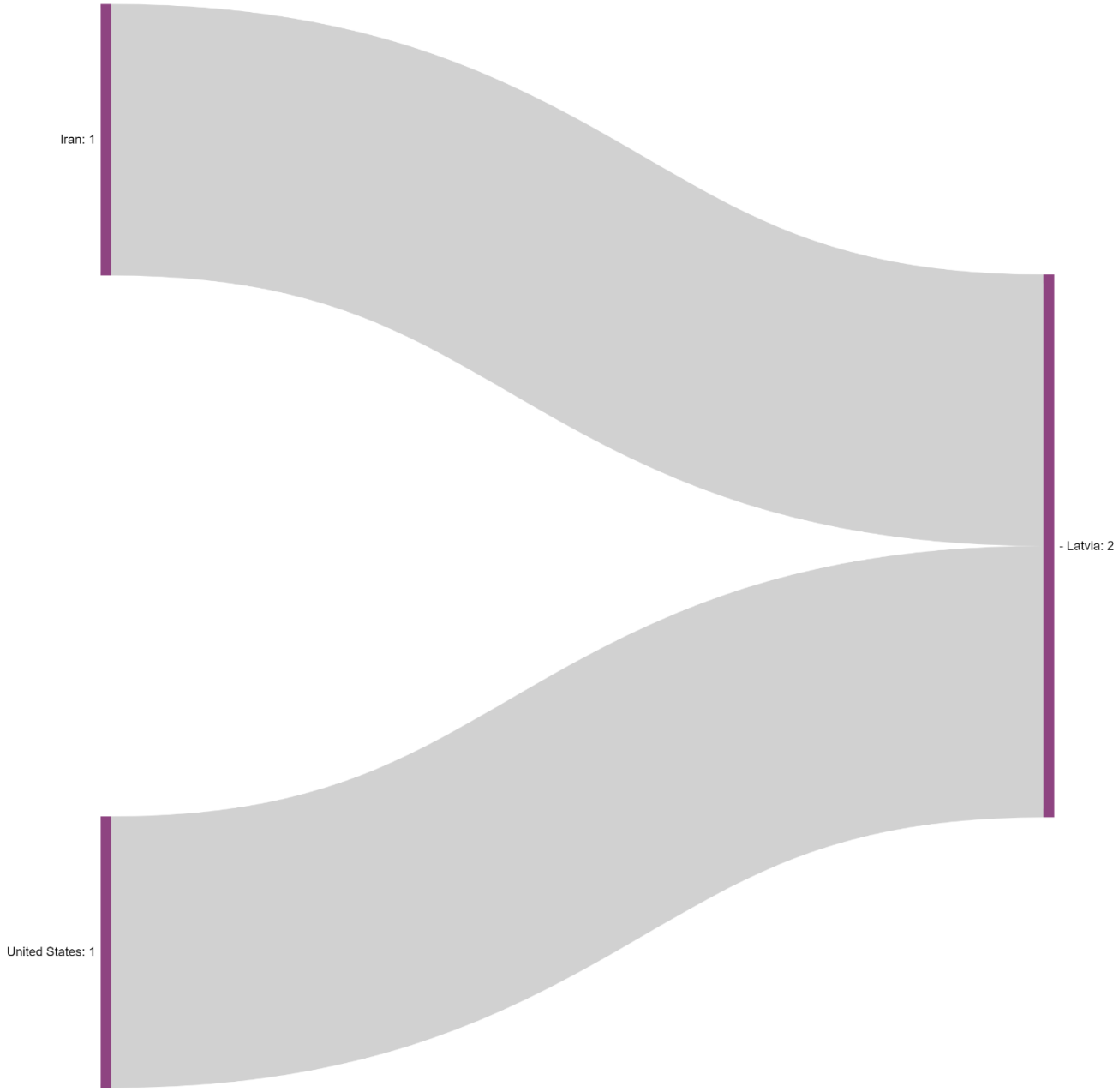

Lithuania

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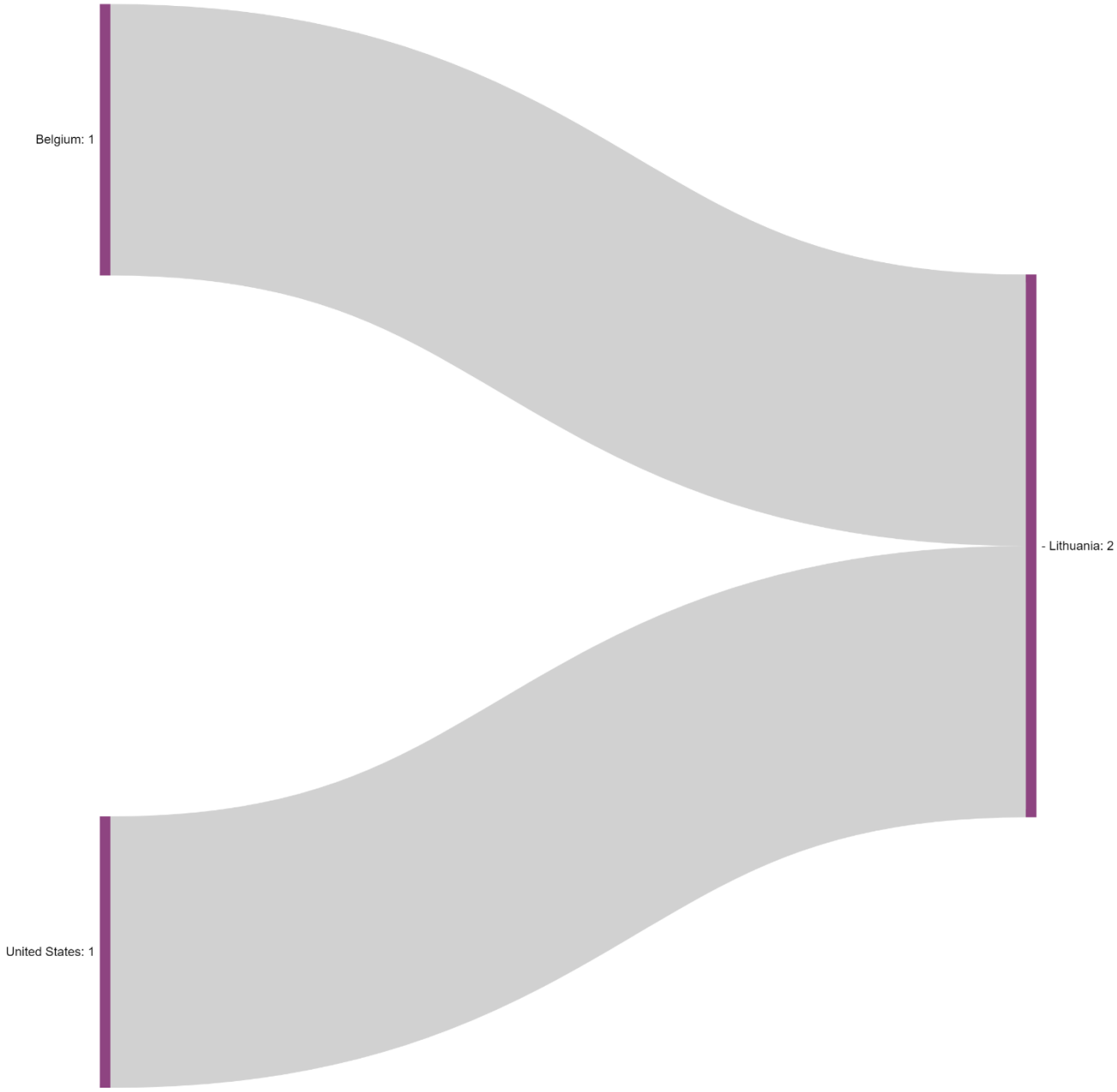

Luxemburg

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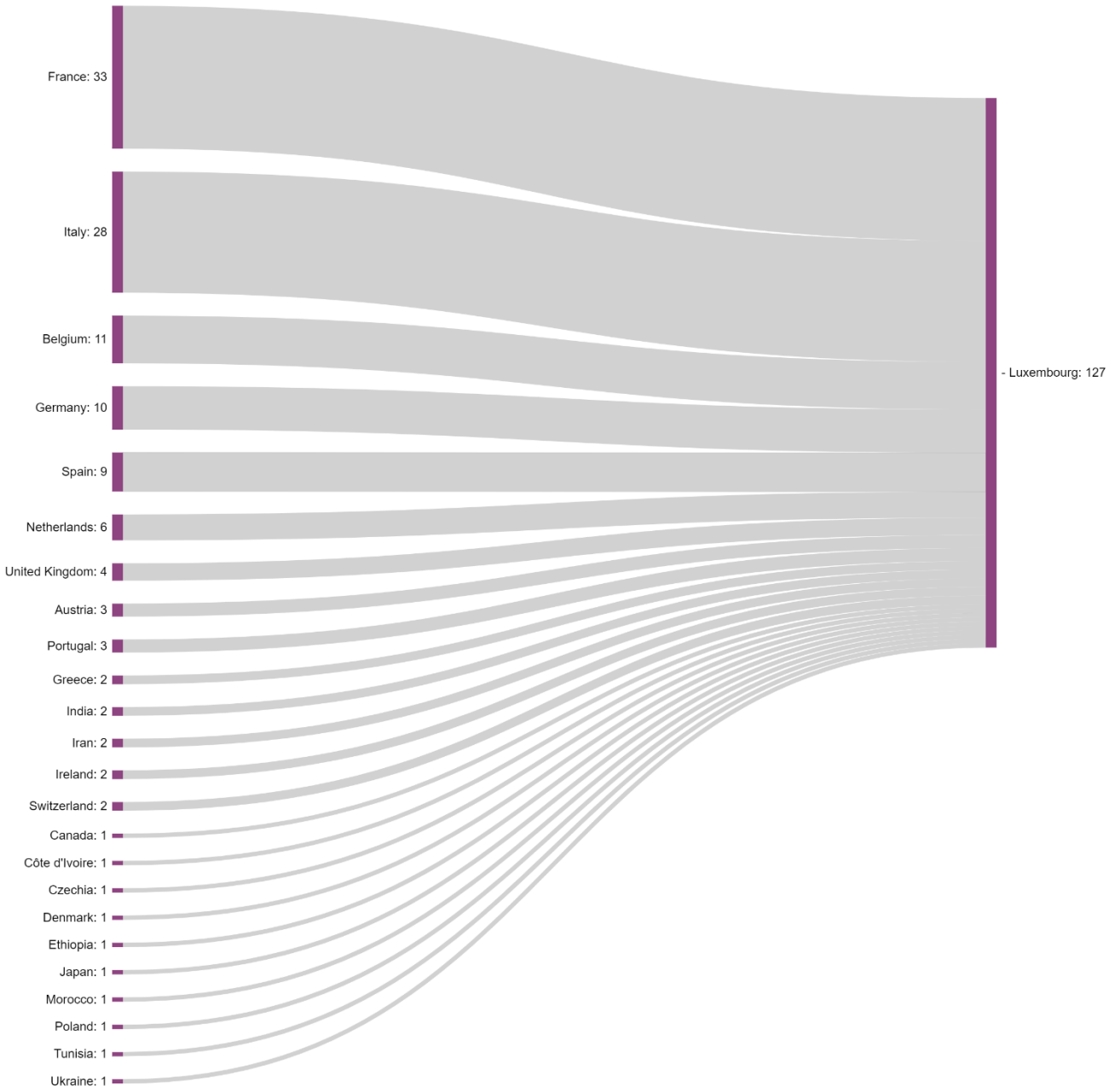

Netherlands

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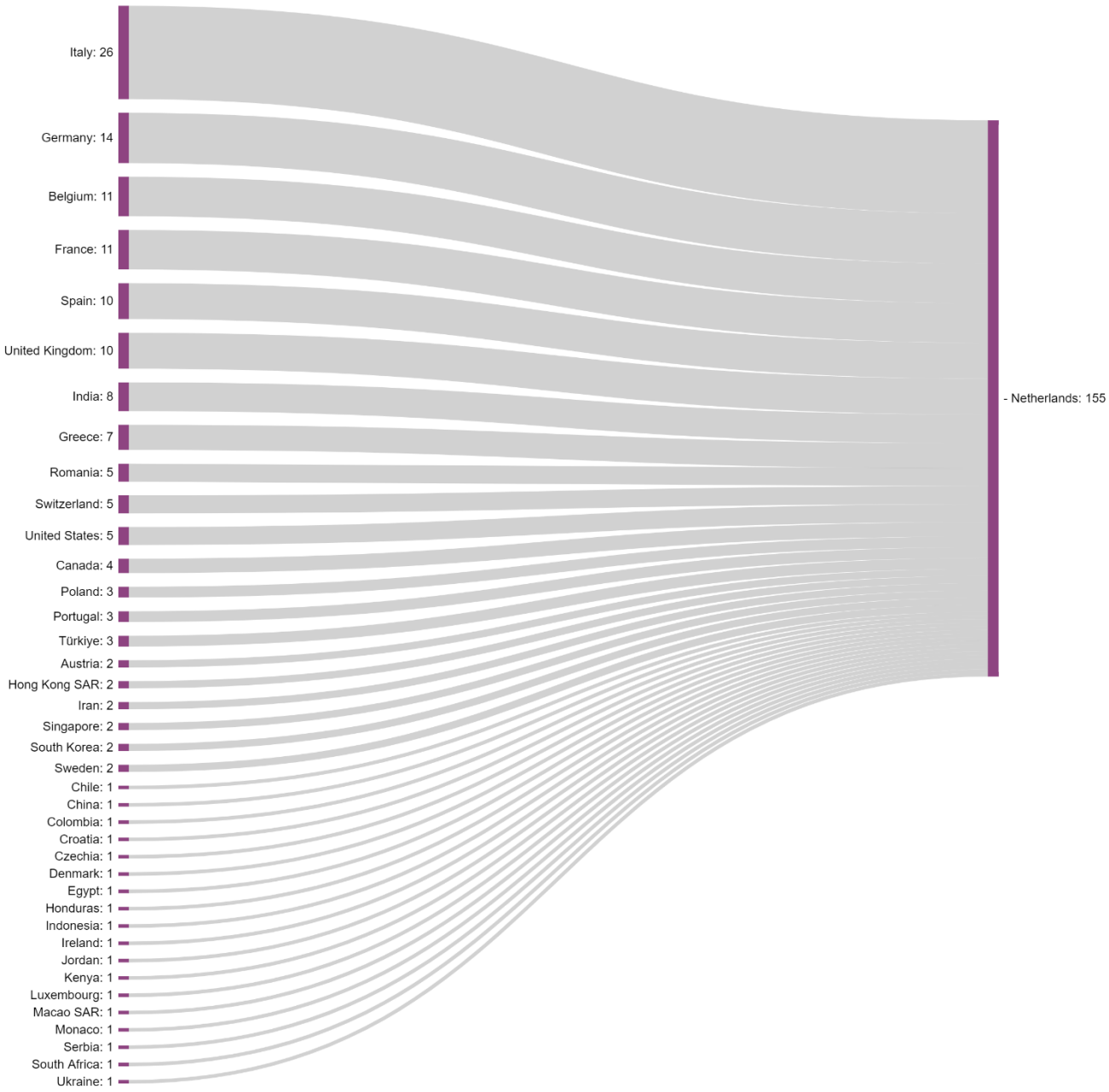

Poland

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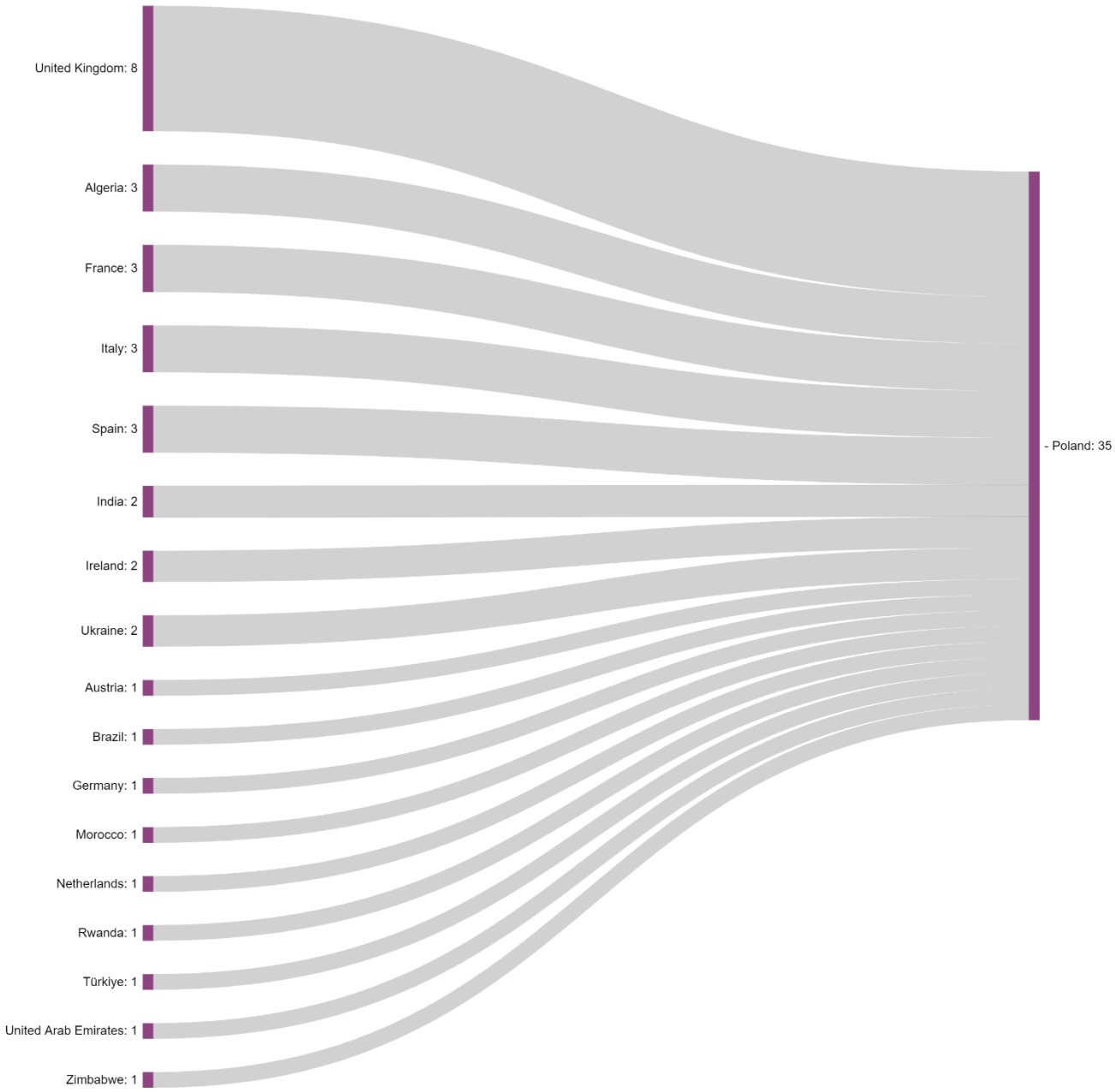

Portugal

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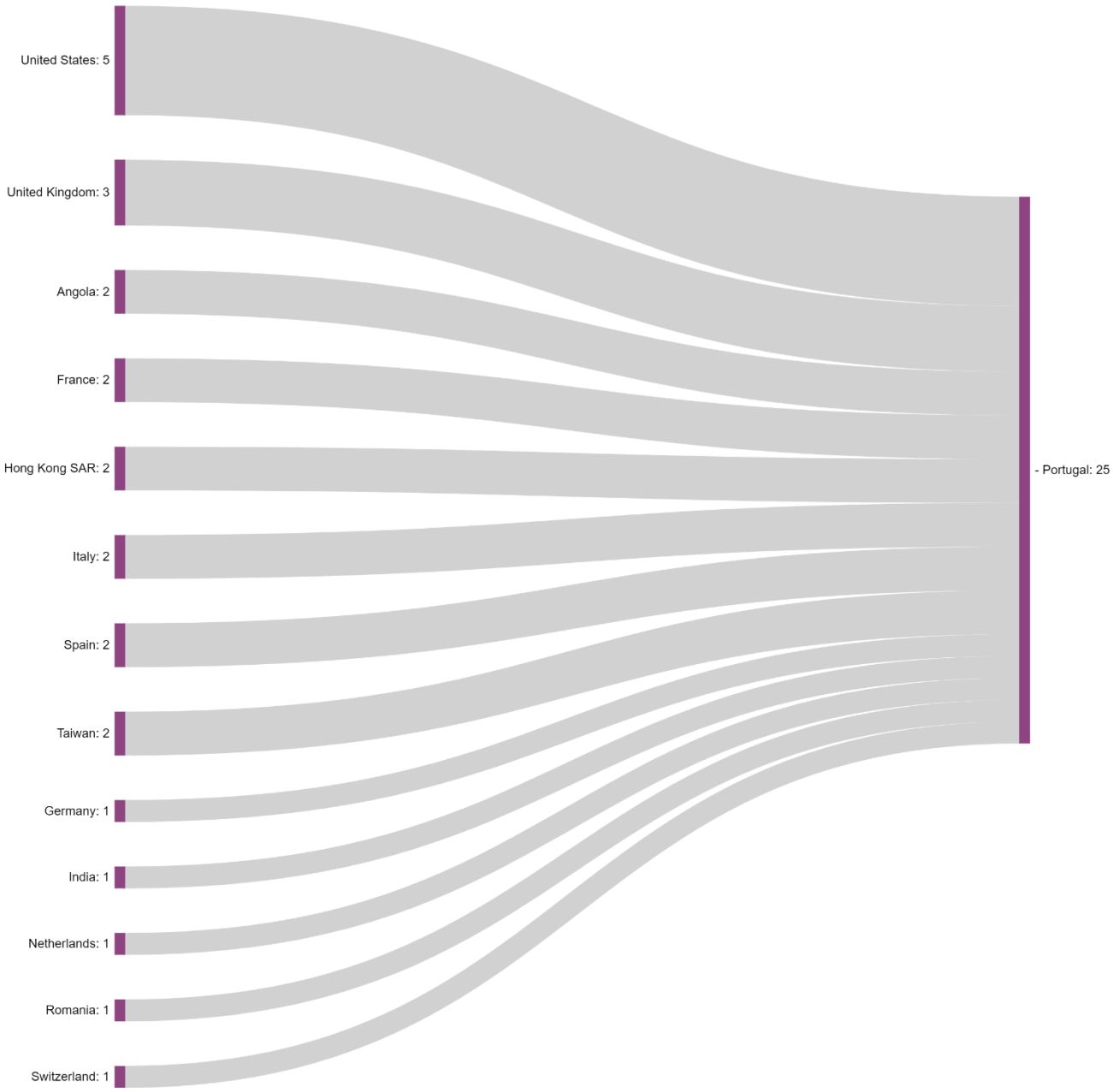

Romania

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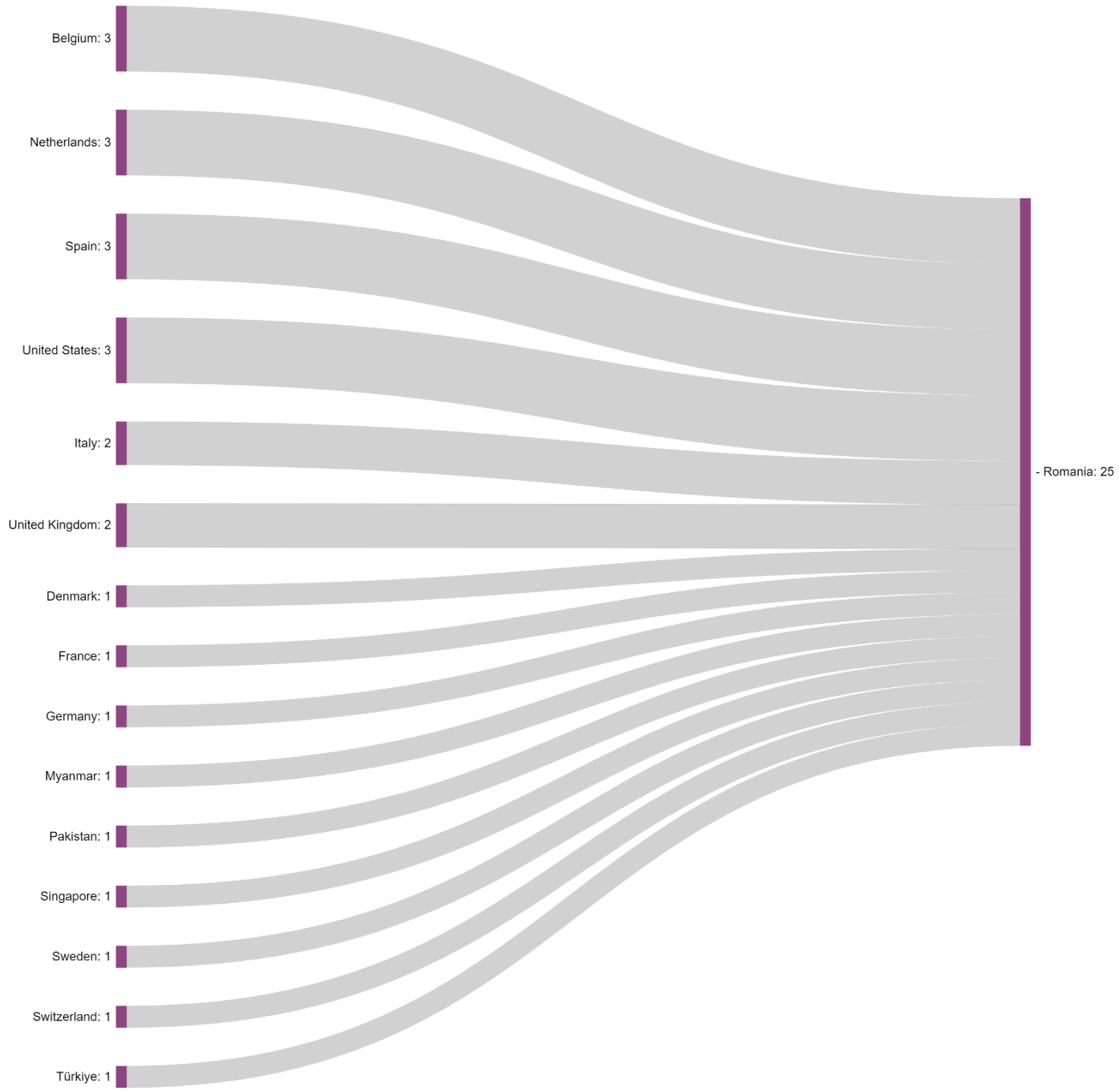

Slovakia

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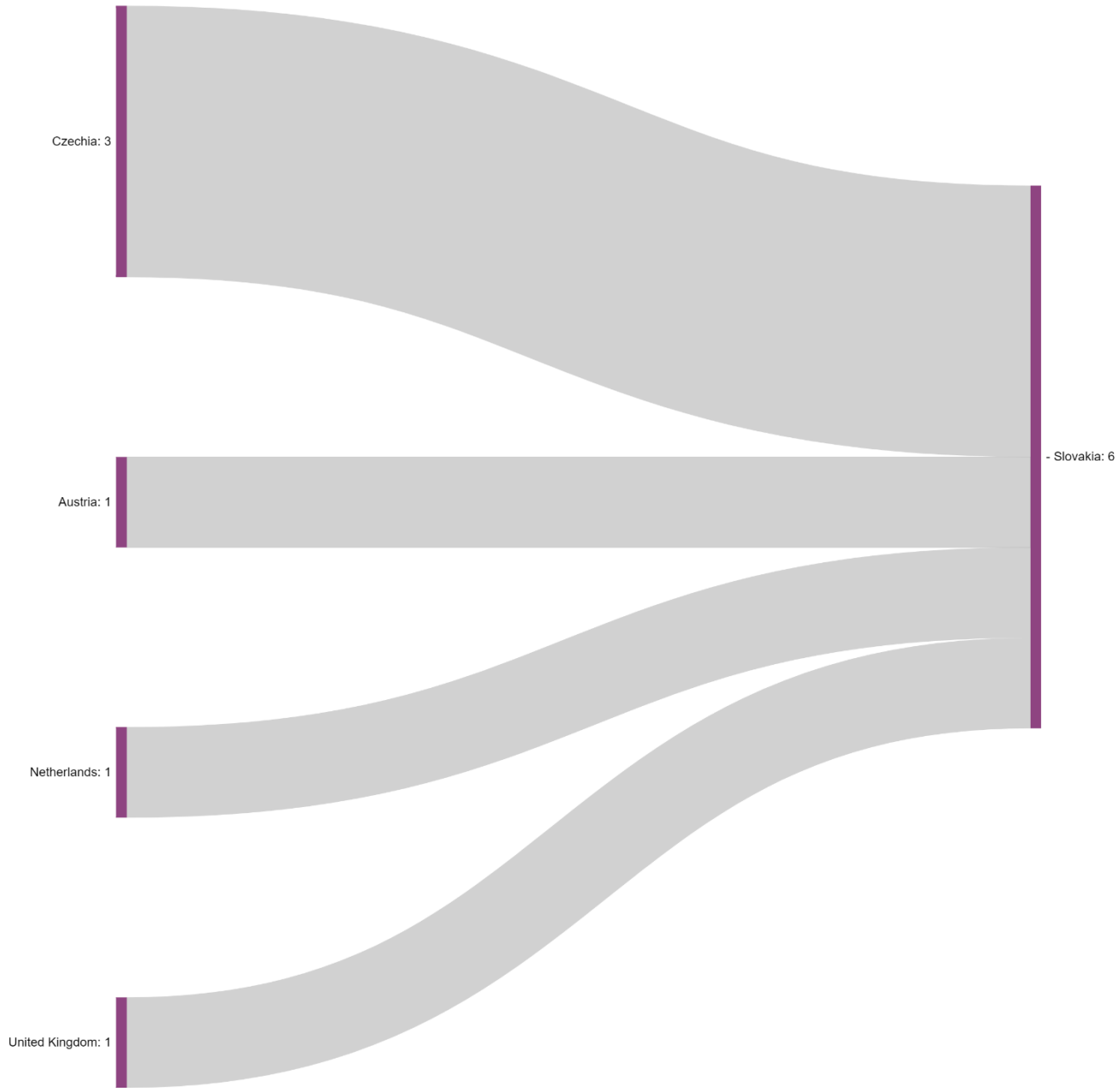

Slovenia

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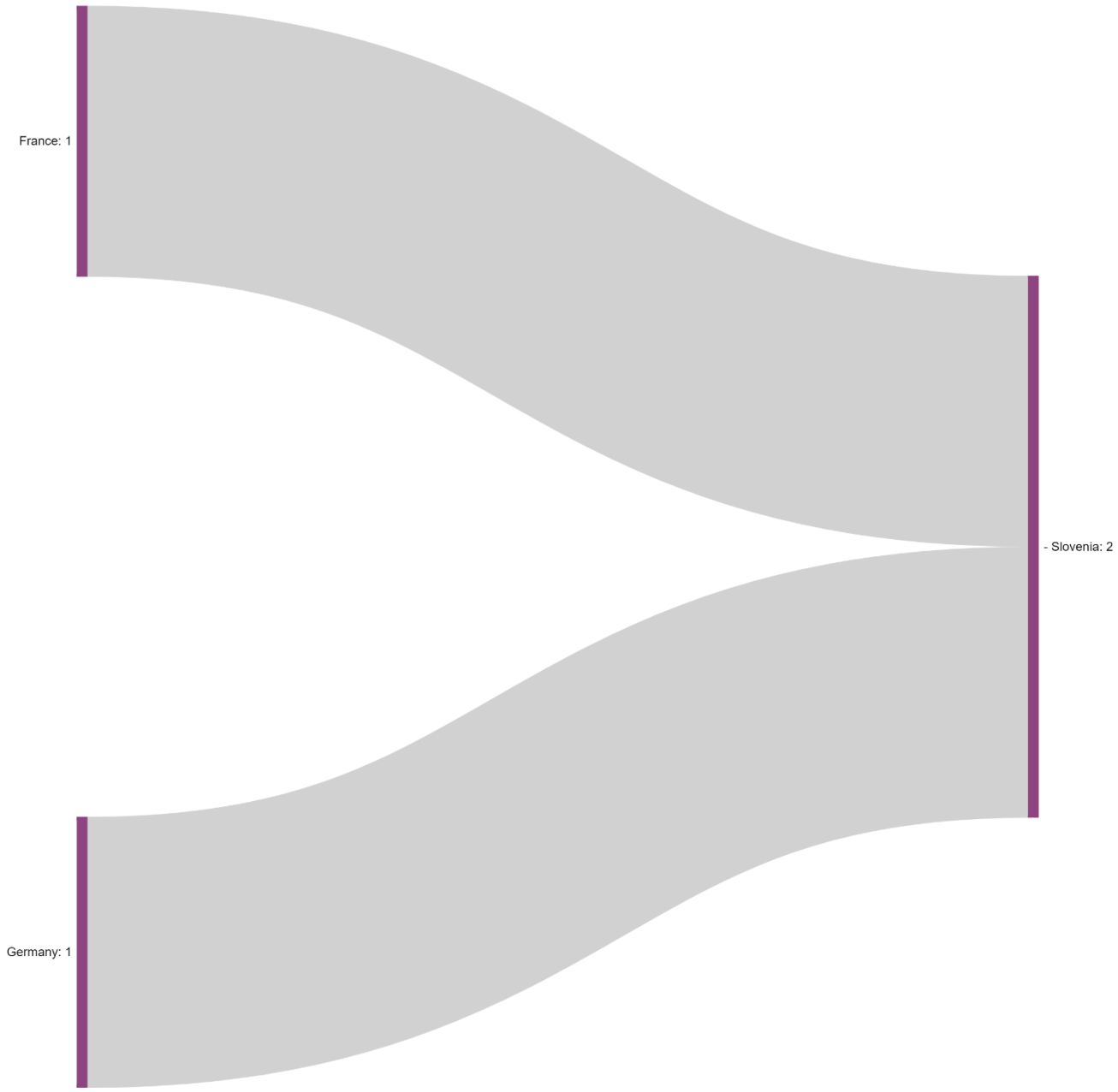

Spain

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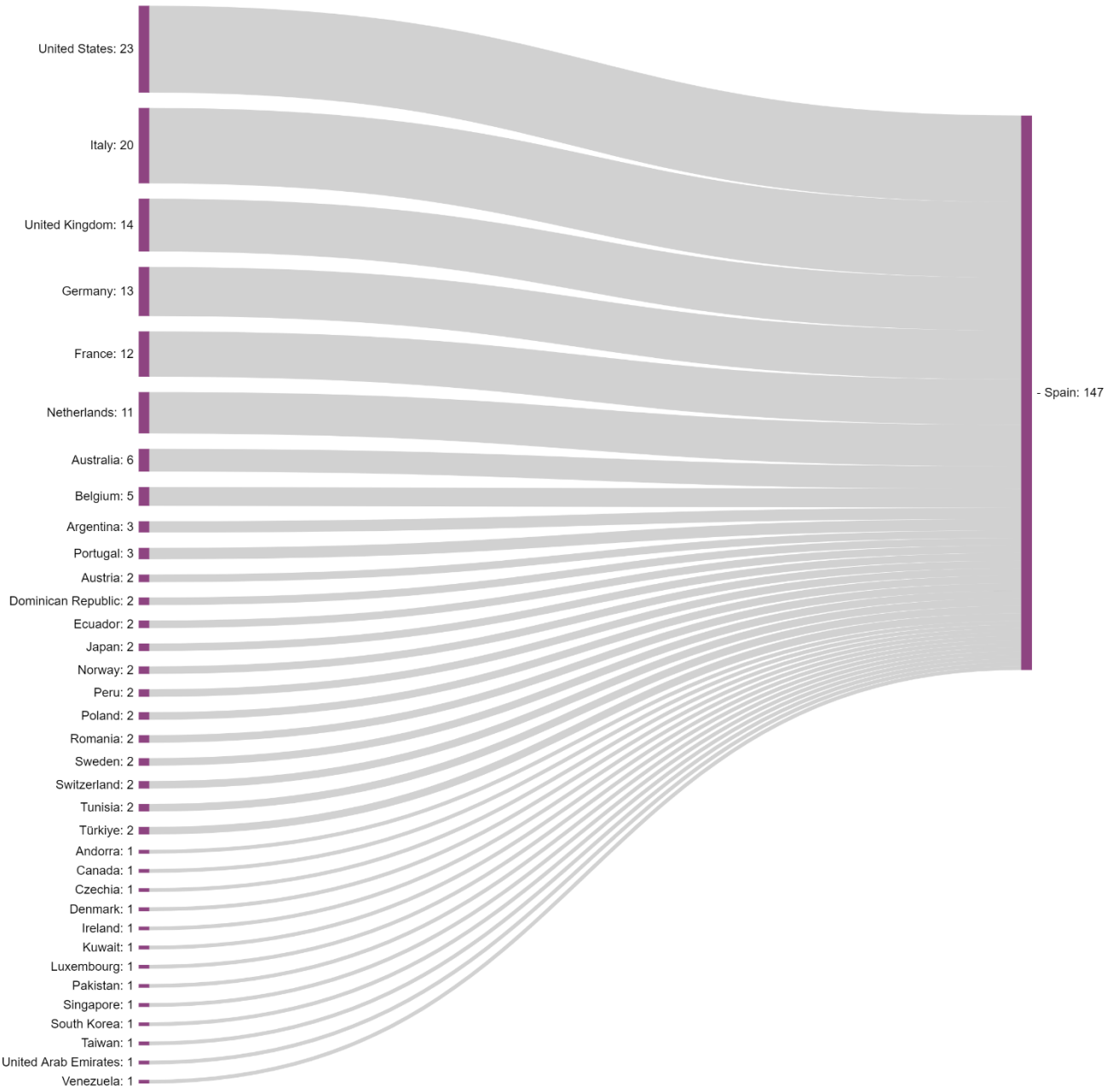

Sweden

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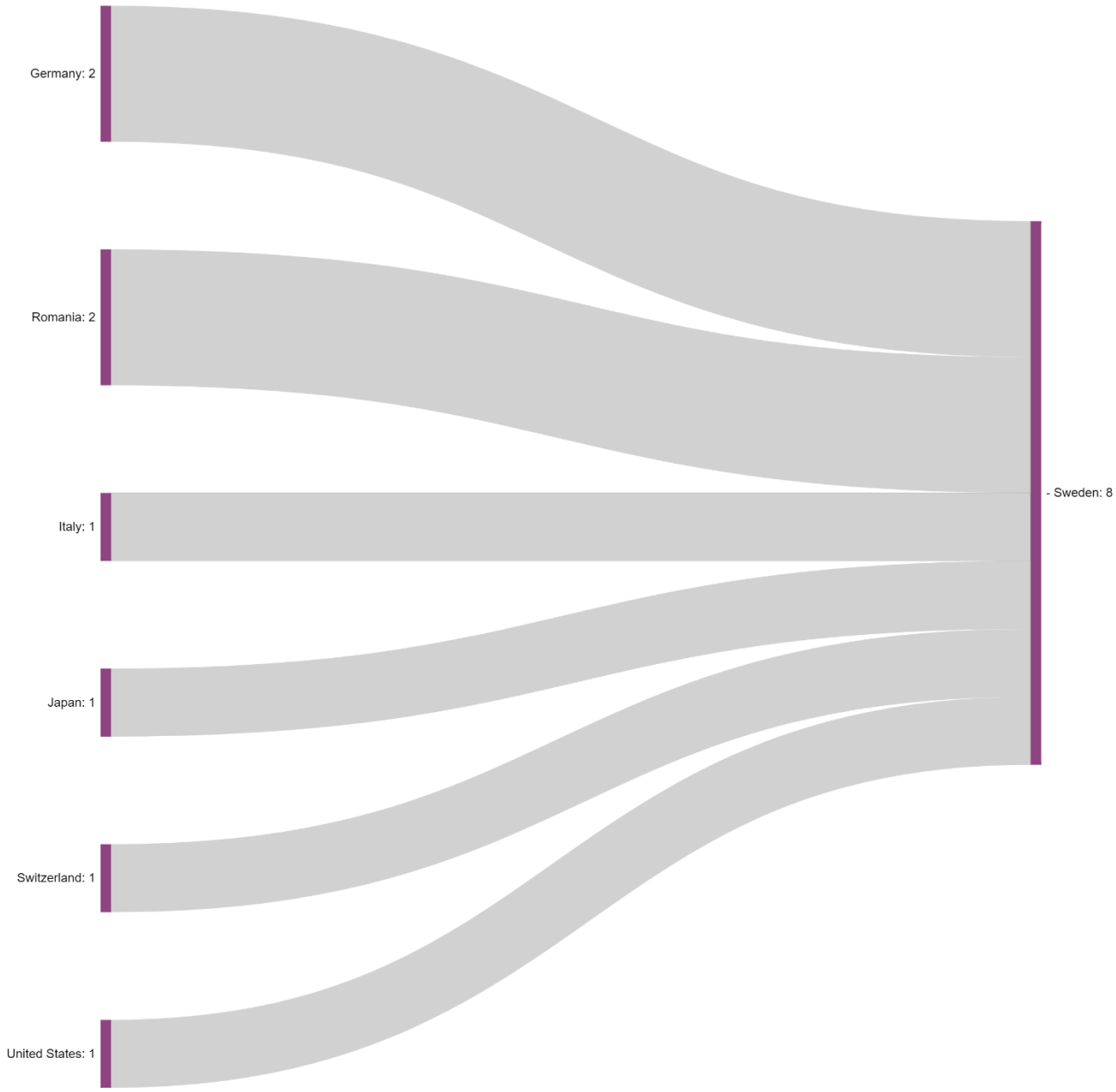

United Kingdom

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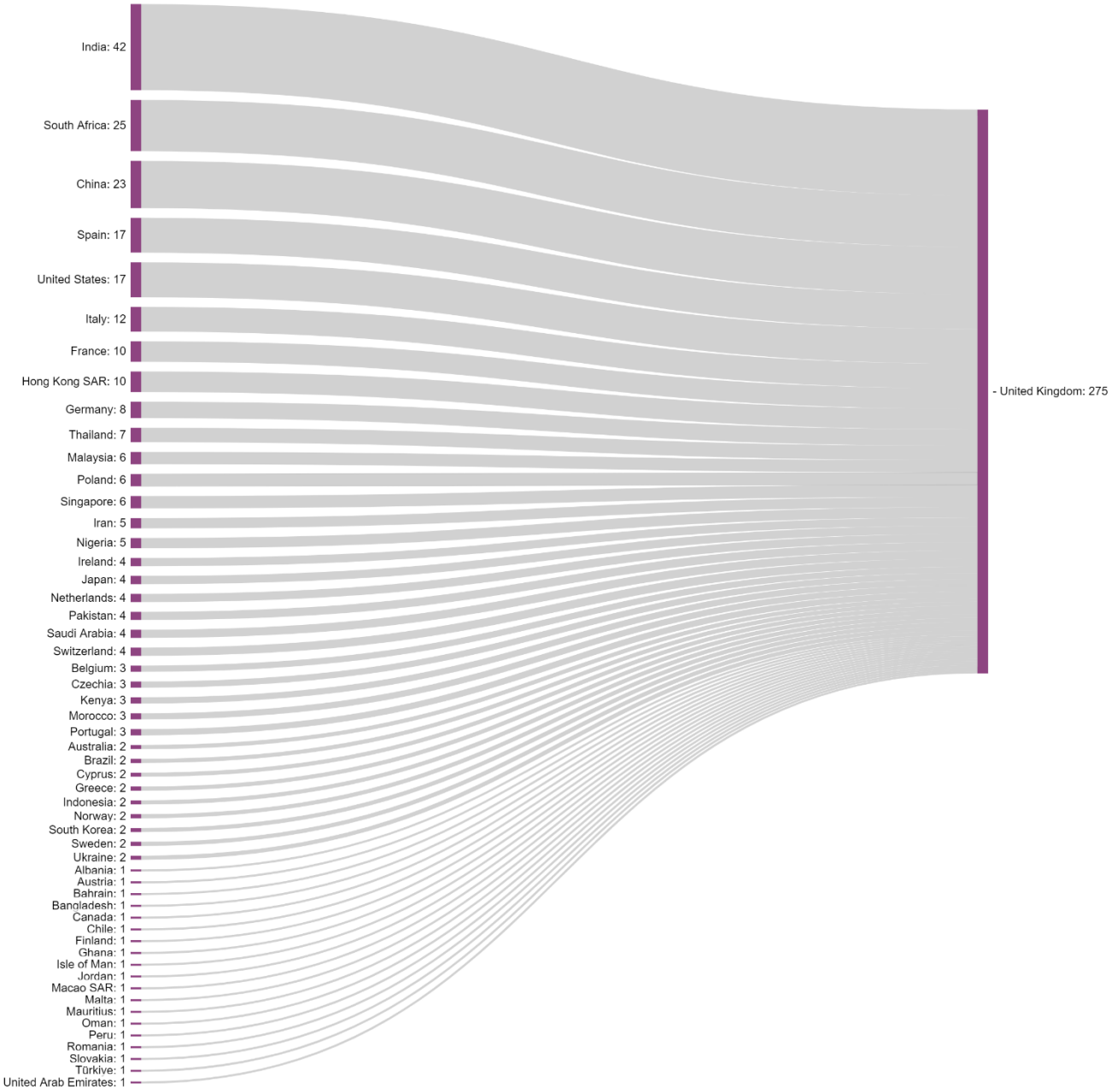

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12. APPENDIX E

Excel – raw data extracted from the online survey platform of the Mobility and Soft Skills Survey.

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13. APPENDIX F

Excel – raw data extracted from the online survey platform of the ASTRAIOS Survey on Career Paths.

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14. APPENDIX G

Analysis Report on Existing Mobility Programs (ERASMUS) – attached.

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Alias ASTRAIOS_Survey_on_Mobility_and_Soft_Skills
Export Date 06/11/2024 13:59

1. I am:	2. What is your gender?	3. Which country do you originally come from?	4.A. What is your qualification? Bachelor:Field of study (subject, specialization)	4.A. What is your qualification? Bachelor:Country	4.A. What is your qualification? Master :Field of study (subject, specialization)	4.A. What is your qualification? Master :Country	4.A. What is your qualification? Ph.D.:Field of study (subject, specialization)	4.A. What is your qualification? Ph.D.:Country	5. In which country are you currently based (for work/study)?	6. Did you get any of your degrees in a country other than your native country?	7. If you moved countries for studies, what was the reason?	7.1. Other - If you moved countries for studies, what was the reason?	8.1. Other - If you have not moved out of your country for studies, why did you decide to remain in your home country?	9. Have you got any professional experience?	10. During your life, how many times have you moved countries to pursue your studies/training? Please [include/exclude] any secondments, internships and/or exchanges during your degree(s).
Student	M.	Italy			Telecomunnication Eng				Italy	No				Junior (0-4 years of prof	1-2 times
Student	F.	Italy			Computer Sciences	Italy			Italy	No				Mid-career (5-14 years (	1-2 times
Senior professional	M.	France					Astrophysics	France	France	No				Senior with 15+ years o	1-2 times
Senior professional	M.	France			Mechatronics & Comple	France			France	No			Family constraints	Senior with 15+ years o	1-2 times
Student	M.	India	Aerospace	India	Aerospace	Russia	Aerospace	United Kingdom	United Kingdom	Yes	I found this program to l			No professional experie	1-2 times
Senior professional	M.	Belgium	Aerospace Eng.	Belgium	Space mission analysis	United Kingdom			United Kingdom	Yes	I found this program to l			Mid-career (5-14 years (	1-2 times
Senior professional	M.	France			General Eng.	France			France	No			French specific scholars	Senior with 15+ years o	None
Young professional	F.	Serbia	Aerospace Eng.	Netherlands	Space Eng.	Netherlands			Netherlands	Yes	I found this program to l			No professional experie	1-2 times
Young professional	M.	United Kingdom			Mechanical Eng.	United Kingdom			France	No				Mid-career (5-14 years (	3-5 times
Young professional	M.	France			Compute Eng.	France			France	No				Mid-career (5-14 years (	1-2 times
Senior professional	M.	Greece				Greece		Greece	Germany	Yes	This specialization does			Mid-career (5-14 years (	3-5 times
Senior professional	F.	Spain	Aerospace Eng.	USA	Aerospace Eng.	USA			Netherlands	Yes	Other	I found this program to l		Senior with 15+ years o	1-2 times
Senior professional	M.	United Kingdom					Sciences	United Kingdom	Netherlands	Yes	I secured a scholarship			Senior with 15+ years o	5+ times
Senior professional	M.	Italy	Aerospace Eng.	Italy	Space Eng.	Italy	Space System Eng.	Italy	Netherlands	No				Senior with 15+ years o	1-2 times
Student	M.	Germany	Aerospace, Space-systems	Germany					Germany	No				No professional experie	None
Young professional	M.	Japan	Mechatronics	Japan	Mechatronics	Japan			Japan	No				Mid-career (5-14 years (	1-2 times
Student	F.	Spain	Aerospace vehicules Eng.	Spain	Aeronautical Eng.	Spain			United Kingdom	Yes	I wanted to move out of			No professional experie	1-2 times
Senior professional	F.	Italy			Aerospace Eng.	Italy			Netherlands	Yes	I found this program to l			Senior with 15+ years o	1-2 times
Senior professional	M.	Japan			Plasma Physics	Japan			Japan	No				Senior with 15+ years o	None
Young professional	M.	Italy					Electronics Enegineerin	Italy	Italy	No			I wanted to contribute to	Mid-career (5-14 years (	None
Young professional	F.	United Kingdom	Aerospace Eng.	United Kingdom	Spacecraft Eng.	United Kingdom			Germany	No			was not promoted to do	Junior (0-4 years of prof	1-2 times
Student/Young professi	M.	Italy			Space Engineering	Italy			Netherlands	No				Junior (0-4 years of prof	3-5 times
Senior professional	F.	Spain			Aerospace Enginee; Tel	Spain			France	No				Mid-career (5-14 years (	3-5 times
Young professional	X.	United Kingdom	Natural sciences - Physics	United Kingdom			Space engineering GNS	United Kingdom	United Kingdom	No			Recieved PhD funding i	Mid-career (5-14 years (	1-2 times
Student/Young professi	F.	Italy	Aerospace	Italy	Aerospace (propulsion)	Italy			Italy	No				No professional experie	None
Young professional	M.	France			Mechanical Engineering	Switzerland			Germany	Yes	Other	The university was more		Junior (0-4 years of prof	1-2 times
Student/Young professi	M.	Italy	Mechanical Engineering	Italy	Energy / Mechanical En	Italy / United Kingdom	System Engineering	Italy / Germany	Italy	Yes	Other	Erasmus+ / Phd ABROA		Junior (0-4 years of prof	1-2 times
Young professional	F.	Italy	Aerospace Engineering	Italy	Aerospace Engineering	Italy	Physics and astronomy	United Kingdom	United Kingdom	No				Mid-career (5-14 years (	1-2 times
Senior professional	M.	Turkey	Astronomy	Turkey	Space Management	Turkey	Space Tech	Turkey	Turkey	Yes	I found this program to l			Senior with 15+ years o	5+ times
Senior professional	F.	France					Public Policy / Space pc	Japan	France	Yes	I found this program to l			Senior with 15+ years o	5+ times
Young professional	M.	Greece	electrical engineering	greece	robotics	greece			Luxembourg	No				Junior (0-4 years of prof	1-2 times
Young professional	F.	Germany	physics	germany	space science	germany			United Kingdom	No				Junior (0-4 years of prof	1-2 times
Student/Young professi	M.	Germany	electrical engineering	germany	robotics	germany			Germany	No				Junior (0-4 years of prof	1-2 times
Senior professional	F.	Switzerland	physics	switzerland	systems engineering	switzerland			Luxembourg	No				Mid-career (5-14 years (	1-2 times
Young professional	X.	United Kingdom	engineering	uk	spacecraft engineering	uk			United Kingdom	No				Mid-career (5-14 years (	None
Senior professional	M.	Norway	electrical engineering	norway			space engineering	norway	Norway	No				Mid-career (5-14 years (	None
Young professional	F.	Denmark			satellite engineering	denmark			Sweden	No				Junior (0-4 years of prof	1-2 times
Young professional	M.	United Kingdom	aerospace engineering	UK	systems engineering	UK			United Kingdom	No				Junior (0-4 years of prof	None
Student/Young professi	M.	Portugal	mechanical engineering	portugal	robotics	portugal			Spain	No				Junior (0-4 years of prof	1-2 times
Young professional	F.	Romania	business	romania	business	romania			Belgium	No				Junior (0-4 years of prof	1-2 times
Senior professional	M.	United Kingdom	physics	uk			astrophysic	france	United Kingdom	Yes	I found this program to l			Senior with 15+ years o	3-5 times
Young professional	M.	Poland			mechanical engineering	poland			Germany	No				Junior (0-4 years of prof	1-2 times
Senior professional	F.	United Kingdom	physics	UK			space science	UK	United Kingdom	No				Senior with 15+ years o	1-2 times
Student/Young professi	F.	Spain	mechanical engineering	spain					Spain	No				Junior (0-4 years of prof	None
Young professional	F.	Italy	engineer	italy	Satellite Engineering	italy			France	No				Junior (0-4 years of prof	1-2 times
Senior professional	M.	Germany	Engineering	Germany			Aerospace Engineering	Germany	Netherlands	No				Senior with 15+ years o	1-2 times
Young professional	X.	France	Physics	France			Astrophysics	France	France	No				Junior (0-4 years of prof	None
Student	M.	Hungary	Business	Hungary					Hungary	No				No professional experie	None
Senior professional	F.	France			Space systems enginee	France			France	No				Mid-career (5-14 years (	3-5 times
Young professional	F.	Hungary			Architecture and Engine	Hungary			Italy	Yes	I found this program to l			Mid-career (5-14 years (	3-5 times
Student	M.	South Africa	mech engingeering	south africa	space studies	france, isu			South Africa	Yes	This specialization does			Junior (0-4 years of prof	1-2 times
Student	X.	United Kingdom	Aeromechanical Engineering	Scotland	Aeromechanical Engine	Scotland			United Kingdom	No				No professional experie	1-2 times
Young professional	M.	India	computer science and engin	India	space studies	France			India	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Young professional	X.	Ireland	B.A. International in Astroph	Ireland	Master of Science in Sp	France			Netherlands	Yes	This specialization does			Mid-career (5-14 years (	5+ times
Student/Young professi	M.	United States	Engineering	USA	Engineering	USA	Engineering	Germany; Switzerland	Germany	Yes	I found this program to l			Mid-career (5-14 years (	3-5 times
Senior professional	F.	United States	BM - Music performance	USA	MLIS - Library & Inform	Usa			United States	No				Senior with 15+ years o	None
Senior professional	F.	Italy			International Politics	Italy			Ireland	Yes	I wanted to move out of			Senior with 15+ years o	1-2 times
Student	F.	Italy	Archaeology	Uk	Molecular biology;	Australia	Earth Life Science	Japan	Japan	Yes	I secured a scholarship			Junior (0-4 years of prof	5+ times
Senior professional	M.	Austria	Technical Physics, Solid Sta	Austria	Geophysics, Planetary /	Austria			Austria	Yes	This specialization does			Senior with 15+ years o	1-2 times
Student/Young professi	M.	Belgium	Physics	Belgium	Aerospace engineering	Belgium			Belgium	No				Junior (0-4 years of prof	None
Student	X.	United States	Mechanical Engineering (Ast	United States	Space Studies (in progr	France			France	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Young professional	F.	United States	Biology	USA	Space Sciences	FRANCE			France	Yes	I found this program to l			Mid-career (5-14 years (	1-2 times
Student	F.	Denmark	Political Economy	UK	Space Studies	France			France	Yes	I found this program to l			No professional experie	1-2 times
Student	M.	Canada	Aerospace Engineering	Canada					France	No				Junior (0-4 years of prof	1-2 times
Student/Young professi	F.	Mexico	Cibernetics and Computers	Mexico					France	Yes	This specialization does			Mid-career (5-14 years (	1-2 times
Student	F.	Rwanda	Political Science	USA/UAE					France	Yes	I secured a scholarship			Junior (0-4 years of prof	5+ times
Student/Young professi	M.	Mexico	Medical Doctor	Mexico	Direction and Managem	Mexico			France	No				Junior (0-4 years of prof	1-2 times
Student	F.	Greece	Physics -electronics	Greece	Space studies	France			France	Yes	I found this program to l			No professional experie	1-2 times
Senior professional	M.	Greece					Mechanical Engineering	Greece	Greece	No				Mid-career (5-14 years (	None
Young professional	F.	Mexico	Mechanical Engineering	Mexico	Aeronautics and Space	Mexico			Mexico	No				Junior (0-4 years of prof	None
Senior professional	F.	United Kingdom			HR management	UK			Netherlands	Yes	Other	I did not move countries		Senior with 15+ years o	None
Young professional	M.	United Kingdom	Physics	UK	Astronautics and Space	UK			United Kingdom	No				Mid-career (5-14 years (	None
Senior professional	M.	New Zealand	Computer Science	Australia	Artificial Intelligence	UK			United Kingdom	Yes	Other	Career development.		Senior with 15+ years o	None

Young professional	M.	United Kingdom	Politics & International Relat	UK					United Kingdom	No				Junior (0-4 years of prof	1-2 times
Senior professional	F.	United Kingdom	Graphic Communication	Uk					United Kingdom	No				Mid-career (5-14 years (	None
Senior professional	M.	France	Electronics	France	Telecommunications	France			France	No				Senior with 15+ years o	None
Senior professional	F.	United Kingdom	None	None					United Kingdom	No			Great country for educa	Senior with 15+ years o	None
Student/Young professic	F.	South Africa	Aviation	Australia	Space science	France			Australia	Yes	This specialization does			Senior with 15+ years o	1-2 times
Young professional	F.	India	Computer science and engin	India	Space exploration syste	United Kingdom			United Kingdom	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Senior professional	M.	United Kingdom	Physics	Uk	Electronics	Uk	Microelectronics	Uk	United Kingdom	No				Senior with 15+ years o	5+ times
Young professional	F.	Italy	Languages and Economics	Italy	Marketing and Commur	UK			United Kingdom	Yes	I found this program to l			Junior (0-4 years of prof	3-5 times
Student/Young professic	M.	United Kingdom	Physics	UK	Astrophysics	UK	Space Systems Enginee	UK	United Kingdom	No				Junior (0-4 years of prof	None
Student/Young professic	M.	Germany	Engineering	DE	Aerospace Engineering	NL			Germany	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Senior professional	M.	United Kingdom	Anthropology	UK	Level 7 Diploma in Strat	UK			United Kingdom	No				Mid-career (5-14 years (	None
Young professional	M.	United Kingdom	Physics	UK	Astronautics & Space E	UK	Physics	UK	United Kingdom	No				Mid-career (5-14 years (	3-5 times
Young professional	F.	United Kingdom	Physics	UK	Physics	UK	Astrophysics	UK	United Kingdom	No				Mid-career (5-14 years (	None
Young professional	F.	Luxembourg	Aerospace Engineering	Germany	Space Studies	France			Germany	Yes	This specialization does			Junior (0-4 years of prof	3-5 times
Young professional	F.	Mexico	Aerospace Engineering	Mexico	Space Studied	France			Netherlands	Yes	This specialization does			Mid-career (5-14 years (	1-2 times
Senior professional	M.	Australia	Civil Engineering	Australia	Space Studies	France			Bulgaria	Yes	This specialization does			Senior with 15+ years o	1-2 times
Senior professional	M.	France			Physics, Systems, Auto	France			Belgium	No				Senior with 15+ years o	1-2 times
Young professional	F.	Canada	Kinesiology - University of T	Canada	Space Studies - Internat	France			France	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Young professional	F.	Italy			Space Exploration Engi	Netherlands			Germany	Yes	I found this program to l			Junior (0-4 years of prof	3-5 times
Young professional	M.	Canada	Automated Manufacturing Er	Canada	Space Studies	France			Belgium	Yes	I found this program to l			Mid-career (5-14 years (	3-5 times
Student	M.	France					EGYPTOLOGY_History	France	France	No				Junior (0-4 years of prof	5+ times
Young professional	M.	India	Computer science and engin	India	Space studies	France			India	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Young professional	F.	France			ISU, space domain	France			France	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Senior professional	F.	India					Physics	India	India	Yes	I found this program to l			Senior with 15+ years o	3-5 times
Young professional	F.	India	Architecture, Insitu materials	India	Space Studies	France			France	Yes	I found this program to l			Mid-career (5-14 years (	1-2 times
Young professional	F.	North Macedonia			Masters of Space Studie	Strasbourg, France			North Macedonia	Yes	This specialization does			Mid-career (5-14 years (	3-5 times
Young professional	F.	Hungary			Architecture and Engine	Hungary			Italy	Yes	I found this program to l			Junior (0-4 years of prof	3-5 times
Student	M.	United Kingdom	Astronomy, Space Science,	UK	Space studies	France	Planetary Science (quar	Germany	Germany	Yes	I found this program to l			No professional experie	1-2 times
Student/Young professic	M.	Uganda	Telecommunications Engine	Uganda	Space engineering	France			France	Yes	This specialization does			Junior (0-4 years of prof	1-2 times
Student	F.	France	Architecture	France	Architecture	France			Germany	No				Junior (0-4 years of prof	3-5 times
Student/Young professic	F.	India							France	Yes	I found this program to l			No professional experie	1-2 times
Student	F.	Spain	Aerospace Engineering	Spain	Space Studies	France			France	Yes	I found this program to l			Junior (0-4 years of prof	1-2 times
Student	F.	Ukraine	Mechatromics (Photonics En						Poland	Yes	This specialization does			Mid-career (5-14 years (	1-2 times
Student	M.	Germany	Mechaniza (Enginering)	Germany					Germany	No			My contry is very well s	No professional experie	None
Student	F.	Poland							Poland	No			i have just graduated fr	No professional experie	1-2 times
Student	M.	Denmark	Earth and space Physics an	Denmark					Sweden	No				Junior (0-4 years of prof	3-5 times
Student	M.	Poland	Mechaironics¬phoionics (cur	Poland					Poland	No				No professional experie	None
Student	F.	Germany	Mechanical engineering, spa	Germany					Germany	No				No professional experie	3-5 times
Senior professional	M.	Italy			Aerospace Engineering	Italy			Luxembourg	Yes	I found this program to l			Mid-career (5-14 years (	3-5 times
Senior professional	M.	Spain			Astronomy	Spain			United States	Yes	This specialization does			Mid-career (5-14 years (	1-2 times
Young professional	M.	Poland			Sociology	Poland			Poland	No				Mid-career (5-14 years (	1-2 times
Young professional	M.	Poland	Geology	Poland	Geology	Poland			Poland	No				Junior (0-4 years of prof	1-2 times
Student/Young professic	M.	Romania			Electronics in Engineeri	Denmark			Denmark	Yes	I wanted to move out of			Mid-career (5-14 years (	3-5 times
Student/Young professic	F.	Italy	Chemistry	UK	Chemistry + Space Stuc	UK + France			Netherlands	Yes	I found this program to l			No professional experie	1-2 times
Student/Young professic	X.	Ukraine	Law	France	Public Law	France			France	Yes	Other	I didn't move because o		Junior (0-4 years of prof	None
Student/Young professic	M.	United Kingdom	International Relations (Ba)	UK	Climate Change & Deve	UK			United Kingdom	Yes	I secured a scholarship			Junior (0-4 years of prof	1-2 times
Student	M.	Poland	Geoinformatics	Poland					Poland	No				Junior (0-4 years of prof	None
Student	M.	Poland	Geology	Poland					Poland	No				Junior (0-4 years of prof	1-2 times
Student	M.	Netherlands	Material science						Sweden	No				Junior (0-4 years of prof	1-2 times
Student	M.	Ukraine			Telecommunication	Ukraine			Germany	Yes	Other	I moved for work and fo		Mid-career (5-14 years (	1-2 times
Student	F.	Poland	Civil Engineering	Poland					Poland	No				No professional experie	None
Student	F.	Poland	Civil Engineering	Poland					Poland	No				No professional experie	None
Student	F.	Germany	Physics	Germany					Germany	No				No professional experie	None
Senior professional	F.	France	Aerospace Engineering	Russia	Space Studies	France			Netherlands	Yes	This program is located			Mid-career (5-14 years (	3-5 times
Student/Young professic	M.	Iran	Horticultural science and eng	Iran	Horticultures seed scien	Poland			Poland	Yes	I secured a scholarship			Mid-career (5-14 years (	3-5 times
Student	F.	Poland	Geography	Poland					Poland	No				No professional experie	None
Student	M.	Poland	Geography	Poland					Poland	No				Junior (0-4 years of prof	None
Senior professional	F.	Iran					Materials Engineering	Germarny	Germany	No				Mid-career (5-14 years (	3-5 times
Senior professional	F.	Poland					Psycholog	Poland	Poland	No				Senior with 15+ years o	5+ times
Senior professional	F.	Poland			Aerospace engineering	Poland			Poland	No				Mid-career (5-14 years (	1-2 times
Senior professional	M.	Poland			civil engineering	Poland			France	Yes	I wanted to move out of			Senior with 15+ years o	3-5 times
Senior professional	M.	Poland					Optimisation in operatio	Poland	Poland	Yes	I wanted to move out of			Senior with 15+ years o	3-5 times
Senior professional	M.	Serbia					Geodetic Engineering	Serbia	Serbia	No				Senior with 15+ years o	1-2 times
Senior professional	F.	Serbia	Geodesy and geoinformatics	Serbia	Space Studies	France	Mining and geotechnolo	Slovenia	France	Yes	This specialization does			Senior with 15+ years o	1-2 times
Senior professional	M.	Greece	Medical Studies	Greece	Space Studies	France			Germany	Yes	This specialization does			Senior with 15+ years o	1-2 times
Senior professional	F.	Netherlands					Space Communication	Netherlands	Netherlands	No				Senior with 15+ years o	3-5 times
Senior professional	M.	Japan					Engineering	Japan	Japan	No				Senior with 15+ years o	1-2 times
Senior professional	M.	Turkey					Telecommunication	UK	United Kingdom	Yes	I secured a scholarship			Senior with 15+ years o	3-5 times
Senior professional	M.	Poland	IT	Austria	Space Science	France			Germany	Yes	I secured a scholarship		I moved	Senior with 15+ years o	3-5 times

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What gender do you identify as:	What is your age:	Where were you born?	If in EU-27, please select the country:	Please list any formal university/college degrees or equivalent that you have: Bachelor:Discipline	Please list any formal university/college degrees or equivalent that you have: Bachelor:Country	Please list any formal university/college degrees or equivalent that you have: Master:Discipline	Please list any formal university/college degrees or equivalent that you have: Master:Country	Please list any formal university/college degrees or equivalent that you have: PhD:Discipline	Please list any formal university/college degrees or equivalent that you have: PhD:Country	How many years have you worked in the space sector?	How many times have you relocated countries for work?	Have you ever take a career break? e.g., parental or carer leave
Male	50-59	Europe		Maths	Uk	Maths	Uk	Physics	Uk	20+	Never	No
Female	20-29	Europe				Physics and Astronomy	UK	Astronomy	UK	0-2 years	Never	No
Female	20-29	Asia				information engineering	Uk			0-2 years	Never	Yes, 1 time
Male	20-29	Europe		Biomedicine	UK	Neuroscience	UK	Applied Maths	UK	0-2 years	Never	No
Male	20-29	Europe	Italy	Aerospace engineering	Italy	Aerospace engineering	Italy	Aerospace engineering	Italy	0-2 years	1	No
Male	30-39	Europe	Italy	Aerospace engineering	Italy	Space and astronautica	Italy	Astronomy, astrophysics	Italy	3-5	2	No
Female	20-29	Europe		History	United Kingdom	Communications	Australia			0-2 years	Never	No
Female	40-49	Europe		Law coms		HR Crim		Law		5-10	1	Yes, 2+ times
Male	20-29	Asia		Flight vehicle design				Computer sciences	CAS	5-10	2	Yes, 1 time
Male	20-29	Oceania		Aerosapce	Australia					3-5	1	No
Male	30-39	Oceania						Aero eng	Aus	10-20	Never	No
Male	30-39	Asia		Electrical eng	Iran	Electrical eng	Iran	Applied math	Canada	0-2 years	1	No
Male	30-39	Asia		Kinesiology and medica	Canada	Electrical and computer	Canada			10-20	2	No
Male	30-39	Europe	Germany	electrical engineering	germany	robotics	germany			5-10	3+	No
Non-binary	20-29	Other		aerospace engineering	uk	aerospace engineering	uk			0-2 years	Never	No
Male	30-39	Africa		mechanical engineering	south africa	space systems engineer	france			3-5	2	No
Male	50-59	Other		aeronautical engineerin	uk					20+	Never	No
Female	20-29	Americas (North, Centra		physics	brazil	physics with space scier	brazil	astrophysics	uk	3-5	1	No
Male	30-39	Europe	Germany	mechanical engineering	germany	mechanical engineering	germany			3-5	1	No
Female	60+	Other		business	uk	business (MBA)	uk			10-20	Never	Yes, 2+ times
Male	40-49	Europe	France	computer science	france	robotics	france			20+	1	Yes, 2+ times
Female	20-29	Europe	Poland	physics	poland	space systems engineer	uk			0-2 years	1	No
Male	30-39	Europe	Spain	engineering (mechanica	spain	systems engineering	spain			5-10	1	No
Male	50-59	Other		electrical engineering	uk					20+	1	Yes, 1 time
Male	40-49	Other		physics	uk	space science	uk			10-20	Never	Yes, 1 time
Female	20-29	Europe	Germany	aerospace eng	germany	propulsion engineering	germany			3-5	Never	No
Male	30-39	Europe	Italy	aerospace engineering	italy	space systems engineer	netherlands			5-10	1	No
Female	50-59	Other		mechanical enginering	uk	space engineering	united states			20+	3+	Yes, 2+ times
Female	20-29	Asia		computer sciences	india	computer sciences	india			3-5	2	No
Male	40-49	Europe	France	physics	france	astrophysics	france			10-20	2	Yes, 1 time
Female	30-39	Other		aerospace engineering	uk	space systems	uk			5-10	2	No
Female	40-49	Europe	Cyprus	BSc in Public Health an	Lebanon	MSc in Environmental H	Cyprus/USA			0-2 years	1	Yes, 1 time
Male	20-29	Africa		Mechanical eng	South africa	Space studies	france			3-5	1	No
Female	30-39	Europe	Czechia	Physics	CZ	Physics	CZ			5-10	Never	No
Female	30-39	Europe	Poland			Law	Poland			3-5	Never	No
Male	30-39	Asia		Electrical Engineering		Aerospace Engineering		Aerospace Engineering		10-20	1	No
Male	20-29	Europe	Italy	Business and managem	Italy	Space studies	France			3-5	1	No
Female	30-39	Europe	France	Mathematics	France	Aerospace engineering	France			0-2 years	3+	No
Male	20-29	Europe		BEng Mechanical Engin	United Kingdom					0-2 years	Never	No
Male	20-29	Americas (North, Centra		Mech	Canada	Aero	Canada			3-5	Never	No
Male	20-29	Americas (North, Centra		Aerospace	Canada					0-2 years	Never	No
Non-binary	30-39	Europe	Ireland	astrophysics and filmma	Ireland	Msc in space studies	France			0-2 years	3+	No
Male	30-39	Europe				Aerospace systems	Scotland			0-2 years	Never	No
Female	20-29	Europe		Physics	UK					0-2 years	Never	No
Male	20-29	Europe	Netherlands							0-2 years	Never	No
Female	20-29	Europe	Italy			Mathematics	Italy			0-2 years	1	No

ASTRAIOS

Analysis of Skills, Training, Research, And Innovation Opportunities in Space

D3.2 - Analysis report of geographical gaps & student mobility characteristics

Appendix G: Existing Mobility Programs (ERASMUS)

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Document Contributor(s)	Christie Maddock (UStrath)

Abstract

This report, titled "3.1.1 Existing Mobility Programs (ERASMUS)", is part of Deliverable D3.2: Analysis Report of Geographical Gaps & Student Mobility Characteristics, prepared under the ASTRAIOS project. It provides a comprehensive analysis of the Erasmus+ program's mobility trends spanning the academic years 2013–2014 to 2022–2023. The analysis focuses on identifying geographical patterns and demographic insights derived from mobility data encompassing 28 European countries, with an additional "Other" category capturing non-EU participants.

Keywords

Space Education, Geographical Coverage, Student Mobility, ERASMUS, Underrepresented Countries, Europe

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Approved for submission by		
Name and Organization	**Position and title**	**Date**

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1. INTRODUCTION

1.1 Introduction to the Erasmus+ Program

The Erasmus+ program, initiated in 2014 by the European Union, is a flagship initiative that supports education, training, youth, and sport across Europe. It builds on earlier Erasmus programs, integrating and expanding their scope. By fostering cross-border cooperation and learning opportunities, Erasmus+ aims to address skills gaps, improve employability, and promote social cohesion.

One of the program's central components is Key Action 1: Learning Mobility of Individuals, which facilitates exchanges for students, teachers, apprentices, and youth workers. This action aims to provide transformative experiences, enhancing participants' academic, professional, and intercultural competencies. Benefits include improved employability, stronger digital and foreign language skills, and a deeper understanding of European values. Beyond individuals, participating institutions benefit from strengthened international partnerships and innovative teaching methodologies.

In the academic context, mobility under Erasmus+ enables millions of students to study or train abroad, contributing to a more interconnected and inclusive European educational ecosystem. Between 2014 and 2020, the program supported over 4 million individuals, with mobility opportunities extended to students from diverse socioeconomic backgrounds. During the current 2021–2027 funding period, Erasmus+ has been further aligned with green and digital priorities, reflecting the EU’s broader policy goals.

Mobility trends reveal how Erasmus+ serves as a platform to address challenges such as post-pandemic recovery and regional disparities in participation. Insights from mobility data inform efforts to optimize resource allocation and expand access to underrepresented groups. This foundational role underscores the importance of mobility not just as a means of individual development but as a driver of societal and institutional transformation.

This analysis situates Erasmus+ mobility within the broader objectives of the ASTRAIOS project, particularly as it relates to identifying and addressing geographical disparities and enhancing participation in underrepresented fields, including aerospace and space-related disciplines.

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1.2 Data Identification, Preparation, and Analytical Approach

1.2.1 Data Overview

The dataset utilized for this analysis originates from the Erasmus+ program and encompasses individual mobility records spanning ten academic years (2013-2014 to 2022-2023). The core data includes 5,895,074 mobility entries, capturing a wide range of information such as participants' countries of origin and destination, academic years, and demographic details like gender. This extensive dataset forms the foundation for exploring mobility trends and identifying geographical gaps relevant to the ASTRAIOS project's objectives.

1.2.2 Data Preparation and Pre-Processing

To enable meaningful analysis, the data underwent a systematic preparation process:

1. Row Expansion: The dataset originally aggregated participant counts under a single entry per record. To conduct individual-level analysis, each record was expanded based on the "Actual Participants" field, effectively converting aggregated data into a detailed, participant-level dataset.
2. Geographical Categorization: The scope was narrowed to 28 European countries of interest, with remaining nations grouped into an "Other" category. This grouping streamlines cross-country comparisons while maintaining focus on key regions.
3. Handling Missing and Undefined Data: Records with incomplete or undefined values (e.g., unspecified gender) were retained for inclusivity, as these categories also reveal insights about the dataset's limitations.

1.2.3 Analytical Approach and Tools

Given the dataset's volume and complexity, Python was selected as the primary analytical platform. Python's robust data manipulation libraries (e.g., Pandas, NumPy) and visualization tools (e.g., Matplotlib, Seaborn, Plotly) facilitated efficient processing and clear visual representation of trends. The analytical workflow included:

1. **Data Cleaning**: Addressing inconsistencies and ensuring uniform formatting of country names, academic years, and other categorical fields.
2. **Trend Analysis**: Aggregating data by academic year, sending/receiving country, and gender to examine high-level patterns.
3. **Visualization**: Creating dynamic and static charts, including Sankey diagrams, bar plots, and gridline graphs, to highlight participant flows and mobility trends.
4. **Exploratory Analysis**: Investigating variability in stay durations and their correlation with destination countries.

1.2.4 Challenges and Initial Insights

The high volume of data posed challenges for traditional spreadsheet-based tools (e.g., Excel, Access), necessitating a programmatic approach. Python's scalability enabled handling the dataset efficiently and allowed for iterative refinement of insights. Initial findings highlight:

- Fluctuations in participant numbers due to external factors like the COVID-19 pandemic.
- Variability in gender representation and participation rates across countries.

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- Preliminary observations of imbalances in mobility flows, with larger nations dominating as both senders and receivers.

This foundational analysis serves as a stepping stone for more detailed investigations, including country-specific trends, participant duration analysis, and alignment with ASTRAIOS objectives.

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2. TECHNICAL DATA ANALYSIS

2.1 Analysis of Population Trends Across Academic Years

The visualization of mobility trends over the academic years from 2013-2014 to 2022-2023 provides a comprehensive overview of Erasmus+ program participation.

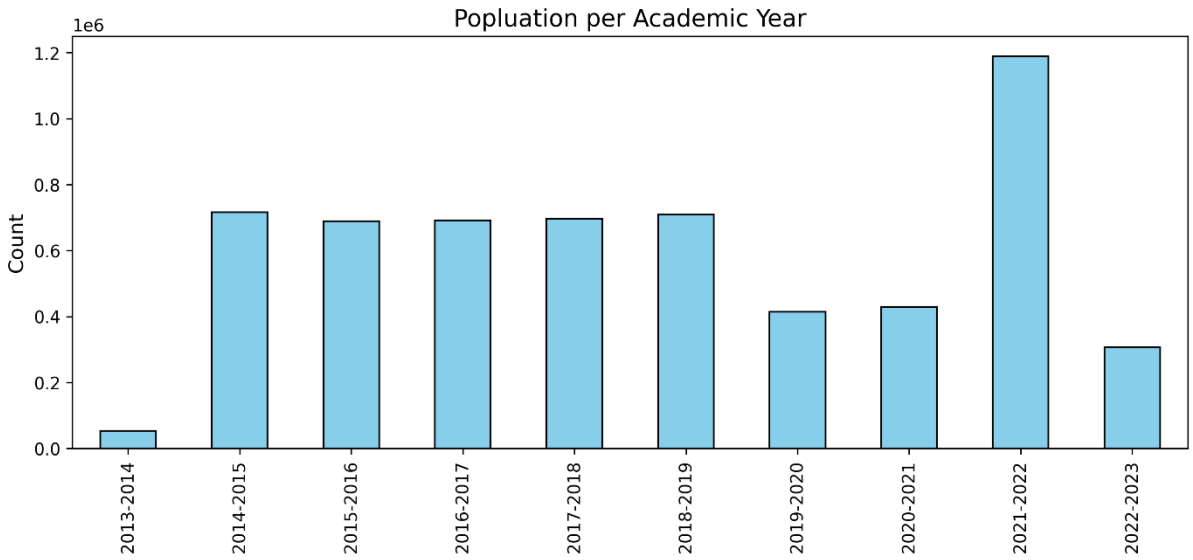

Figure 1: Population Trends Across Academic Years

Key insights are as follows:

1. **Initial Growth (2013-2014 to 2018-2019):** The early years show a steady increase, stabilizing at approximately 0.7 million participants annually. This trend aligns with the program's increasing popularity and robust infrastructure development during this period.
2. **Pandemic Impact (2019-2020 to 2020-2021):** As expected, the COVID-19 pandemic caused a significant drop in mobility, reducing participation to approximately 0.4 million annually. Restrictions on travel, health risks, and institutional closures were major contributors to this decline.
3. **Post-Pandemic Surge (2021-2022):** Following the relaxation of COVID-related restrictions, the 2021-2022 academic year saw a dramatic rebound, reaching a peak of about 1.15 million participants. This spike could be attributed to pent-up demand for mobility experiences and a coordinated effort by the European Commission to support mobility during recovery phases.
4. **Drop in 2022-2023:** The subsequent academic year shows a sharp decline, with mobility numbers falling to 0.3 million. Further investigation about this unusual trend confirms that the data collection and publication process for 2022-2023 may have been incomplete during the analysis phase, as noted in official statistics from the European Commission. Additionally, the conclusion of Erasmus+ funding cycles often correlates with reduced activity levels due to programmatic adjustments for the next phases.

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2.2 Analysis of Sending and Receiving Countries Across Academic Years

The comparative analysis of mobility trends for sending and receiving countries, visualized through 29 individual subplots for each country, provides a granular view of participation dynamics across the Erasmus+ program. These trends align partially with the broader annual population trends while showcasing unique country-specific patterns. Key insights include:

2.2.1 Receiving Countries

mobility trends for receiving countries shown in Figure 2.

1. **Trend Alignment with Overall Mobility:**
    - Countries such as Austria, Belgium, Czech Republic, Denmark, Greece, Finland, Hungary, Netherlands, Poland, Portugal, Romania, and Sweden closely mirror the overall population per academic year trend.
    - These countries exhibited consistent participation peaks in 2021-2022, followed by a decline in 2022-2023, similar to the program-wide dynamics.
2. **Flat Participation Levels:**
    - Smaller countries like Cyprus, Bulgaria, Estonia, Croatia, Lithuania, Luxembourg, Latvia, Slovenia, and Slovakia displayed relatively flat trends, suggesting stable but lower levels of participation. These trends imply consistent engagement without significant fluctuations, although minor adherence to the overall program pattern can be noted.
3. **Countries with Sharper Changes:**
    - Larger participants such as Germany, Spain, France, Italy, Ireland, Other and United Kingdom show more dynamic trends, reflecting their status as key hubs for incoming mobility.
    - Notably, the UK's participation decreases sharply in recent years, likely due to the post-Brexit transition, which limited the UK’s integration into the Erasmus+ framework.

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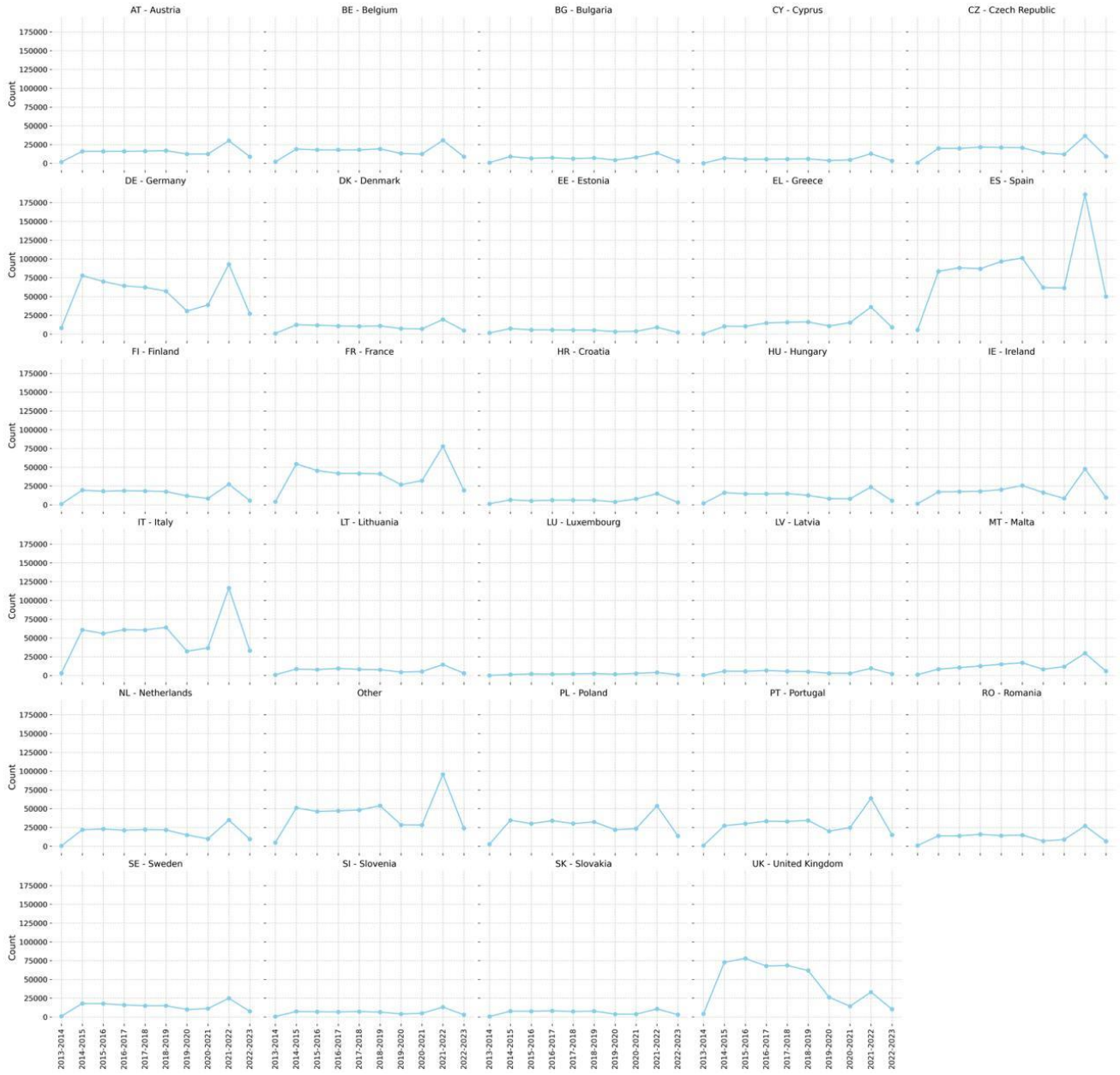

Figure 2: Plot Receiving Countries Over Academic Year

2.2.2 Sending Countries

mobility trends for sending countries shown in Figure 3.

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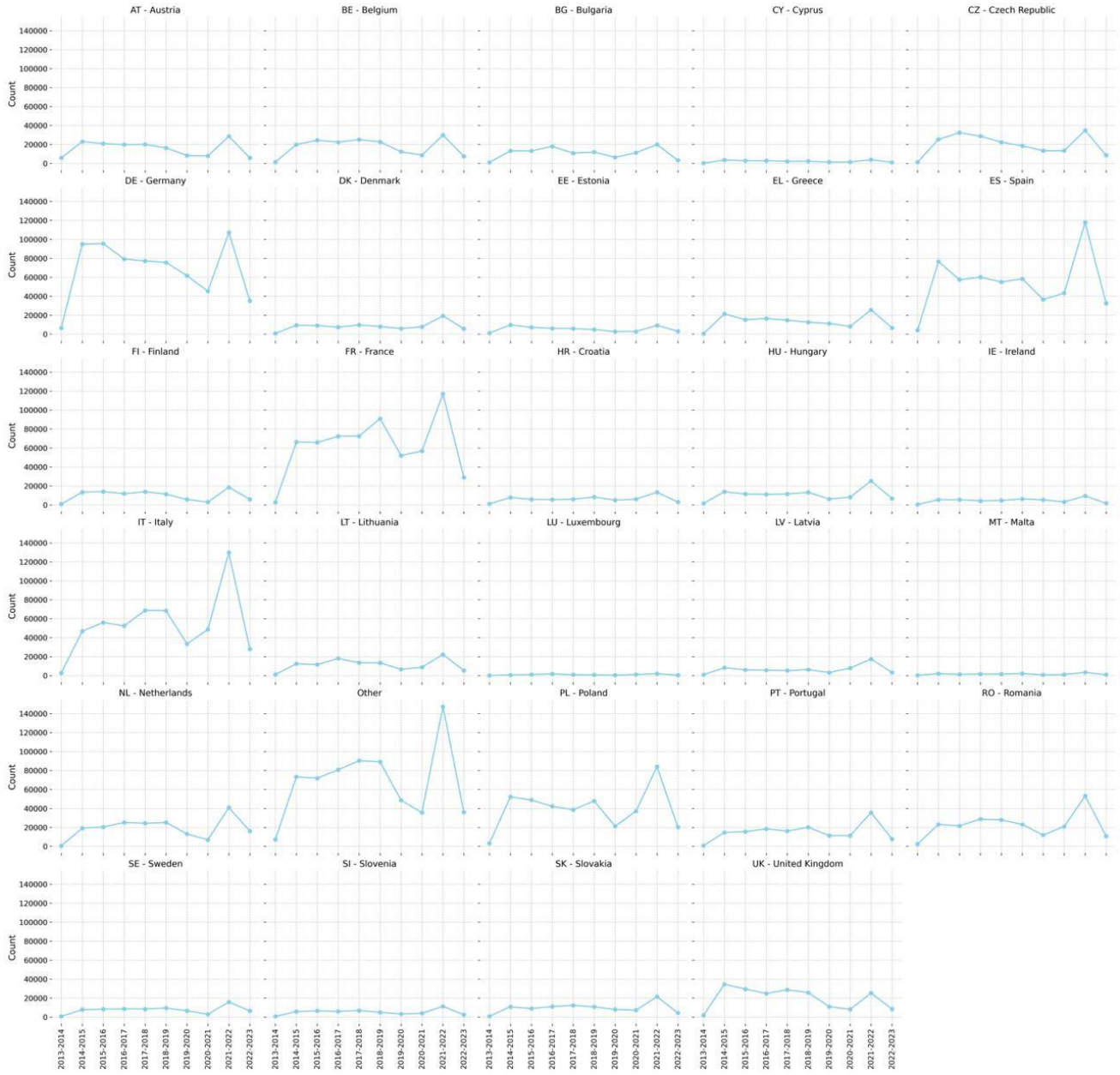

Figure 3: Grid Plot Sending Countries Over Academic Year

1. **Trend Alignment with Overall Mobility:**
    - Countries such as Austria, Belgium, Bulgaria, Czech Republic, Denmark, Greece, Finland, Hungary, Lithuania, Netherlands, Latvia, Portugal, Romania, Sweden, and Slovakia closely follow the overall mobility trend, reflecting consistent outbound participation that peaks in 2021-2022.
2. **Flat Participation Levels:**
    - Similar to the receiving trends, countries like Cyprus, Malta, Estonia, Croatia, Ireland, Luxembourg, and Slovenia maintain steady participation levels with minimal variation over the years.

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3. **Dynamic Sending Patterns:**
    - Major sending countries, including Germany, Spain, France, Italy , Other, and Poland, exhibit more pronounced changes in participation levels, highlighting their central role in outbound mobility.
    - The UK, once a prominent sender, shows a similar decline in later years, consistent with Brexit-related policy changes.

2.2.3 Conclusion:

The UK's participation decline in both sending and receiving roles underscores the profound impact of Brexit. As the UK exited the Erasmus+ program, barriers to participation likely led to a sharp reduction in student mobility, affecting the program's overall dynamics. The UK's departure from the Erasmus+ program at the end of 2020, following Brexit, led to significant shifts in mobility data. The UK exited Erasmus+ officially in December 2020, replacing it with the Turing Scheme. This change caused a notable decline in both incoming and outgoing student mobility for the UK. This drop is evident in the sharp decrease in the UK's participation in the final academic years of the dataset. The withdrawal disrupted well-established networks between UK institutions and European counterparts, impacting not only student numbers but also the collaborative programs between institutions.

While Brexit caused declines for the UK, other factors like the pandemic affected mobility for nearly all countries, reflected in the 2019-2020 and 2020-2021 academic years. However, the subsequent recovery in 2021-2022 for countries like Spain, Germany, and France suggests strong resilience and adaptability within the program's framework.

Regional Patterns: The sharper fluctuations in countries like Germany, Spain, France, and Italy reflect these nations' pivotal roles in the program due to their large-scale participation and networked infrastructure, which makes them more sensitive to external factors like policy shifts or the pandemic. These nations also maintained high engagement levels even during challenging periods, underscoring their foundational place in Erasmus+.

Conversely, smaller or less active participants such as Cyprus, Malta, and Luxembourg displayed relatively steady trends across the years. These smaller-scale programs seem to rely on consistent, smaller cohorts, making their annual trends less dynamic.

2.3 Analysis of Top Sources and Top Destinations

The Total Receiving Country (Figure 4) and Total Sending Country (Figure 5) charts illustrate the overall distribution of Erasmus+ mobility across the key European countries over the program's duration. These charts provide valuable insights into the dominant roles played by specific countries in facilitating academic mobility.

2.3.1 Destination Countries

Spain leads as the most popular destination, hosting over 800,000 participants—a number significantly higher than the next most popular destinations, Germany and Italy, which received approximately 550,000 participants each. This substantial gap highlights Spain's attractiveness as a host country, likely due to its favourable cultural, academic, and geographic conditions for students.

Other notable host countries include:

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- United Kingdom: Despite its decline in recent years (due to Brexit), it remains a historically significant destination.
- France: Consistently popular, with robust participation across the program's years.
- Portugal and Poland: Medium-sized destinations with steady inflows, reflecting their growing appeal in the Erasmus+ network.

At the lower end of the spectrum, Luxembourg, with only about 25,000 participants, represents the smallest receiver. This is expected, given its smaller population and academic infrastructure relative to larger nations.

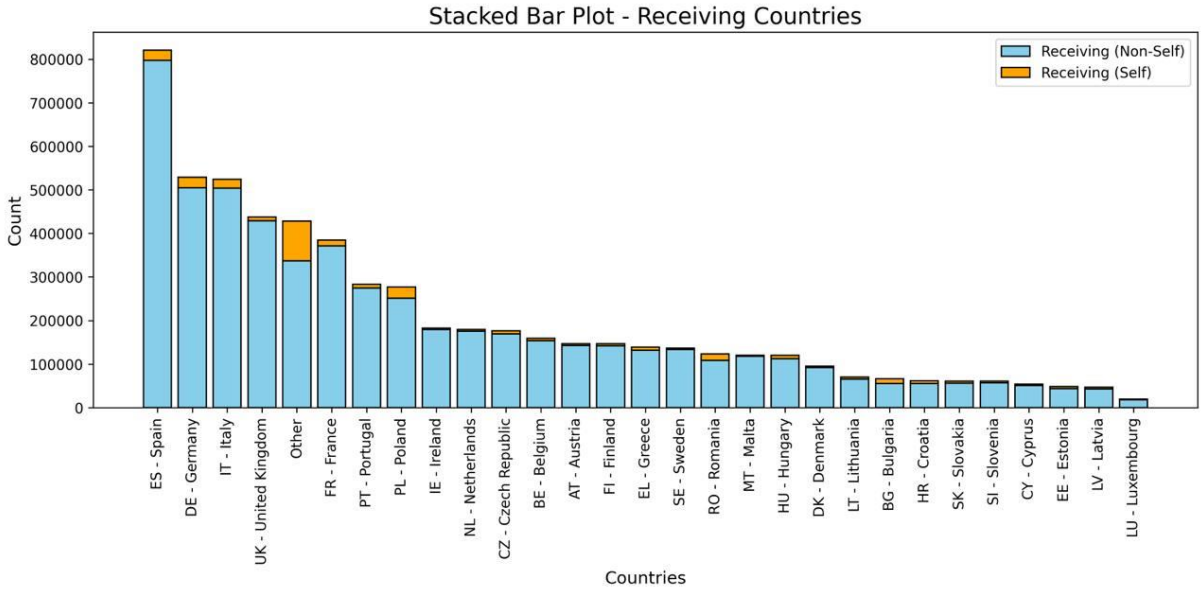

Figure 4: Total Receiving (Destination) Country

2.3.1.1 Receiving Country Self-Mobility

The analysis of self-mobility within receiving countries indicates that the "Other" category exhibits the highest number of self-mobility participants. For the remaining countries, self-mobility constitutes less than 6% of their total received participants, highlighting that this factor does not significantly alter the overall ranking of receiving countries. The low proportion of self-mobility emphasizes the cross-border nature of mobility within the Erasmus+ program.

2.3.2 Source Countries

The *Total Sending Countries* chart reveals that the "Other" category and Germany are the leading senders, each contributing close to 700,000 participants. This suggests that countries within the *Other* category (non-EU or smaller EU states) have collectively facilitated substantial outbound mobility. Germany's high sending volume aligns with its well-established academic and funding systems encouraging student mobility.

Other high-sending countries include:

- France, Spain, and Italy : These countries maintain robust outbound mobility, reflecting their emphasis on international educational exchange.

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- Poland and Romania: Emerging leaders in outbound mobility, leveraging Erasmus+ to connect their students with broader European opportunities.

Luxembourg, similar to its role as a receiving country, also occupies the last position as a sender, reflecting its smaller population and academic ecosystem.

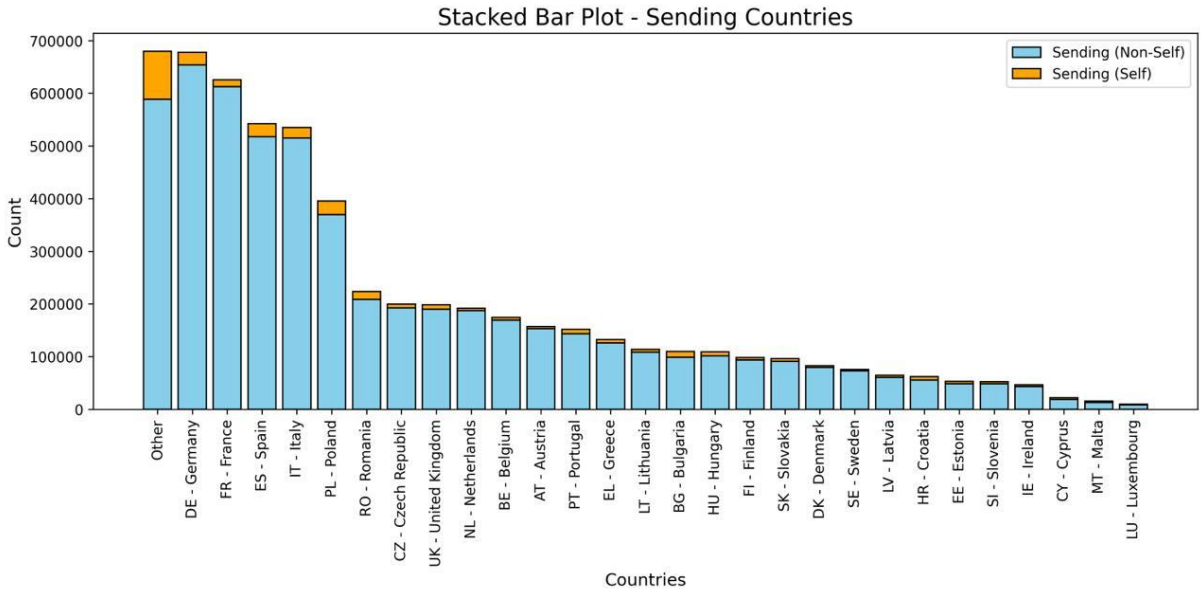

Figure 5: Total Sending (Source) Country

2.3.2.1 Sending Country Self-Mobility

Similarly, the analysis of self-mobility within sending countries reveals that the "Other" category has the largest share of self-mobility participants. For all other countries, the proportion of self-mobility remains below 5% of their total outbound participants. This limited contribution of self-mobility to the overall figures suggests that the rankings of sending countries are predominantly influenced by genuine cross-border exchanges rather than internal movements.

2.3.3 Key Observations

1. **Dominance of Large Economies**: The larger economies—Spain, Germany, France, and Italy—dominate both sending and receiving roles, underscoring their central position in the Erasmus+ network.
2. **Emerging Players**: Medium-sized nations like Poland and Romania demonstrate a growing engagement with Erasmus+, indicating rising participation rates.
3. **Geopolitical Influences**: The UK's declining role as both a sender and receiver post-Brexit reflects the impact of geopolitical decisions on student mobility. The absence of the UK from Erasmus+ is notable in the latter years of the dataset.
4. **Smaller Nations**: Countries like Luxembourg, Malta, and Cyprus, while participating at lower volumes, maintain consistent inflows and outflows, playing niche but stable roles within the program.

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2.4 Average Mobility Duration Across Receiving Countries

The analysis of **average mobility duration** provides a new dimension to understanding the dynamics of Erasmus+ mobility, offering insights into how long participants typically stay in their destination countries. While participant numbers give a measure of volume, average duration highlights the depth of engagement in terms of time spent in each destination.

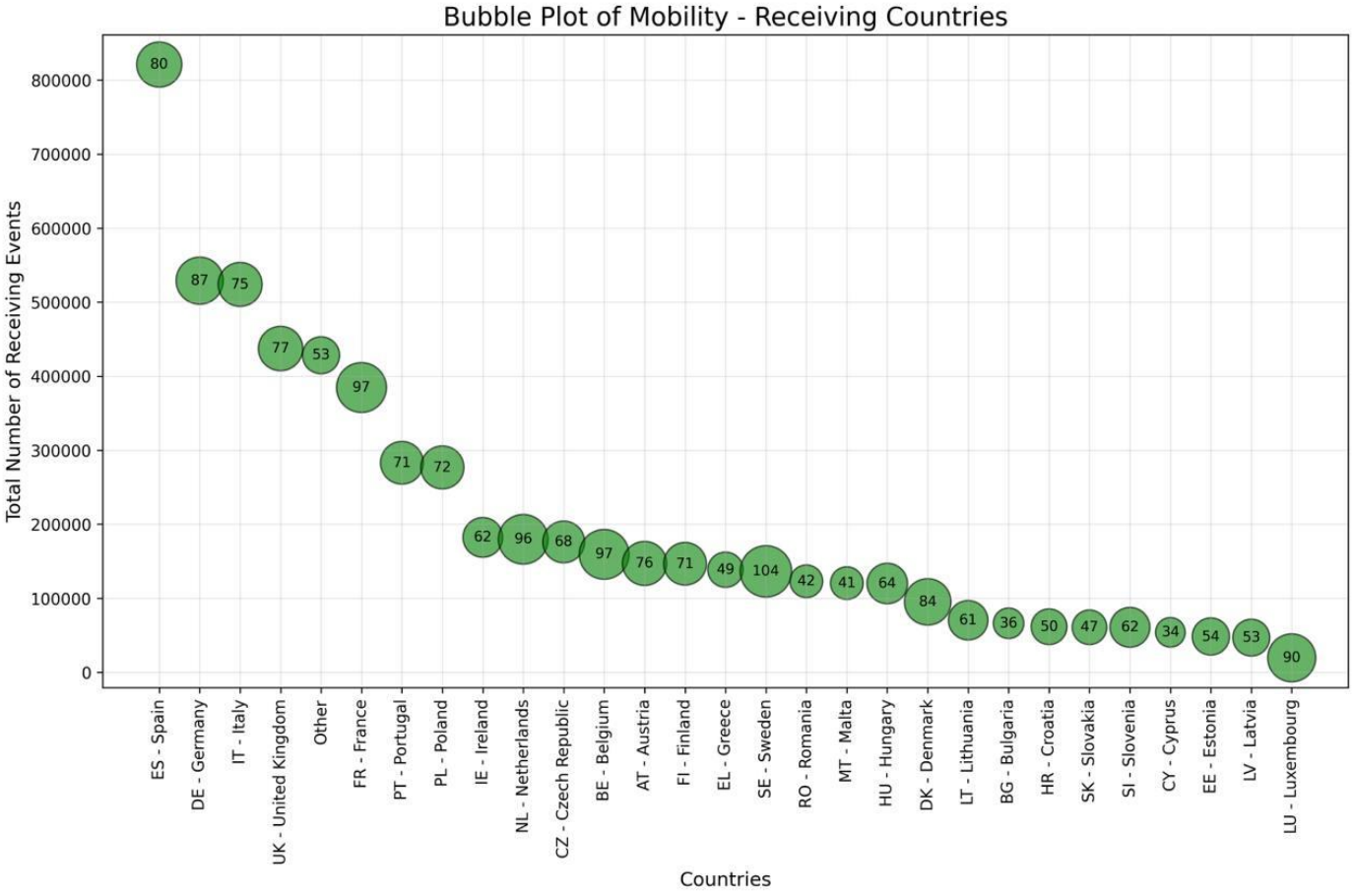

Figure 6: Average Mobility Duration Across Receiving Countries

2.4.1 Key Observations:

1. **Sweden** emerges as the leader in average duration, with a remarkable **104 days per participant**, despite ranking **16th in total participants received** (~150,000). This suggests a tendency for longer, possibly more immersive stays in Sweden, indicating well-structured or extended academic programs. Additionally, Sweden's low self-mobility reinforces the notion of external attractiveness for its academic or professional opportunities.
2. **Belgium** and **France** follow, with averages of **97 days each**. Belgium ranks **12th** in total participants received, and France ranks **6th**, highlighting that while France attracts a high volume of participants, it also maintains an above-average duration of stay.
3. **The Netherlands** (96 days) and **Luxembourg** (90 days) also stand out. Luxembourg, in particular, is noteworthy for having the lowest total participants received, yet the high average duration suggests that those who do visit engage in extended stays, reflecting the country's niche appeal or specialized programs.
4. Countries like **Germany** (87 days) and **Denmark** (84 days) also perform well in average duration, aligning with their strong reputations in education. However, **Spain**, which leads in total participants received, records a more moderate average of **80 days**, indicating that its appeal lies in volume rather than extended engagement.

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5. At the lower end, **Cyprus** records the shortest average duration at **34 days**, suggesting shorter-term opportunities that may align with specific academic or professional goals.

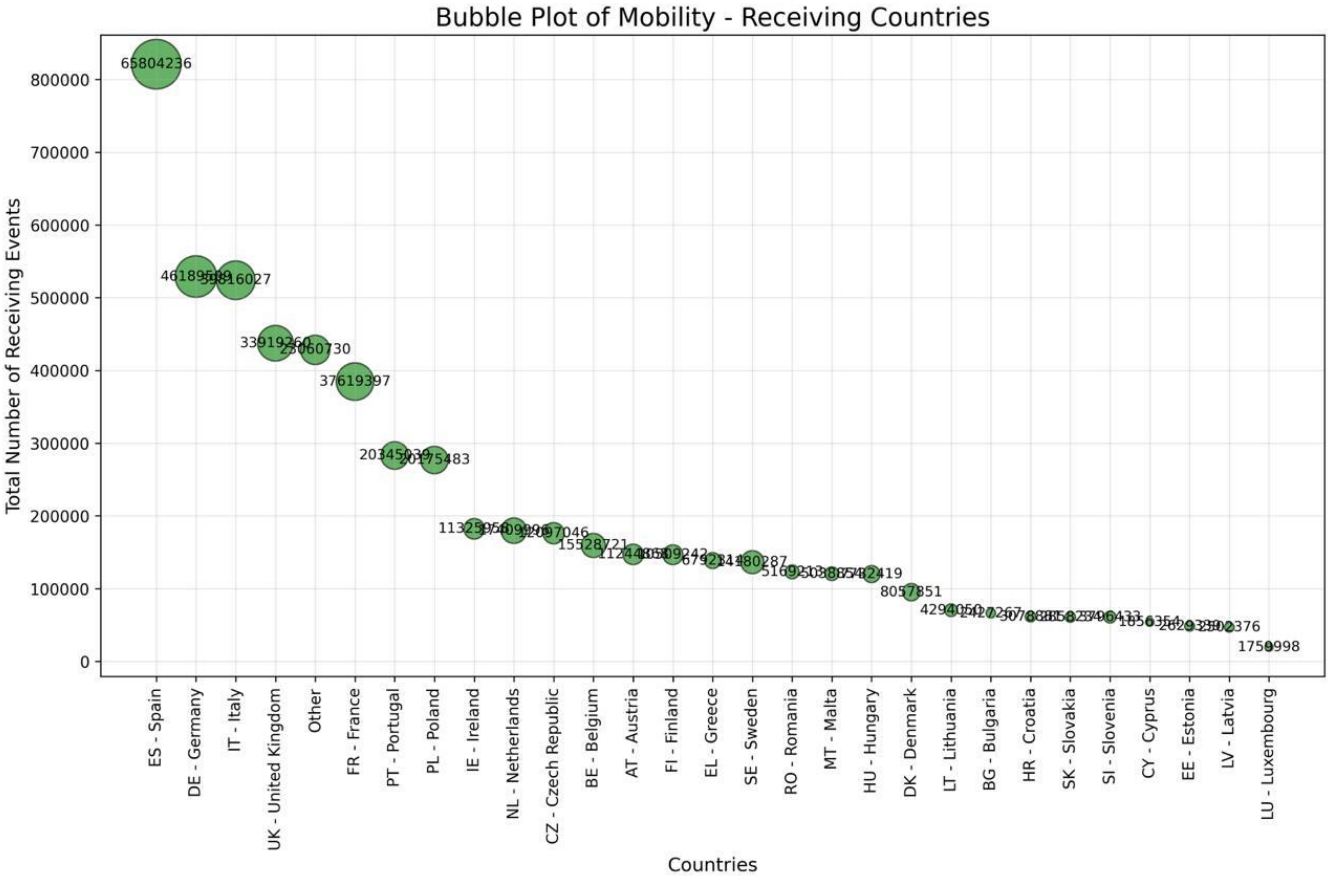

Figure 7: Total Mobility Duration Across Receiving Countries

2.4.2 Cumulative Stay Duration Insight:

Although the chart presented focuses on **average duration**, the **cumulative stay duration** for each country can be inferred by multiplying the average days by the number of participants. This provides a fuller picture of a country's overall contribution to hosting participants. For example:

- Sweden's long average stay contributes significantly to its overall engagement despite lower participant numbers.
- Spain, with its high volume and moderate average, maintains a leading role in total hosting capacity.

2.4.3 Implications and Recommendations:

The **variation in average durations** reflects differences in program structures, objectives, and possibly cultural or logistical factors influencing mobility. Countries with longer durations might prioritize comprehensive courses or extended professional training.

This analysis complements earlier insights into participant numbers by adding depth to the understanding of Erasmus+ mobility trends. It underscores the importance of evaluating both the scale and intensity of engagement to fully grasp the program's impact.

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Appendix G: Existing Mobility Programs (ERASMUS)
Version 0.04

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2.5 Comprehensive Visualization of Erasmus+ Mobility: Sankey Diagram Analysis

To synthesize the findings from previous analyses and provide an overarching view of mobility patterns within the Erasmus+ program, a Sankey diagram was developed. This visualization captures the complete mobility dynamics among the 28 selected European countries, alongside the "Other" category. The diagram represents all outgoing and incoming flows between sending and receiving countries, highlighting the interconnectedness of nations participating in Erasmus+.

Key Features of the Comprehensive Sankey Diagram:

1. **Holistic Representation**:
   - The diagram includes 29 nodes for both *Sending Countries* (left side) and *Receiving Countries* (right side), showcasing a total of 841 unique links. Each country's mobility is depicted by flows that interconnect with all other countries, including itself.
   - For example, France exhibits 625.8K participants as senders, distributing across 29 receiving nodes. Conversely, as a receiving country, France accounts for 384.6K inbound participants from various sources.
2. **Aggregate Mobility Insights**:
   - This Sankey diagram provides a condensed yet visually rich summary of the total mobility landscape, merging the granular data analyzed in earlier sections into a singular, comprehensive flowchart.
   - It effectively portrays the magnitude and directionality of participant exchanges between countries, allowing readers to discern patterns and relationships at a glance.
3. **Cross-Referencing with Previous Findings**:
   - The Sankey diagram builds on insights from grid-line charts and total sending/receiving statistics, reinforcing trends such as Spain's dominance as a receiving nation and Germany's prominence in outbound mobility.

Supporting Sankey Diagrams for Academic Year Trends:

Given the massive scale of the dataset and the diversity of annual dynamics, additional Sankey diagrams were created for each academic year, segmented as follows:

- **Overall Mobility**: Displays total participant exchanges in a given academic year.
- **Gender-Specific Mobility**:
  - *Male Mobility*: Focuses on flows for male participants.
  - *Female Mobility*: Highlights female participant trends.

These annual Sankey diagrams are included in the appendix of this report, offering detailed, year-by-year insights into mobility patterns. By examining these diagrams, stakeholders can better understand how mobility evolved over time, including shifts influenced by external factors such as the COVID-19 pandemic or changes in program priorities.

Analytical Insights:

1. **Macro-Level Trends**:
   - The comprehensive diagram confirms the disproportionate flow towards dominant nodes like Spain, Germany, and Italy, which collectively account for a significant portion of both inbound and outbound mobility.
   - Smaller countries like Luxembourg and Malta maintain consistent but modest exchanges, reflecting their limited capacity within the Erasmus+ framework.
2. **Annual Variations**:
   - Year-specific diagrams reveal that pandemic years (2019–2021) experienced disrupted flows, with reduced volumes compared to pre-pandemic years.
   - Post-pandemic recovery is evident in 2021–2022, which saw record-high exchanges. However, a sharp decline in 2022–2023 might hint at incomplete data or a tapering off as the current Erasmus+ cycle concludes.
3. **Gender Disparities**:Regarding each year graph, Female participation consistently exceeded male participation by a notable margin. For instance:

In 2013–2014, female participants numbered around 31,900 compared to 21,600 males.

In 2021–2022, the peak year for mobility, female participants were approximately 689,900, while males were around 459,800.

Impact of the Pandemic: Both male and female participation dropped sharply during the COVID-19 pandemic (2019–2021). However, female participation remained higher, maintaining the established pattern of greater engagement.

Post-Pandemic Trends: The 2021–2022 academic year marked a significant rebound, with a pronounced increase in participation for both genders. Despite this surge, the ratio of female-to-male participants remained relatively stable.

Gender Ratios: On average, female participation accounts for roughly 60% of the total, while males comprise the remaining 40%. This ratio underscores the stronger representation of women in Erasmus+ mobility programs.

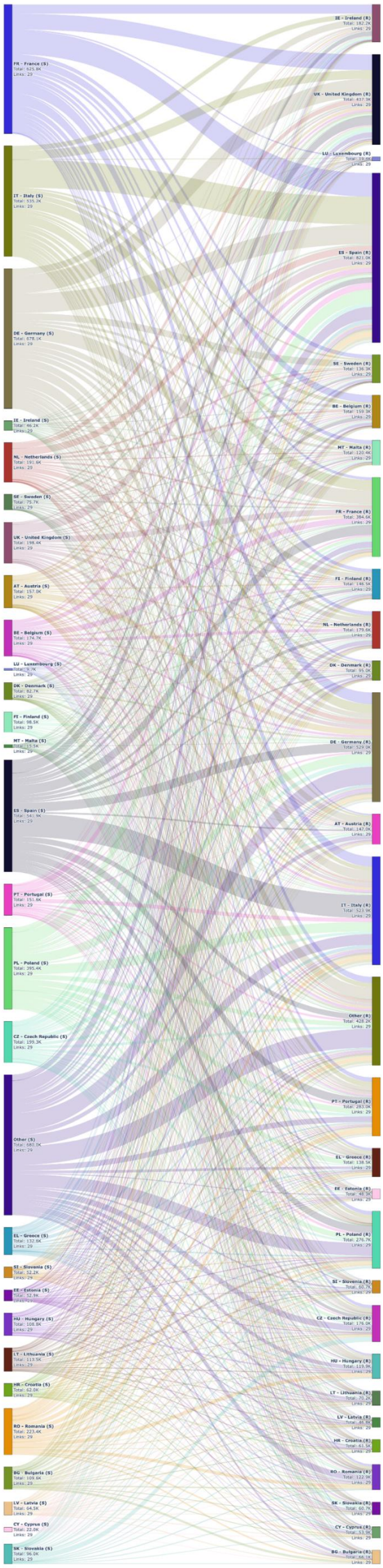

Figure 8: Comprehensive Visualization of Erasmus+ Mobility 2013-2023

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2.5.1 Conclusion

The Sankey diagram serves as a powerful visualization tool, encapsulating the Erasmus+ mobility framework's essence. Its inclusion, alongside year-specific variants, ensures that this report delivers both macro and micro-level perspectives, enabling stakeholders to derive actionable insights. By consolidating earlier findings into this diagram, the report highlights the program's breadth, its impact on fostering international exchange, and the interplay of various socio-economic and policy factors shaping mobility trends.

Language is recognized as an influential factor in shaping student mobility, as shared languages can facilitate communication and enhance the integration experience. However, in the context of this analysis, no definitive patterns linking language commonality and mobility trends were observed. This suggests that while language may play a role in individual mobility decisions, other factors, such as program opportunities, institutional partnerships, and geographic proximity, likely exert a more significant influence on the overall trends within the Erasmus+ program.

Geographic proximity emerges as a significant factor influencing mobility trends in the Erasmus+ program. Countries that share borders or are in close geographic proximity tend to exhibit higher levels of student exchanges, irrespective of language differences. For instance, Spain, as the leading receiving country, draws a substantial number of participants from neighboring countries such as France, Italy, and Germany. Similarly, Portugal sends the majority of its participants to Spain, reflecting strong regional ties. This underscores that while language facilitates mobility in some cases, geographic closeness, shared regional connections, and logistical ease may play an even more pivotal role in shaping mobility patterns.

An analysis of gender distribution among Erasmus+ mobility participants from 2013 to 2023 reveals a consistent trend: female participants significantly outnumber male participants in every academic year. The disparity ranges from approximately 1.5 times the number of males in earlier years to as high as 1.7 times in peak mobility years. This gender imbalance persisted across the program's history, indicating a stronger inclination among female students to engage in international mobility opportunities.

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2.5.2 Supporting Sankey Diagrams for 2013-2014 Academic Year Mobility Trends

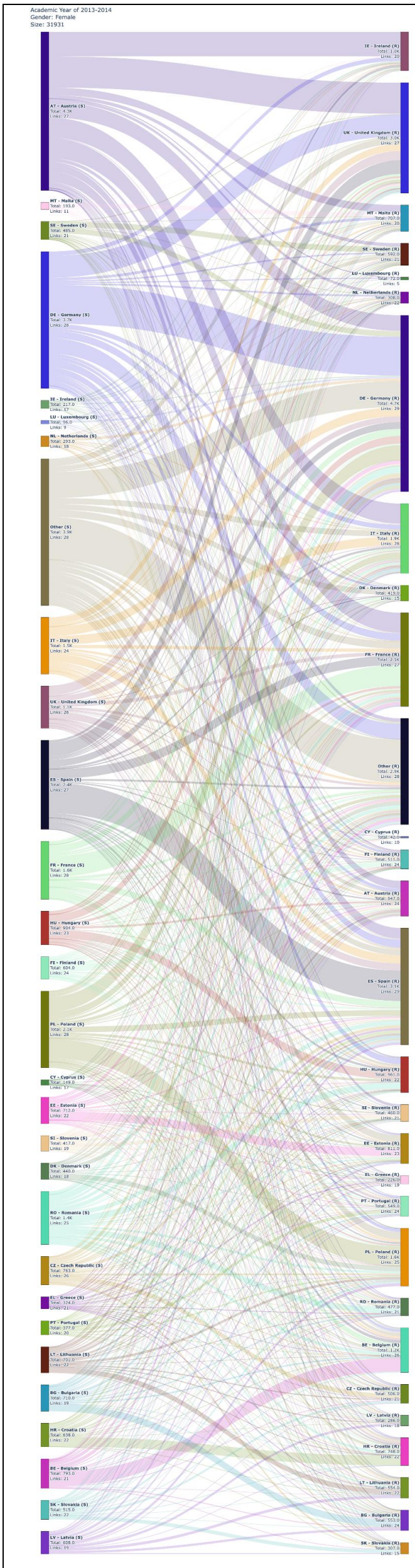

Figure 9: Female Sankey Diagrams for 2014-2015 Trends

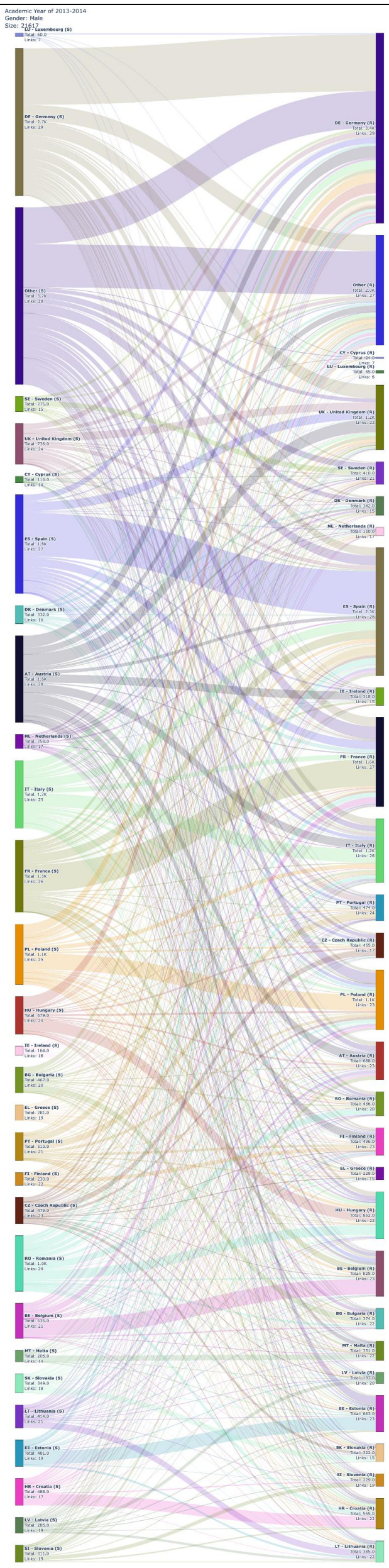

Figure 10: Male Sankey Diagrams for 2014-2015 Trends

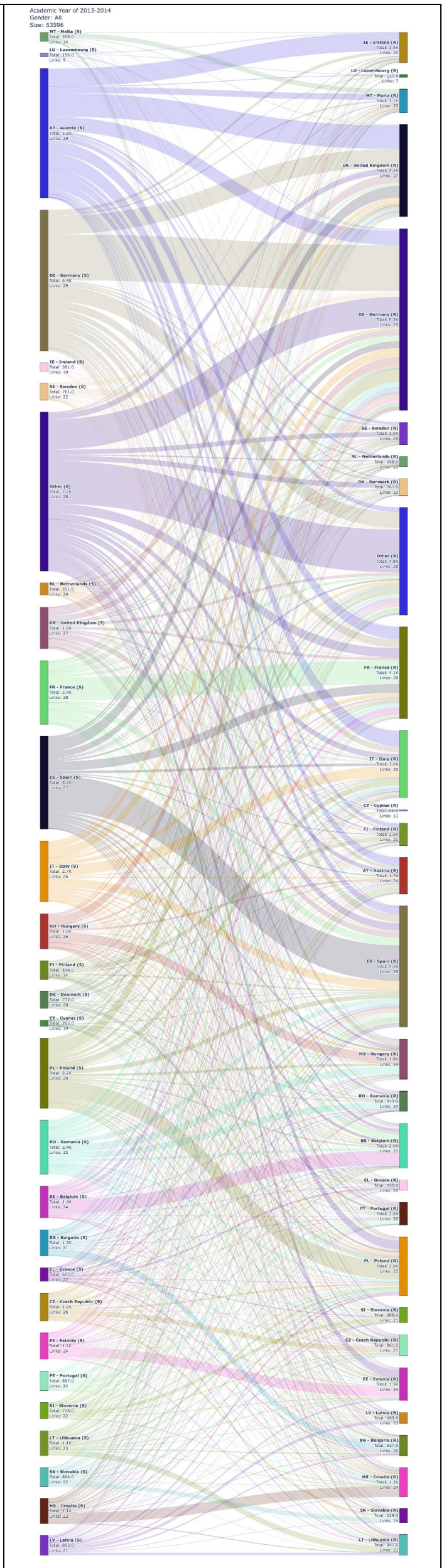

Figure 11: Overall Sankey Diagrams for 2014-2015 Trends

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2.5.3 Supporting Sankey Diagrams for 2014-2015 Academic Year Mobility Trends

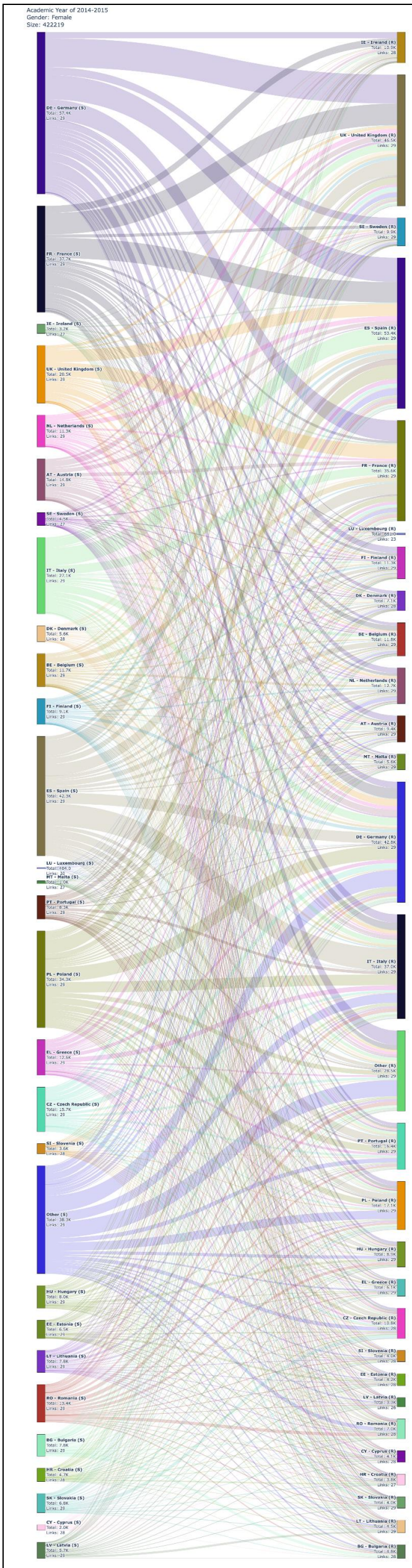

Figure 12: Female Sankey Diagrams for 2014-2015 Trends

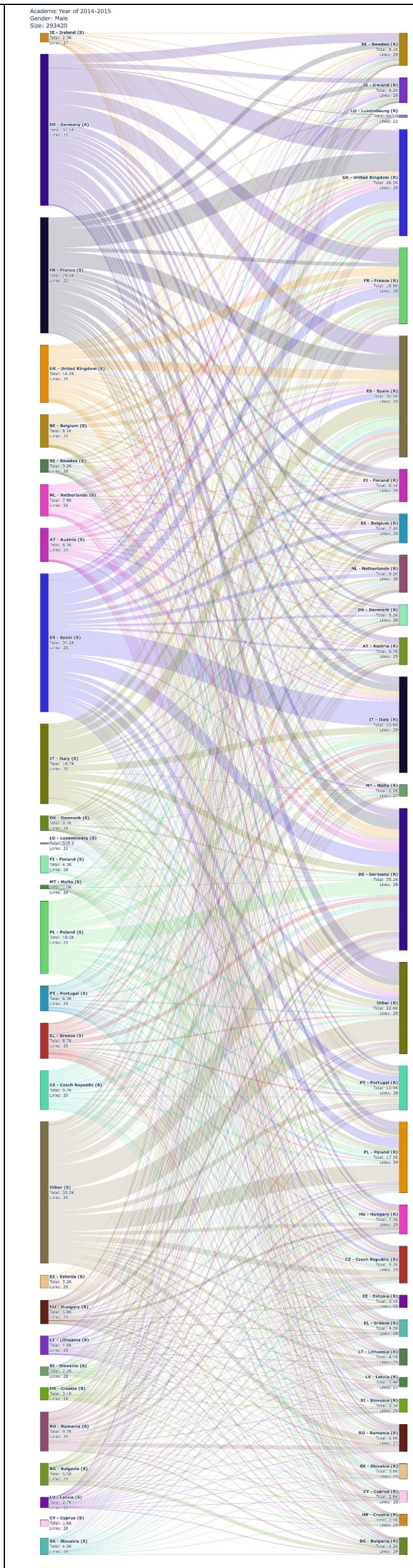

Figure 13: Male Sankey Diagrams for 2014-2015 Trends

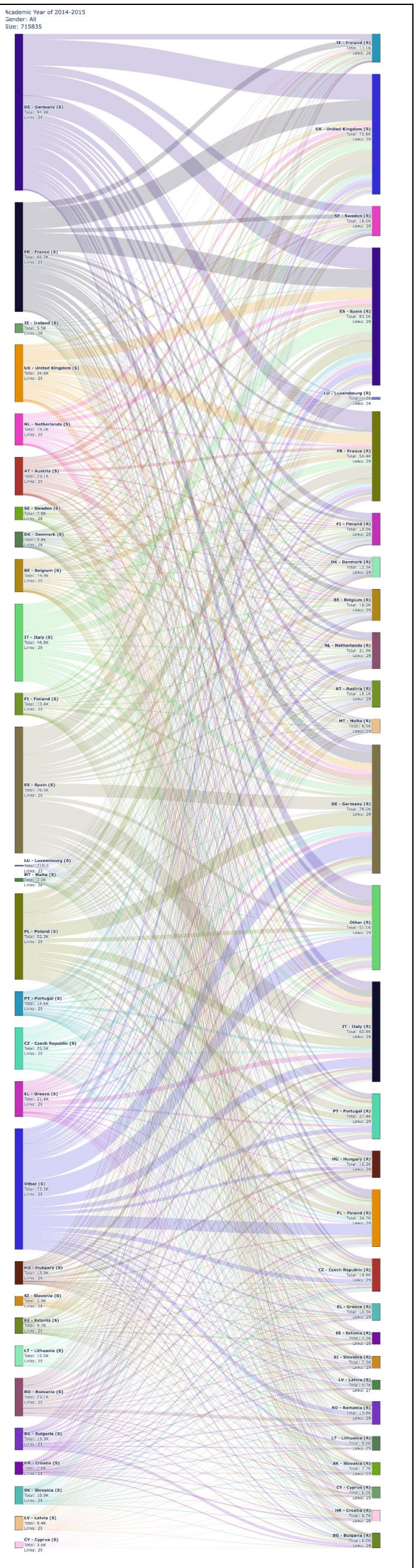

Figure 14: Overall Sankey Diagrams for 2014-2015 Trends

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2.5.4 Supporting Sankey Diagrams for 2015-2016 Academic Year Mobility Trends:

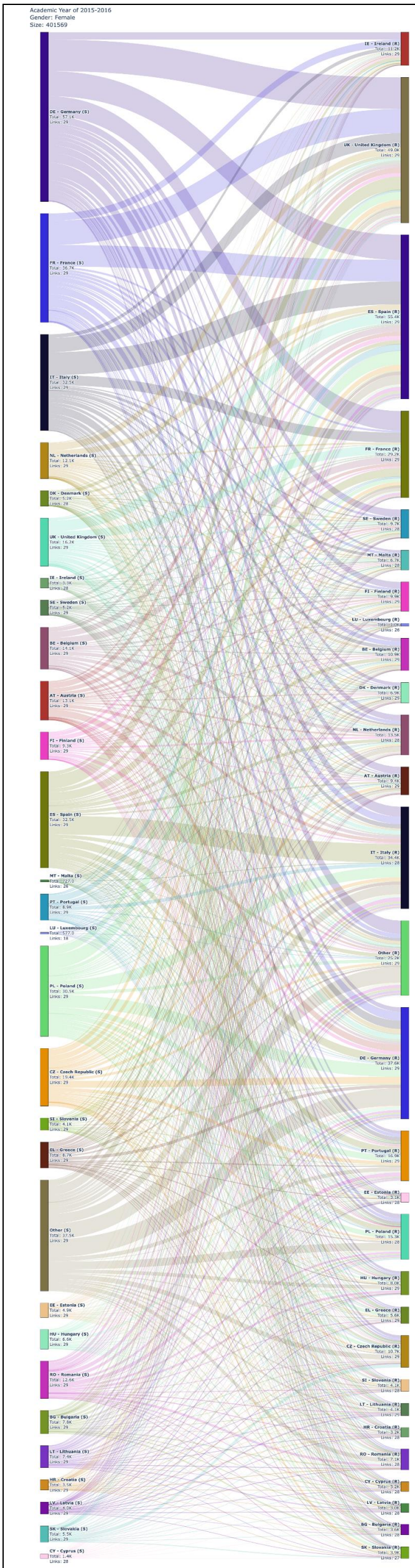

Figure 15: Female Sankey Diagrams for 2015-2016 Trends

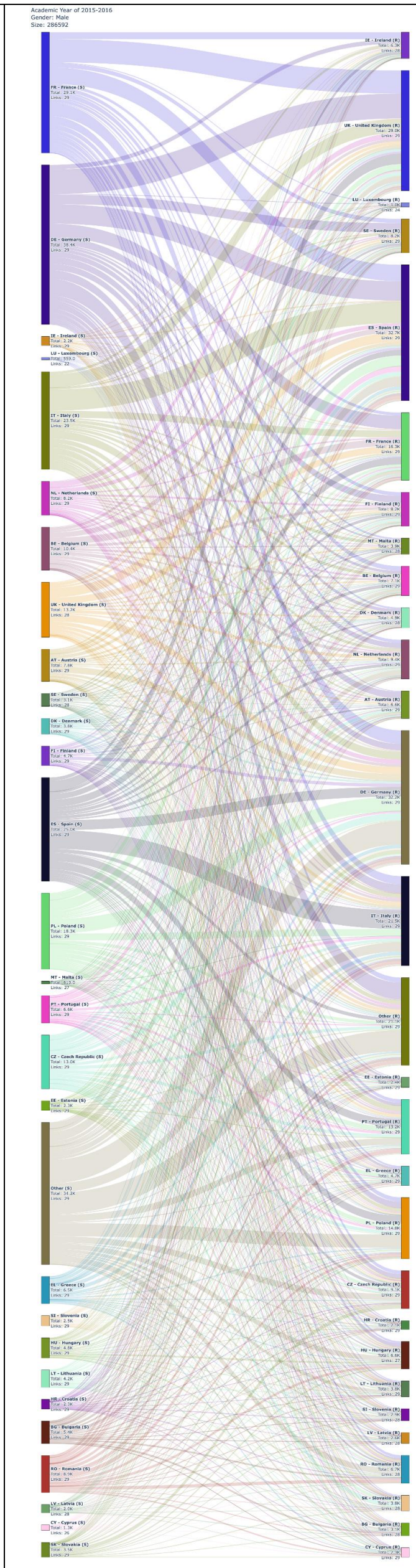

Figure 16: Male Sankey Diagrams for 2015-2016 Trends

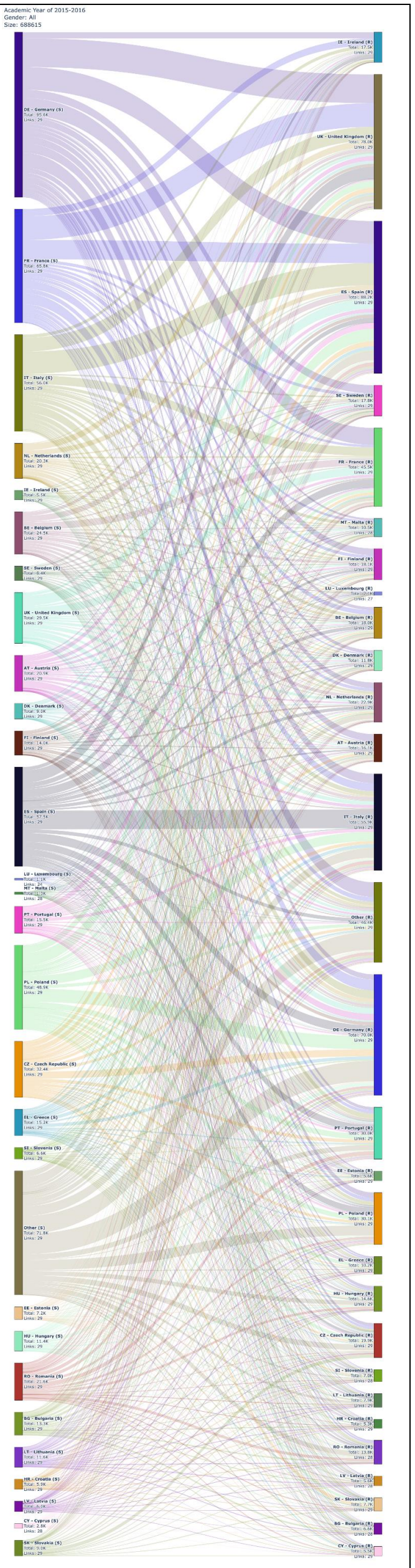

Figure 17: Overall Sankey Diagrams for 2015-2016 Trends

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2.5.5 Supporting Sankey Diagrams for 2016-2017 Academic Year Mobility Trends:

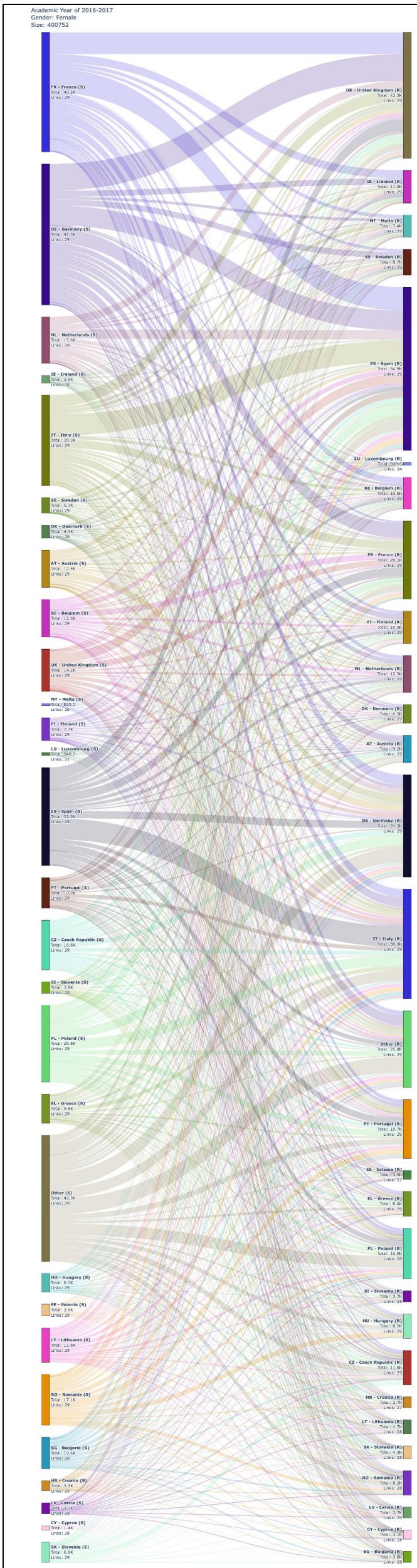

Figure 18: Female Sankey Diagrams for 2016-2017 Trends

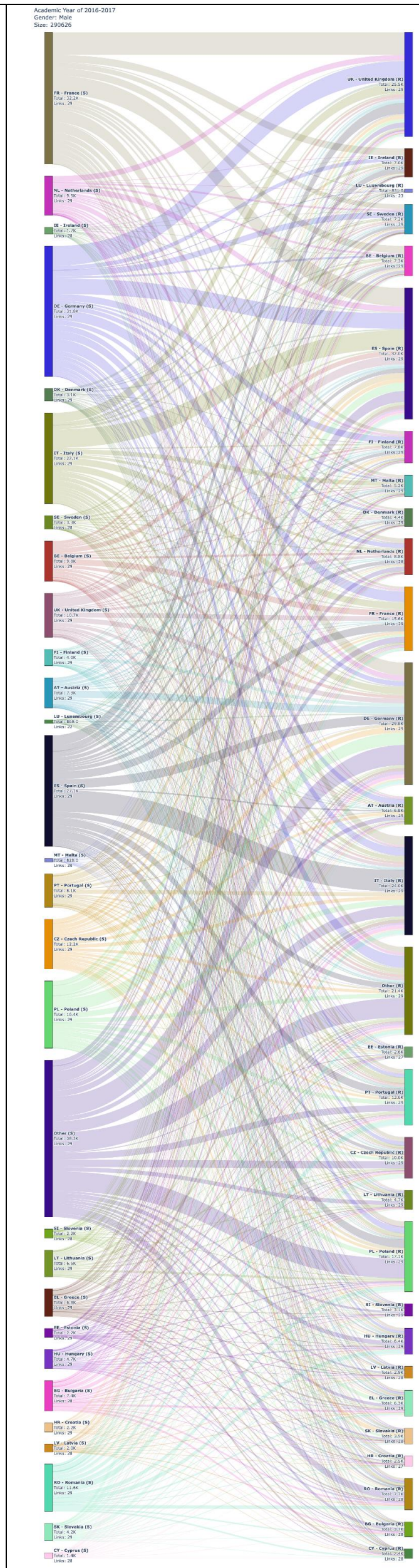

Figure 19: Male Sankey Diagrams for 2016-2017 Trends

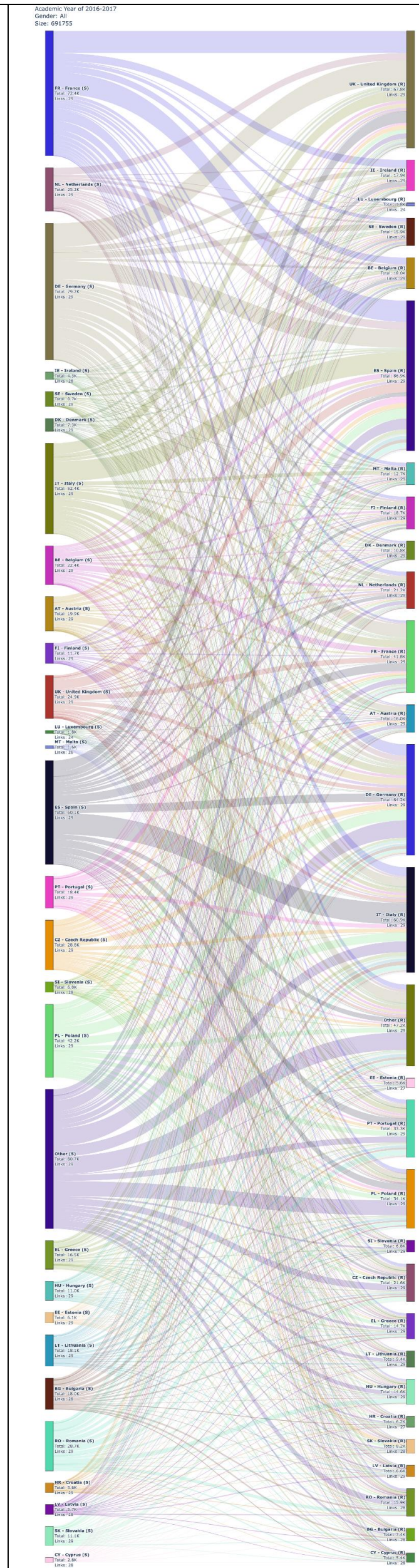

Figure 20: Overall Sankey Diagrams for 2016-2017 Trends

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2.5.6 Supporting Sankey Diagrams for 2017-2018 Academic Year Mobility Trends:

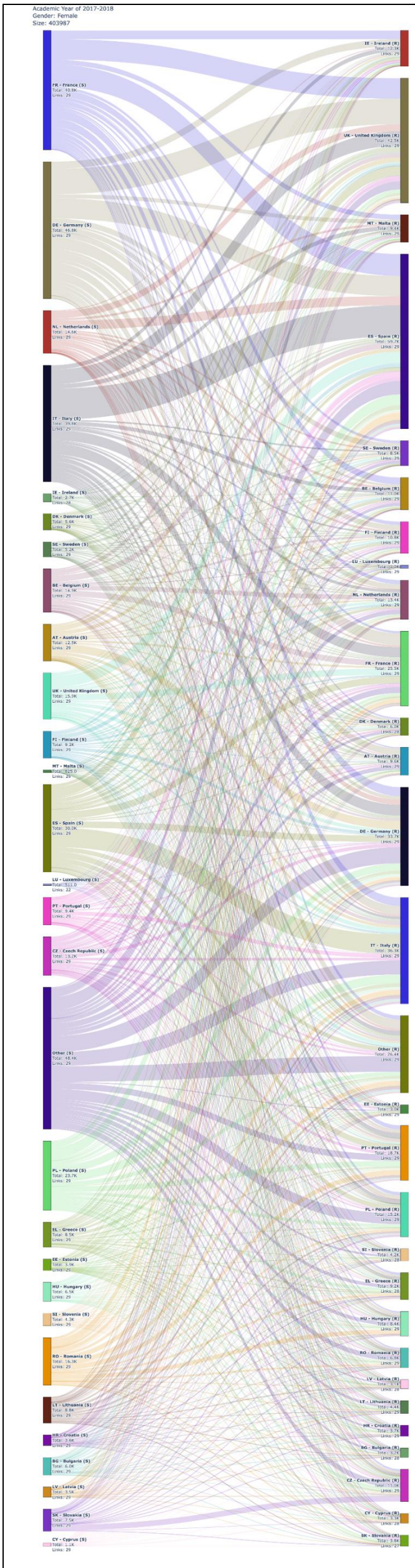

Figure 21: Female Sankey Diagrams for 2017-2018 Trends

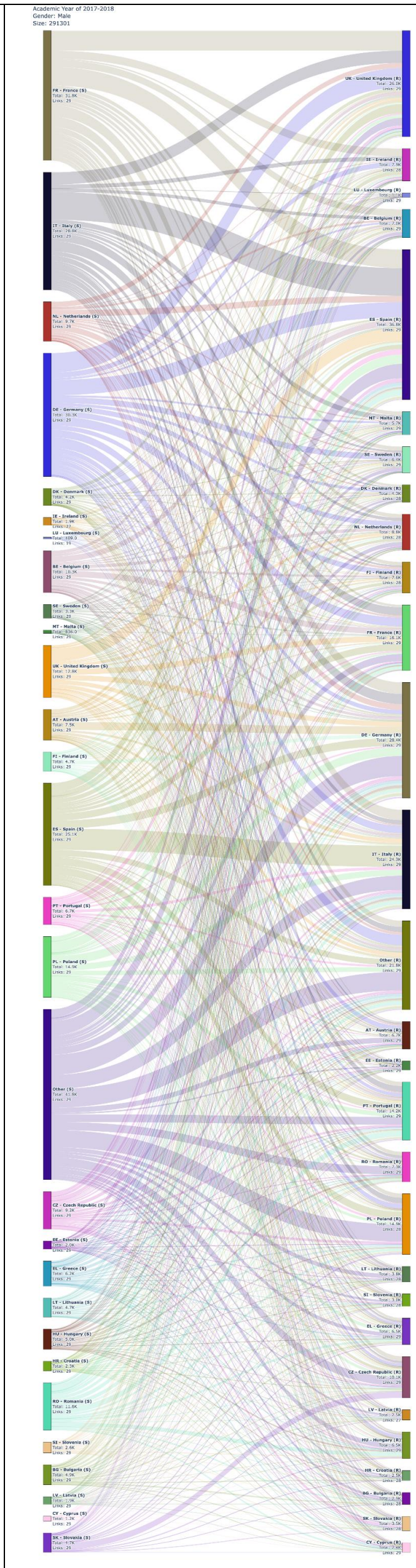

Figure 22: Male Sankey Diagrams for 2017-2018 Trends

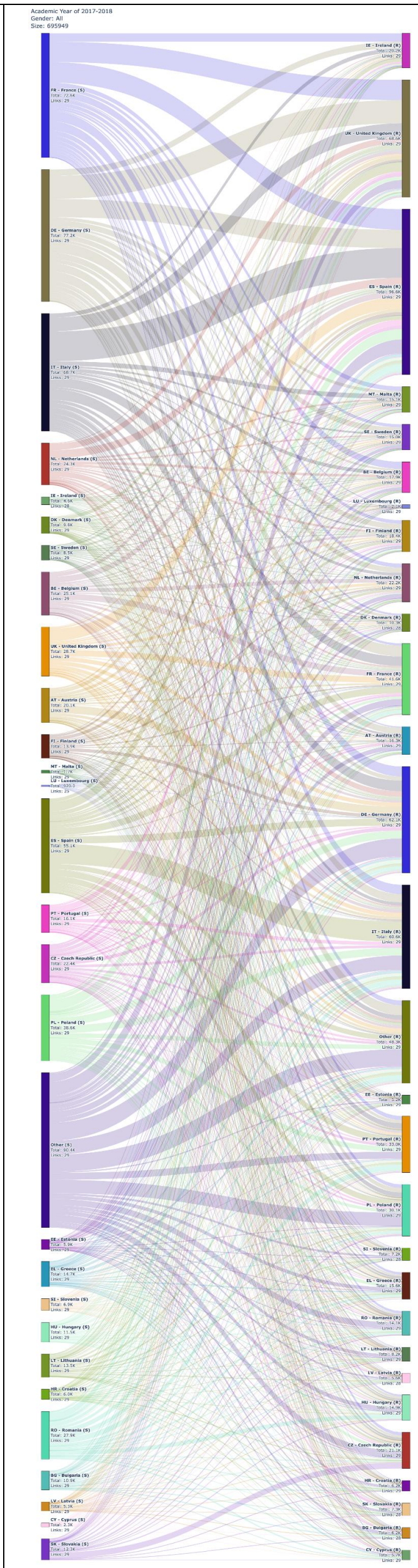

Figure 23: Overall Sankey Diagrams for 2017-2018 Trends

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2.5.7 Supporting Sankey Diagrams for 2018-2019 Academic Year Mobility Trends:

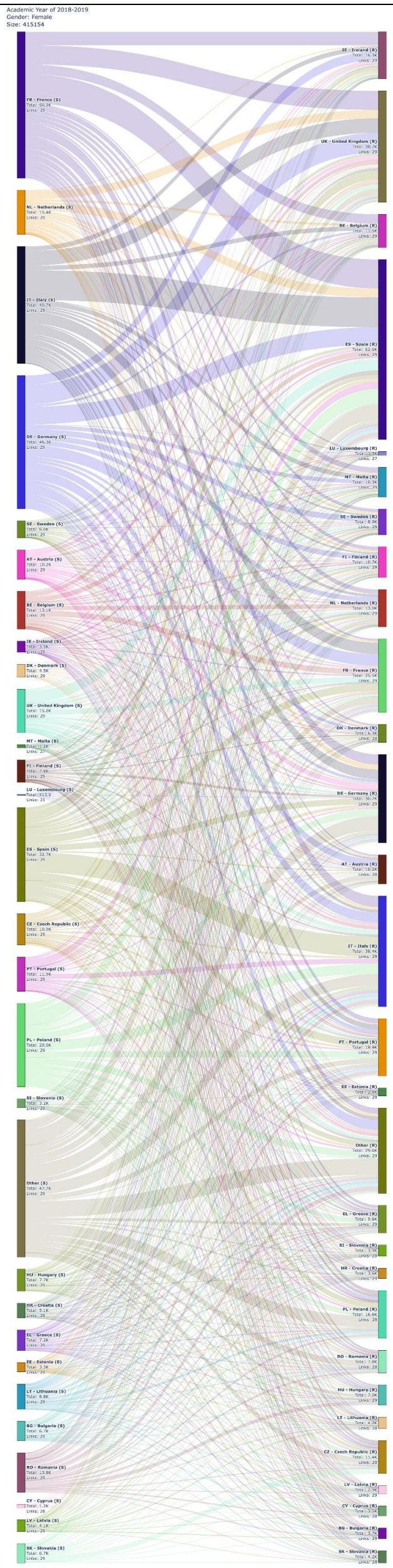

Figure 24: Female Sankey Diagrams for 2018-2019 Trends

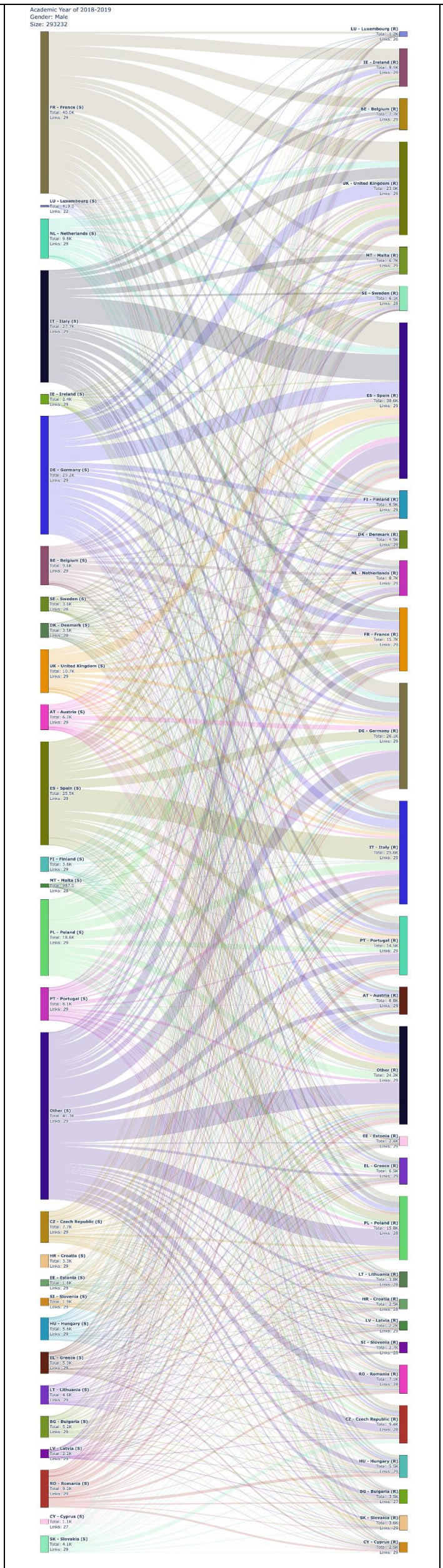

Figure 25: Male Sankey Diagrams for 2018-2019 Trends

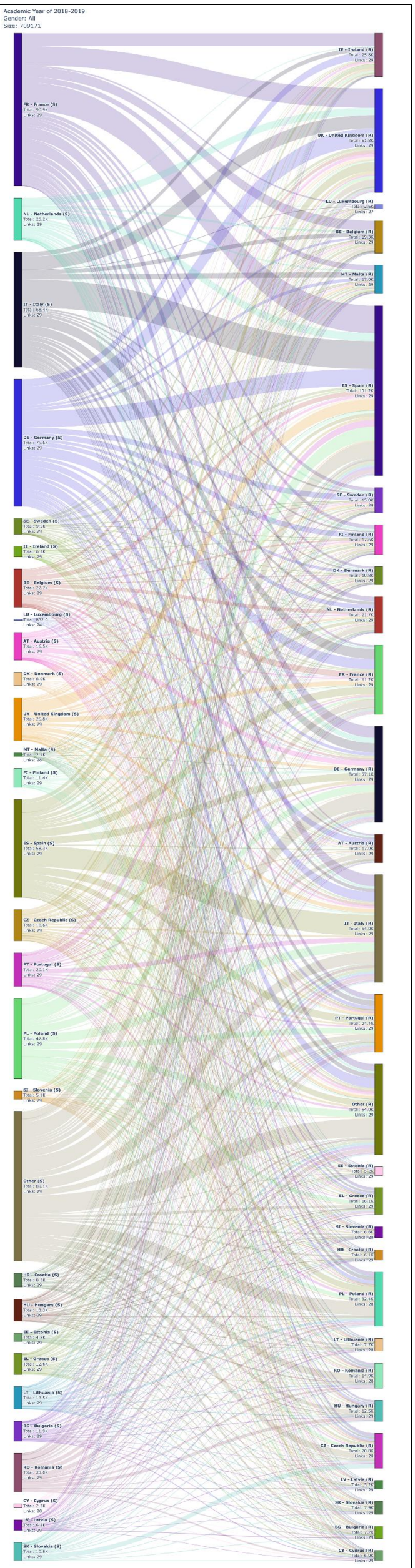

Figure 26: Overall Sankey Diagrams for 2018-2019 Trends

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2.5.8 Supporting Sankey Diagrams for 2019-2020 Academic Year Mobility Trends:

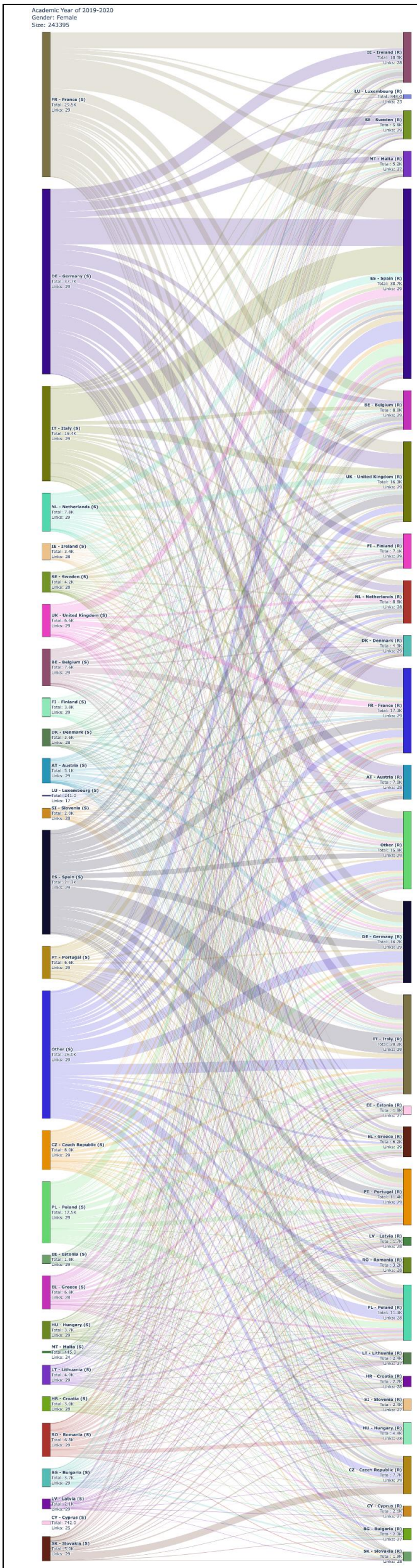

Figure 27: Female Sankey Diagrams for 2019-2020 Trends

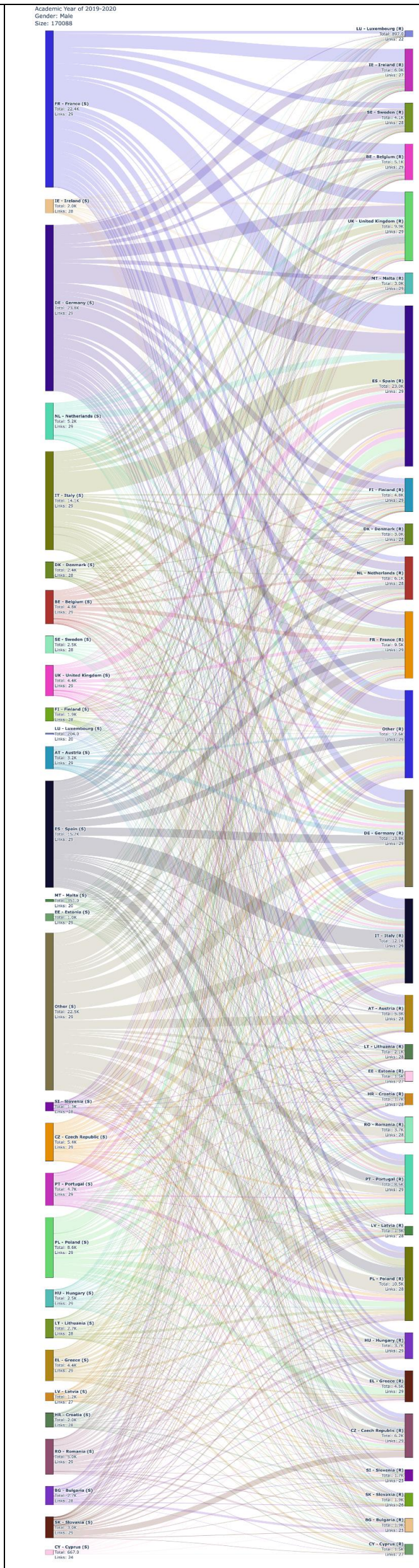

Figure 28: Male Sankey Diagrams for 2019-2020 Trends

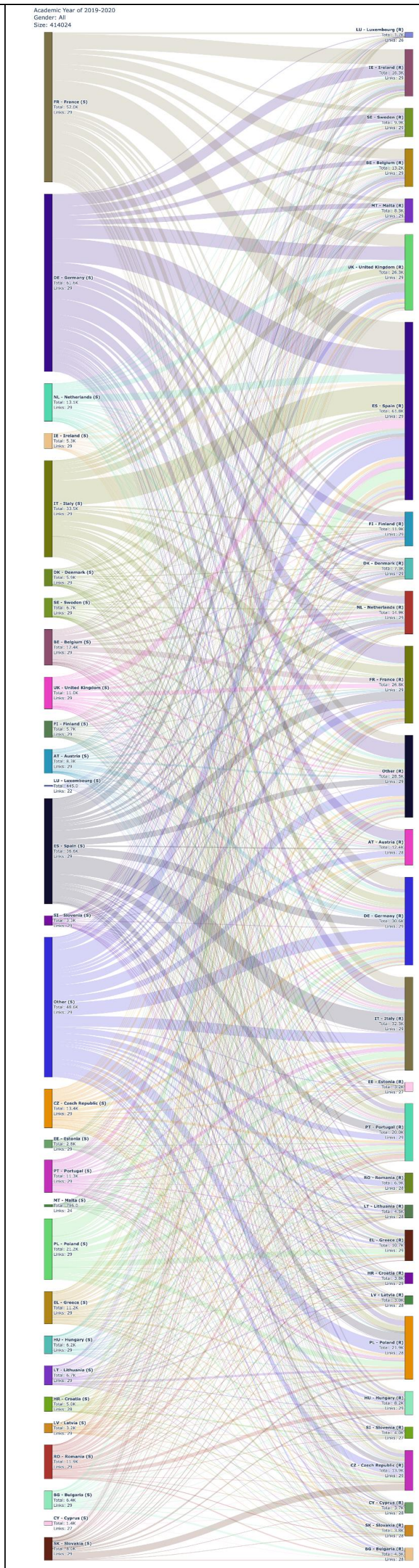

Figure 29: Overall Sankey Diagrams for 2019-2020 Trends

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2.5.9 Supporting Sankey Diagrams for 2020-2021 Academic Year Mobility Trends:

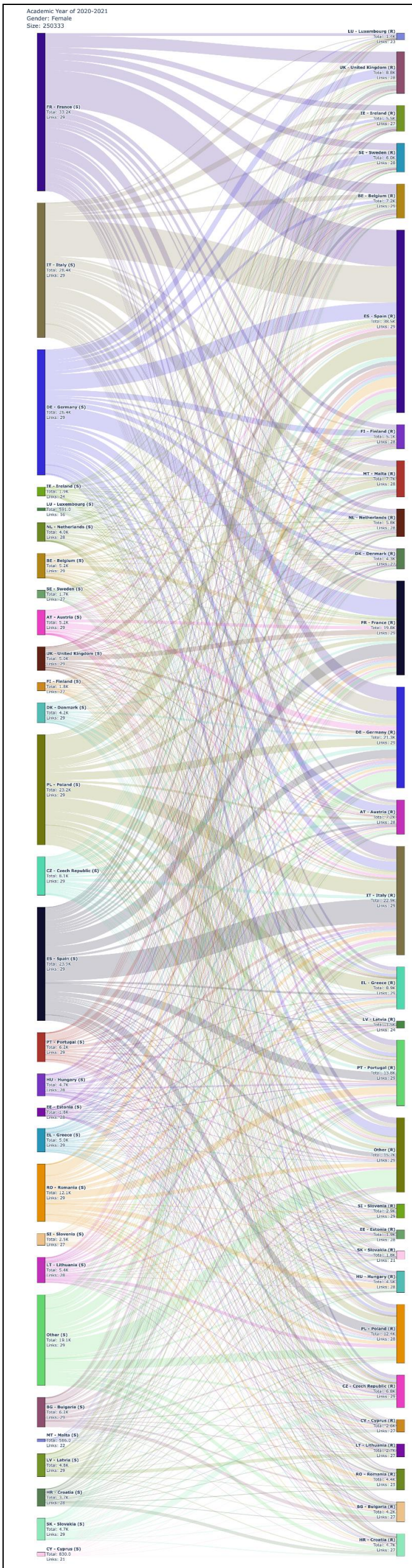

Figure 30: Female Sankey Diagrams for 2020-2021 Trends

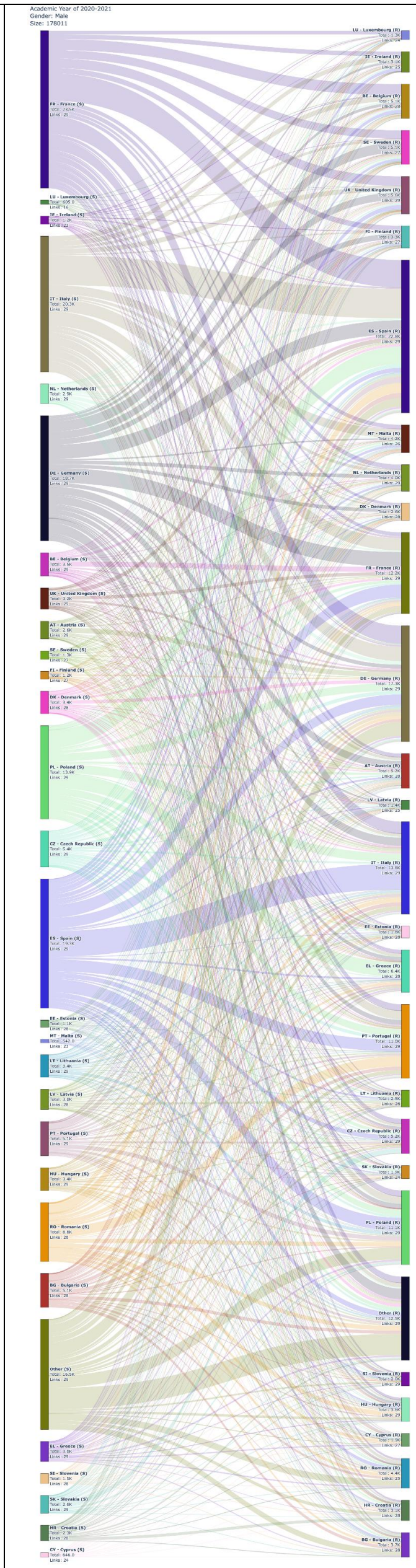

Figure 31: Male Sankey Diagrams for 2020-2021 Trends

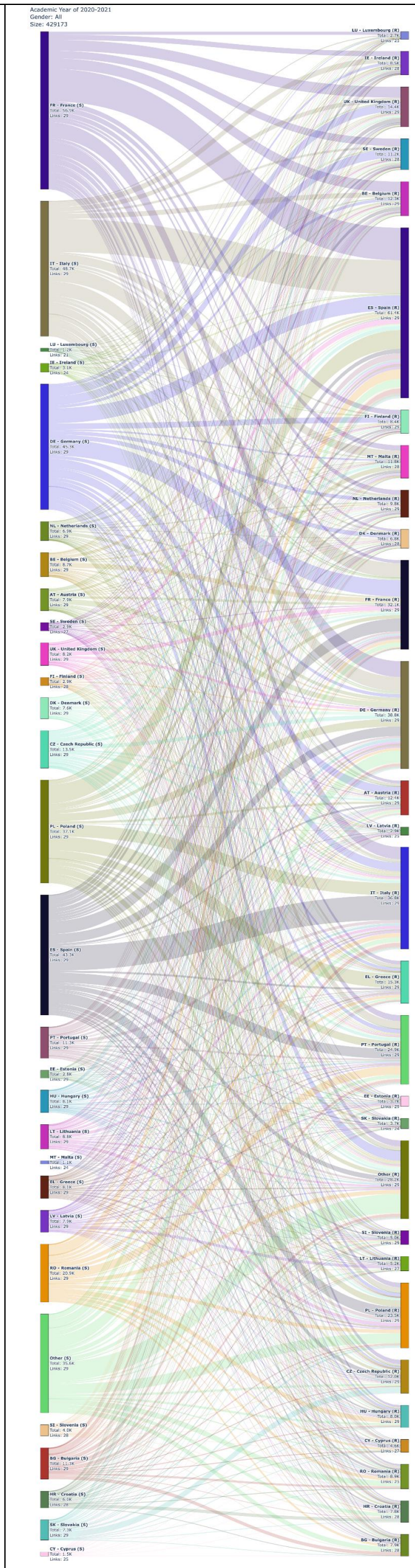

Figure 32: Overall Sankey Diagrams for 2020-2021 Trends

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2.5.10 Supporting Sankey Diagrams for 2021-2022 Academic Year Mobility Trends:

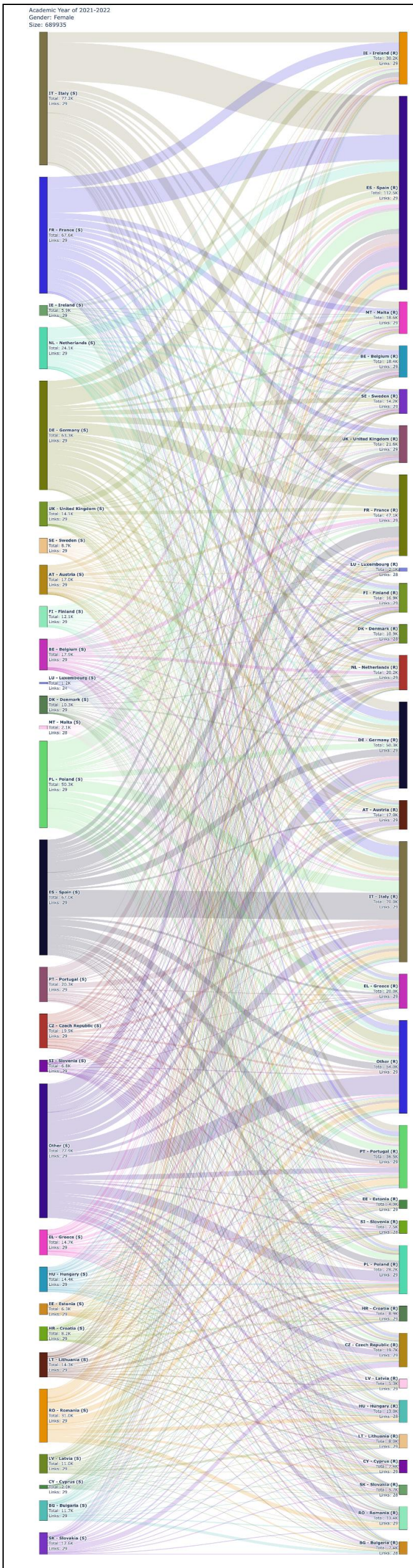

Figure 33: Female Sankey Diagrams for 2021-2022 Trends

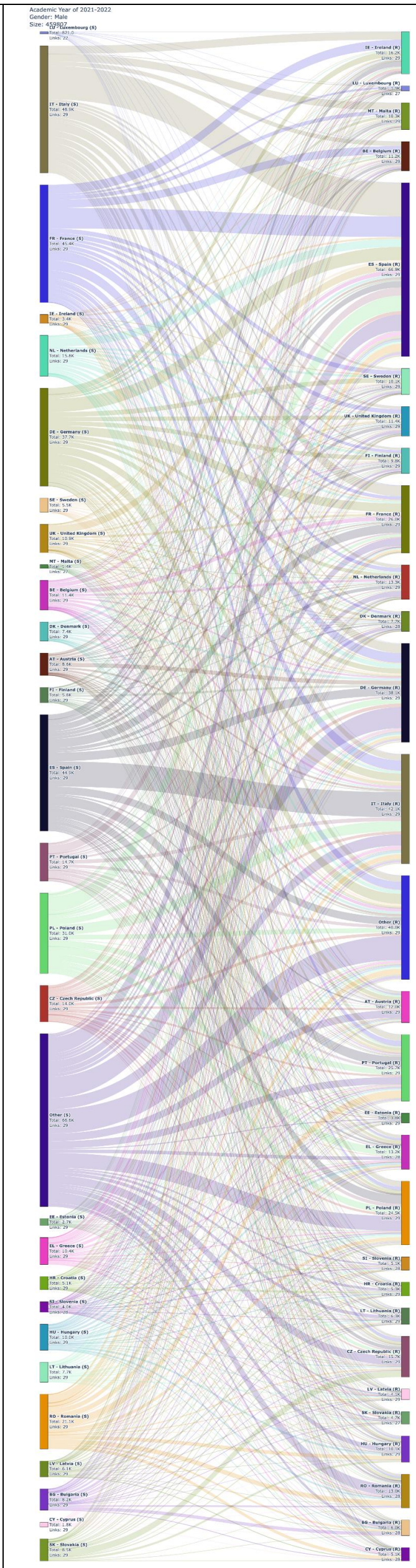

Figure 34: Male Sankey Diagrams for 2021-2022 Trends

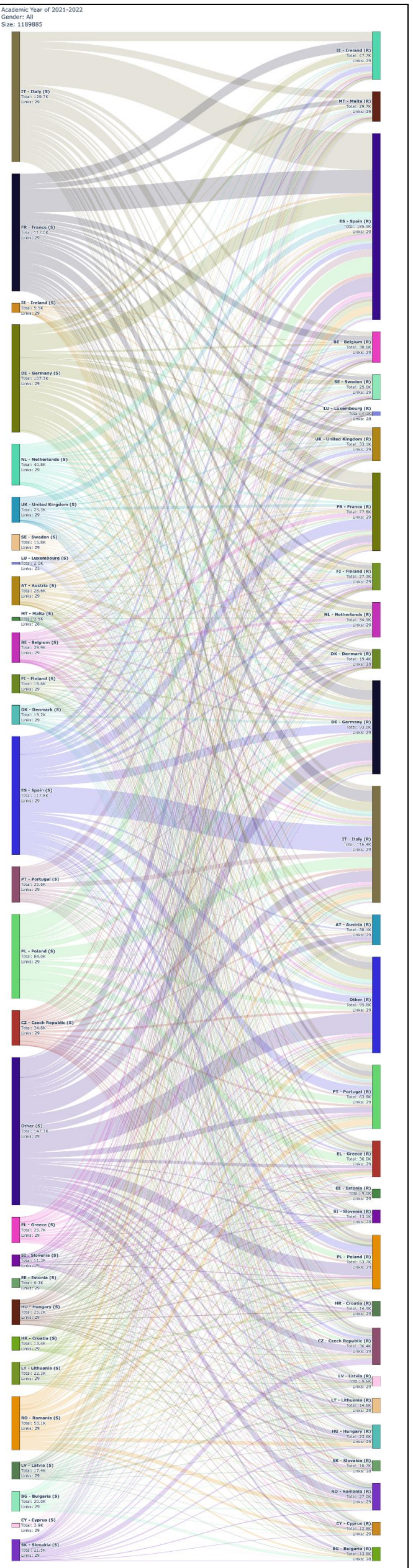

Figure 35: Overall Sankey Diagrams for 2021-2022 Trends

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2.5.11 Supporting Sankey Diagrams for 2022-2023 Academic Year Mobility Trends:

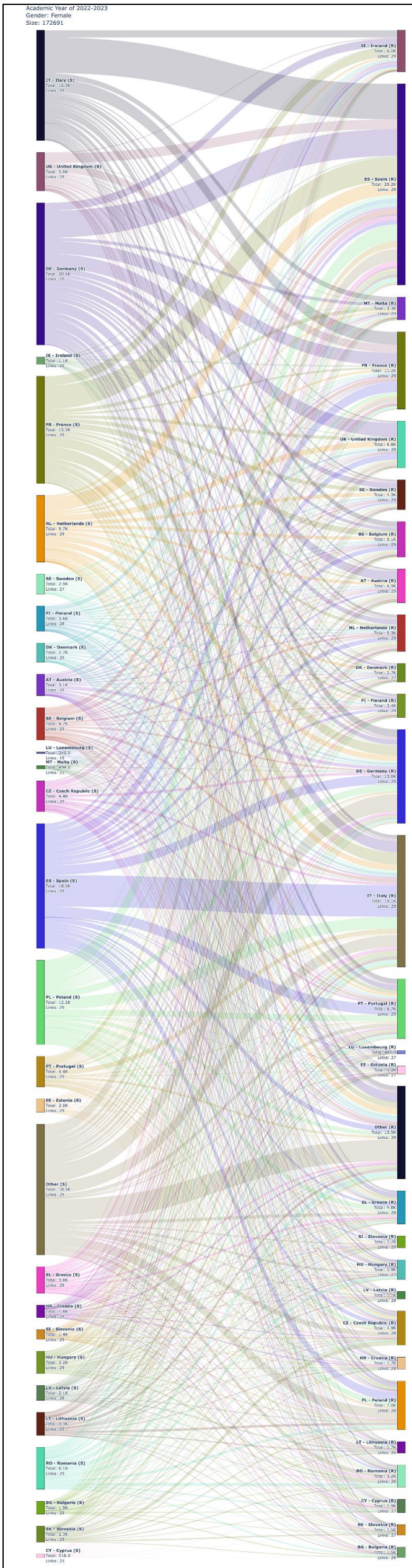

Figure 36: Female Sankey Diagrams for 2022-2023 Trends

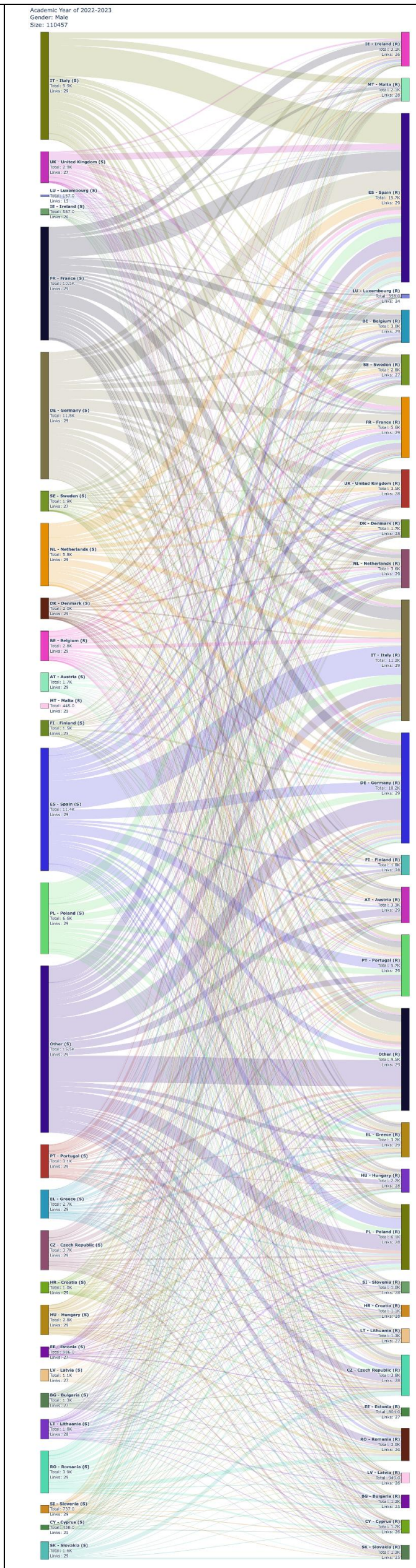

Figure 37: Male Sankey Diagrams for 2022-2023 Trends

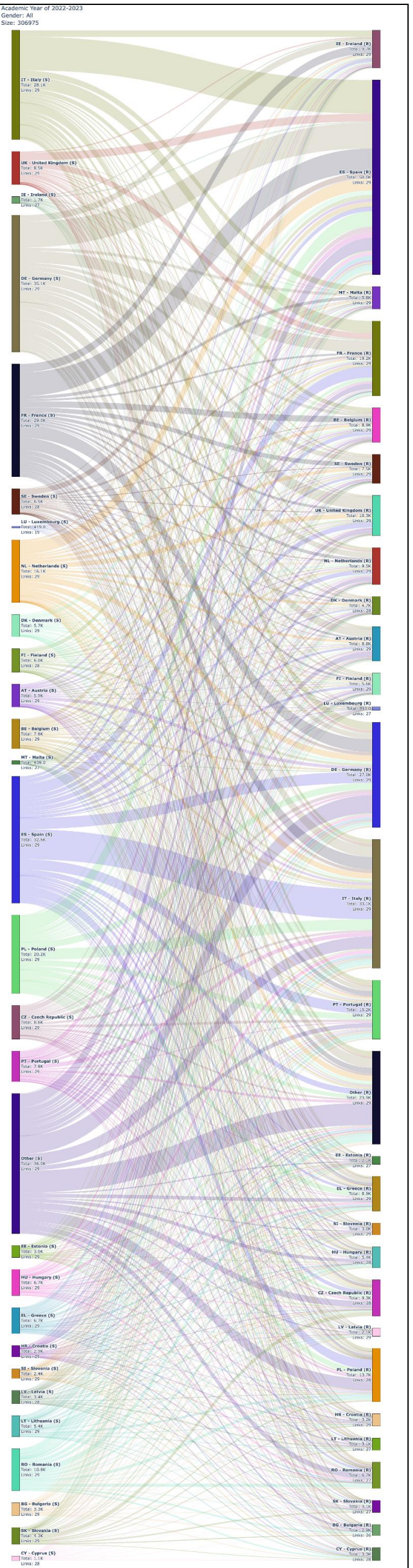

Figure 38: Overall Sankey Diagrams for 2022-2023 Trends

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2.6 Analysis of Participating Universities in the Erasmus Program and Their Connection to Space Programs

As discussed in earlier sections, over 5.8 million participants have taken part in the Erasmus program between 2013 and 2023, engaging in mobility across various countries. The organizations involved in this program include universities, governmental and private organizations, large and small enterprises, schools, and vocational institutions. Participants in the Erasmus program have been associated with over 200,000 different organizations. Among these, 2,108 universities, including campus units and university hospitals, were identified in the 28 countries analysed within the ASTRAIOS project. The distribution of these universities across the 28 studied countries is shown in the figure below.

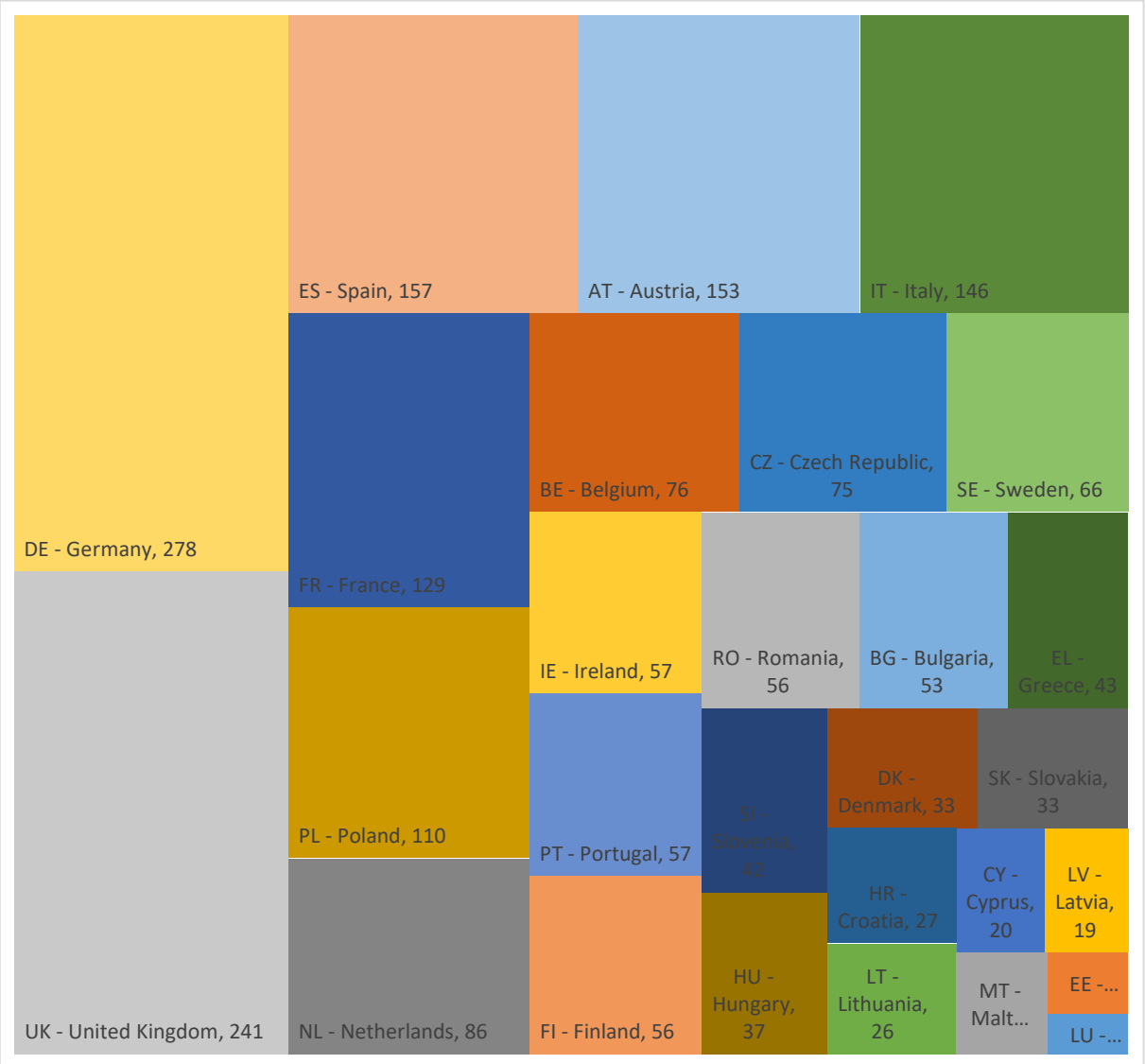

Figure 39: Number of Universities in Erasmus

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Due to inconsistencies in data input, various numerical, analytical, AI-powered natural language processing, fuzzy logic, and official Google API methods were employed to normalize and standardize the data. This approach helped address issues such as multi-language inputs, typographical errors, and inconsistent entries to accurately determine the number of universities. It should be noted that branches of universities in other countries were also classified as host institutions in those countries. For example, the branch of Liverpool University in Austria hosted students, and this was considered as an institution in Austria. This scenario applies to all countries analysed.

To explore the connection between Erasmus and ASTRAIOS, data collected in WP1000 was utilized. Universities offering space-related programs in these countries were compared with those participating in the Erasmus program, and their numbers were identified. The percentage ratio of universities providing space-related programs to the total number of universities is depicted in the following figure.

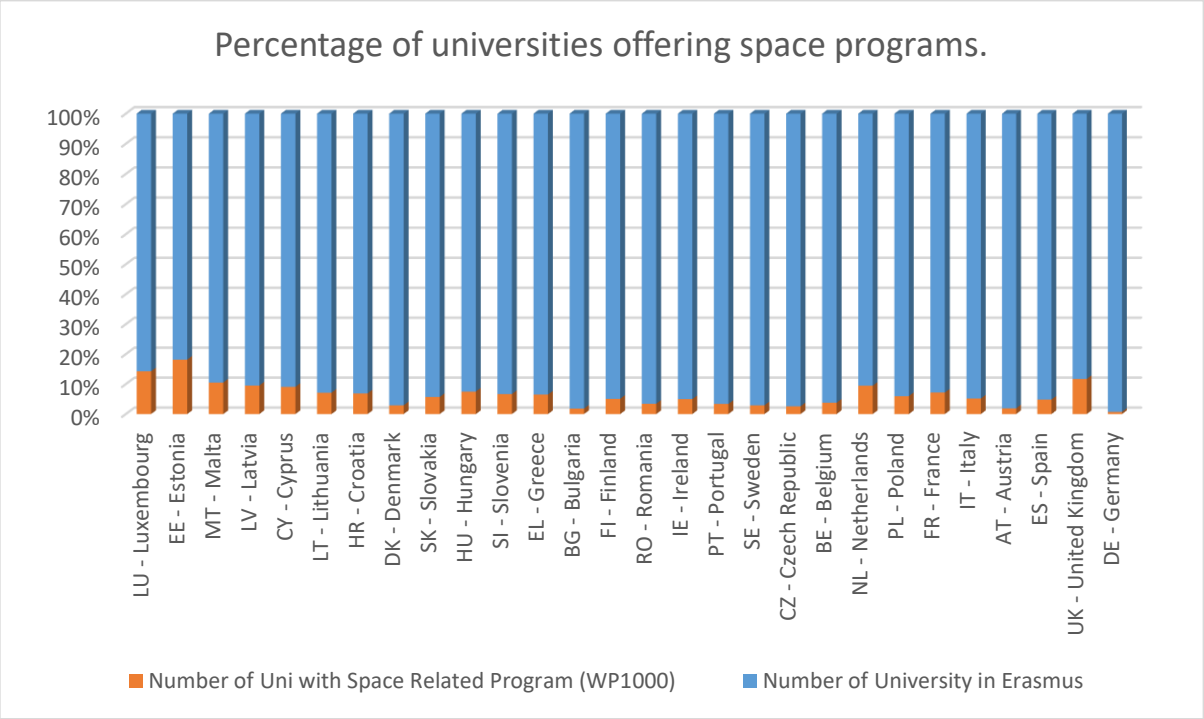

Figure 40: Percentage of Universities Offering Space Programs in Erasmus

In total, 122 universities currently offer space-related academic programs, according to the available databases. Among these universities, several provide more than one space-related program. To illustrate this, the Figure 41 was prepared.

The relatively low proportion of universities offering space-related programs, averaging only 7.07% across participating institutions, raises important questions about the underlying factors contributing to this disparity. Several key aspects merit closer investigation:

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1. **Funding Constraints**: Space-related programs often require substantial investment in infrastructure, such as laboratories, simulation tools, and specialized faculty. In 2023, global government expenditure for space programs reached approximately 117 billion U.S. dollars, with the United States accounting for around 73.2 billion U.S. dollars. [Statista]
2. **Academic Interest and Expertise**: A lack of trained faculty or insufficient academic interest in space-related fields could be a barrier. (Considering the salary difference between academics and industry in the space sector). Building capacity through faculty development programs, research grants, and international collaborations could help address this gap.
3. **National Priorities**: Countries that prioritize industries other than aerospace in their economic or academic policies may exhibit lower engagement in space education. Governments can influence this trend by incorporating space exploration and technology development into their strategic objectives, encouraging universities to align with these goals.
4. **Collaboration Opportunities**: Limited exposure to international space agencies, private aerospace companies, or joint research initiatives can hinder universities' ability to establish space-related programs. Strengthening partnerships through Erasmus, ASTRAIOS, or other similar platforms could bridge this gap.
5. **Public Awareness and Student Demand**: Space-related programs may suffer from lower enrollment due to limited public awareness or perceived career opportunities. Universities and policymakers could collaborate on campaigns to promote the significance and opportunities in space sciences.

By understanding these factors, stakeholders can develop targeted strategies to increase the availability of space-related programs. Efforts could include offering financial incentives, developing collaborative platforms, and fostering cross-disciplinary research, ensuring that more institutions contribute to building a skilled workforce for the growing space industry.

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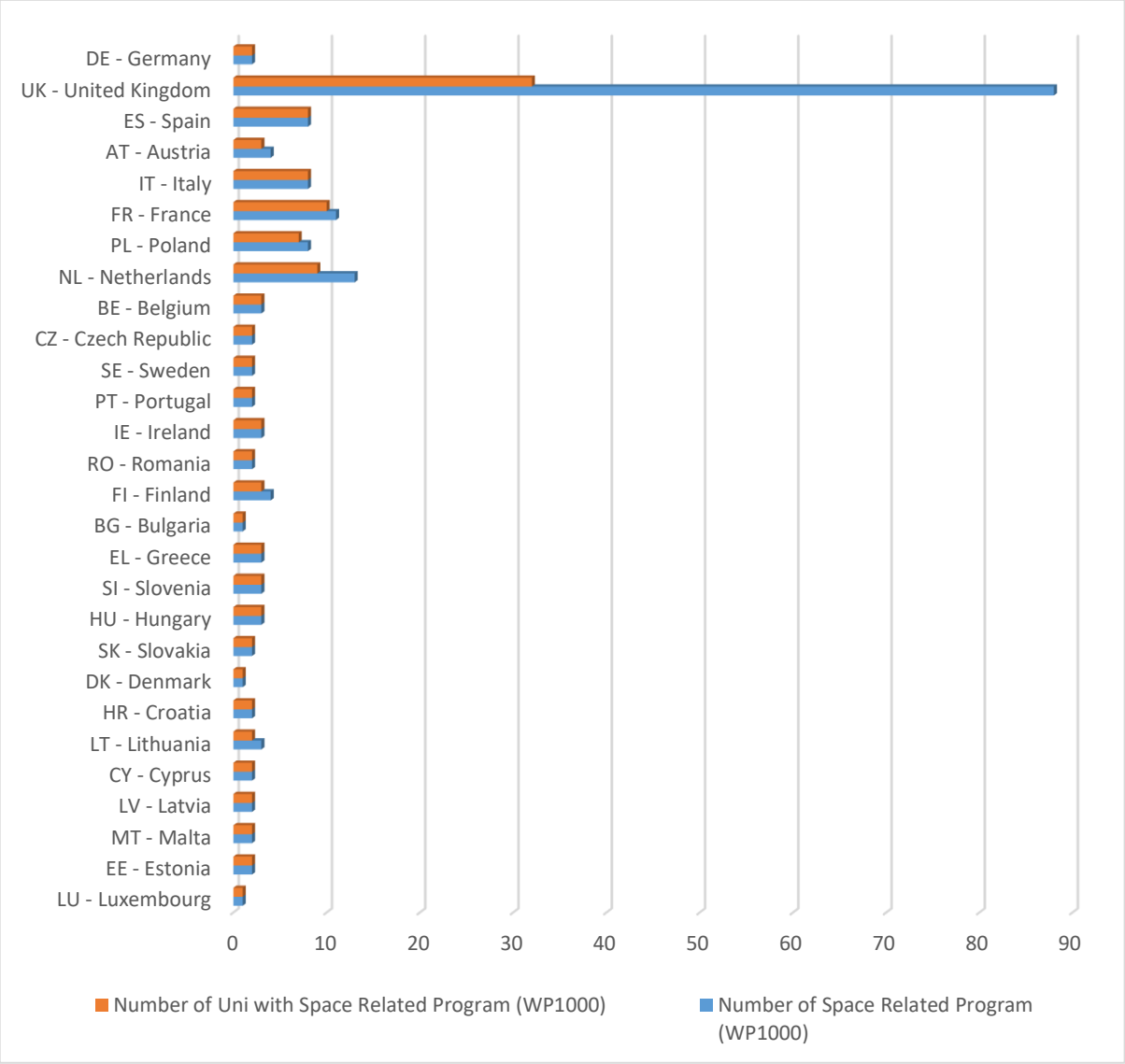

Figure 41: Number of Universities Offering Space Programs and Number of Space-Related Programs

An analysis of space-related educational programs across Europe reveals significant disparities among countries. Notably, the United Kingdom emerge as leaders in hosting space-related programs. Netherlands, Poland, France, Italy, and Spain follow.

This concentration suggests that countries with a robust space industry and supportive governmental policies are more likely to develop extensive academic offerings in this field. For instance, the United Kingdom's emphasis on space education is reflected in its substantial number of programs, which constitute 26% of the total European offer at the bachelor's level. [Space Education in Europe. ESPI]

Highlighting these leading countries provides an opportunity to identify best practices that can be adopted elsewhere. National policies encouraging investment in space research, the establishment of dedicated academic institutions for aerospace studies, and partnerships with international space

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organizations could serve as effective models. Moreover, countries with a high proportion of space-related programs may leverage their expertise to mentor and collaborate with universities in other nations, fostering a global ecosystem of knowledge exchange and capacity building. Recognizing and amplifying the success stories from these leading nations could play a pivotal role in encouraging broader adoption of space-focused education across the ASTRAIOS network.

2.6.1 Conclusion

2.6.1.1 Statistical analysis

Based on the analysis of the data:

- **Total Universities in Erasmus**: 2,108 universities participated in the Erasmus program, for 28 ASTRAIOS related countries.
- **Universities with Space Programs**: 122 universities provided space-related academic programs.
- **Space-Related Programs**: 187 space-related programs were identified across participating universities.
- **Average Percentage of Universities Offering Space Programs**: On average, only 7.07% of universities participating in Erasmus offered space-related programs.

These findings highlight that a relatively small proportion of universities are contributing to space-related education, underscoring a potential area for growth and collaboration in linking space programs with mobility opportunities provided by Erasmus.

Although it is not possible to determine precisely how many of the total Erasmus participants engaged in space-related programs, the analysis in this section indicates that less than 10% of participants were enrolled in universities with the potential to offer space-related programs.

2.6.1.2 Skill Gap in the Space Sector

The European space sector faces significant challenges regarding workforce skill shortages. Reports indicate that 52% of organizations in this sector experience skill gaps, with this figure rising to 65% among larger organizations. These shortages are particularly evident in software and data-related areas, such as artificial intelligence and machine learning (41%) and data analysis and modeling (36%). The impact of these gaps is substantial, leading to increased workloads for existing staff (72%) and delays in product development (65%). [gov.uk]

2.6.1.3 Linking the Skill Gap and Mobility

Given the skill shortages in the space sector, programs like Erasmus+ can play a vital role in bridging these gaps by facilitating educational and professional mobility across countries. However, only 7.07% of universities participating in Erasmus+ currently offer space-related programs, highlighting the need to expand these offerings and encourage greater student participation in them.

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2.6.1.4 Recommendations

1. **Expand Space-Related Academic Programs**: Increasing the number of universities offering space-related programs can directly address workforce skill gaps in the space sector.
2. **Promote Participation in Mobility Programs**: Raising awareness and encouraging student participation in exchange programs like Erasmus+ can help develop the skills required in the space sector.
3. **Strengthen International Collaborations**: Building international partnerships between universities and space organizations can facilitate knowledge and skill exchange, helping to mitigate skill shortages.

By implementing these recommendations, Europe can build a highly skilled workforce for the space sector, driving growth and innovation in this strategically important industry.

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3. CONCLUSION AND RECOMMENDATIONS

This report provides a comprehensive analysis of mobility trends within the Erasmus+ program from the academic years 2013–2014 to 2022–2023, focusing on geographical and demographic patterns across 28 European countries and an additional "Other" category. These findings yield valuable insights into mobility dynamics and present actionable perspectives for enhancing future strategies, particularly within the ASTRAIOS project, with an emphasis on addressing skill gaps in the space sector.

Key Findings:

1. **General Trends and Pandemic Impacts**:
   Mobility trends over the analyzed years reflect the evolving dynamics of the Erasmus+ program. A sharp rebound in 2021–2022 underscores recovery from the COVID-19 pandemic's disruptions, while the observed decline in 2022–2023 likely stems from incomplete data or the program's renewal phase.
2. **Country-Specific Dynamics**:
   Spain, Germany, France, and Italy consistently emerged as dominant participants, acting as major hubs for both sending and receiving mobility. Their central role highlights their importance in shaping Erasmus+ exchanges and international collaborations.
3. **Demographic Insights**:
   Female participants accounted for approximately 60% of the total, consistently outnumbering male participants. This trend highlights the need to understand gender dynamics in mobility programs and address barriers faced by underrepresented groups.
4. **Geographical Patterns**:
   Countries with larger numbers of participating universities, such as Spain, Germany, and Italy, dominate both as sending and receiving nations. Regional patterns reveal a tendency for mobility clustering among geographically or culturally proximate countries, with exceptions driven by institutional collaborations.
5. **Skill Gaps in the Space Sector**:
   The report identifies a critical gap in the availability of space-related education, with only 7.07% of Erasmus+ universities offering such programs. This finding highlights the need to address skill shortages in the space sector, where over 52% of organizations report workforce gaps, particularly in AI, machine learning, and data analysis. These gaps impede innovation, increase workloads, and delay project timelines.
6. **Mobility and Space Education**:
   The integration of space-related education within Erasmus+ mobility programs offers significant potential to mitigate these skill gaps. The identification of 122 universities offering space-related programs and 187 associated curricula provides a foundation for targeted expansion and collaboration across Europe.

By addressing these recommendations and leveraging the insights from this report, the ASTRAIOS project can bridge the skill gap in the space sector, enhance participation in space-related programs. The data suggests a significant opportunity to expand space-related academic programs across the broader set of participating universities. Encouraging collaboration between space-focused universities and those currently not offering such programs could enhance the overall impact of ASTRAIOS.

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