AI-Assisted Knowledge-Based Expert System Link4Skills Navigator for addressing global skill shortages

Link4Skills
Horizon Europe

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Funded by the European Union

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The Problem Addressed

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Challenge:

Global labour markets are increasingly facing critical skill shortages, misaligned skill flows, and policy blind spots when matching labour demand with talent supply—particularly across borders.

Current barriers:

- Fragmented data on EU demography, skill shortages, migration and skill, talent partnerships
- Lack of actionable insights on skill and talent partnerships
- Inaccessible tools for non-experts to explore skill and migration trends
- Lack of support for choosing various policy options how to address skill shortages: upskilling, retraining mid career, later retirment, automation, high immigration, selective migration.

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Objective and Advantages of the Digital Solution

The Link4Skills Navigator is an AI-assisted tool based on expert knowledge that supports data-driven decision-making for managing and optimizing global skill flows.

Core objectives:

- Support labour market stakeholders (policy makers, employers, educators) with actionable insights.
- Enable fair and efficient skill mobility between origin and destination countries.
- Provide open-access, interactive dashboards to empower users with scenario-based planning.

Key Advantages:

- Centralized interface combining labour market data, policy partnerships, and migration insights
- Co-created with stakeholders: policy makers, recruiters and employers
- Enables policy simulations and identification of skill corridors for proactive planning.

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Link4Skills Navigator

What is it?

The Link4Skills Navigator is a solution developed by the Link4Skills project to address global skill shortages, with a special focus on the EU. Navigatoir aims to help tackle skill shortages and migration challenges across global labour markets. It functions as a participatory expert knowledge-based system, analysing skill gaps and flows across continents (Europe, Africa, Asia, and the Americas) and offering tailored solutions for re/up-skilling, AI & automation, and migration strategies.

What will you find in it?

At its core, the Navigator is a knowledge-based expert system that combines robust data analytics with a user-friendly interface. Its features include:

1. Interactive Dashboards

Users can create and customize dashboards, visualizing data through maps, charts, and tables

2. AI-Driven Assistance

A chatbot interface offers contextualized support, answering questions with real-time insights derived from integrated datasets

3. Data Exploration and Visualization

Advanced filtering and export options enable users to tailor analyses for reports and presentations

4. Migration Corridor Analysis

Interactive maps showcase migration flows, policy impacts, and skill dynamics across regions

For whom?

The Navigator is designed to empower EU decision-makers, recruiters, and training providers with actionable insights. It addresses critical challenges, such as skill shortages, workforce planning, and equitable migration policies, by providing:

- Tailored Recommendations: Identify skill gaps and formulate strategies for upskilling, reskilling, and workforce development.
- Policy Support: Develop evidence-based policies through comprehensive analysis of migration patterns and labour market trends.

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Link4Skills Navigator

Info | Migration Skill Corridors | Dashboards | Repository | Partnerships | MIRA

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About the data

The Link4Skills Navigator will primarily present data from research work within the Link4Skills project, funded by the European Union's Horizon Europe research and innovation programme. Key data areas include EU Labor Market Analysis, Future workforce and Scenarios Modelling, Skill and Talent Partnership Inventory and Migration Skill Corridor Data (test cases).

EU Labor Market Analysis

This part concerns data on skill shortages, gaps, and (skilled) labour demand across the EU (using EU-LFS data for 2014-2023). Using AI Navigator Dashboard, users can explore:

- Occupational skill levels of workers by educational attainment and selected demographic and/or migrant characteristics, for the EU27 and Member States
- Past trend in occupational skill mismatch among natives and immigrants (defined as foreign born) and underutilisation of labour. For example, the share (and estimated stock) of highly educated native born and immigrant workers in low (elementary), medium and high skilled occupational, for total labour force, by broad age groups and/or gender.
- Unfilled and filled labour demand by occupational skill levels (elementary, medium and high skilled occupations) and distribution of workers by their qualifications (educational attainment) and other selected characteristics (nativity status, gender). In this analysis we link labour demand data by occupation group employment data from EU-LFS.

Future workforce and Scenarios Modelling

We forecast occupational distribution and skill levels of workers and labour demand in the ageing EU-27. Growing supply of highly educated workers does not always align with the demand for specific skills in the labor market, leading to potential mismatches. Simultaneously, the proportion of immigrants in the workforce has been increasing and labour force outcomes of immigrants and natives differ. We integrate demographic, migration, educational, and occupational variables into a comprehensive microsimulation model that project long-term shifts in European population and workforce. The model allows to explore how demographic changes and projected future skilled labour demand will affect the occupational distribution of the EU workforce

"What-if" scenarios simulate potential implications and labour force outcomes of:

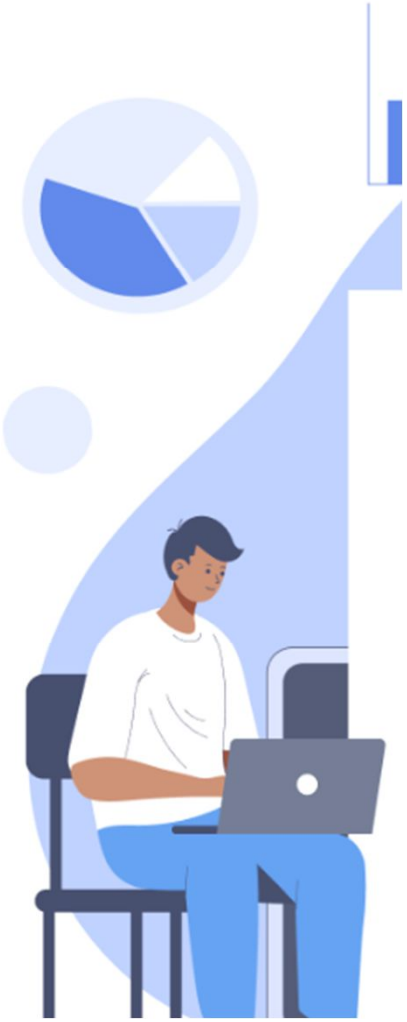
- Human capital responses: Upskilling or reskilling the existing EU population, including improved access to high education and mid-career retraining (for both native and migrant populations).
- Employers' responses: Increased adoption of automation and AI in labour-intensive sectors and upskilling of workers.
- Migration responses: Stimulating fair skilled migration and skill selection of immigrants to the EU from non-EU countries.

Skill and Talent Partnership Inventory

A repository of practices and frameworks for skill exchanges and partnerships between regions.

Migration Skill Corridor Data (test cases)

Detailed data on skill supply and flows in selected 26 global migration skill corridors, including insights into both sending and receiving ends, helping to assess and design equitable partnerships.



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How the Solution Works for the Labour Market

User-centric modules include:

- Customizable Dashboards: Built on Apache Superset for filtering, comparison, and data visualisation.

These modules support:

- Evidence-based policy making.
- Anticipation of future skill demands.
- Human Resource Inventories: Detailed views of workforce capacities in origin countries.
- Development of targeted re/upskilling strategies.
- Migration Skill Corridors Map: Navigate skill flows between countries.
- Skills Mobility and Talent Partnerships Search: Identify ongoing initiatives and partnership frameworks.
- MIRA (Migration-Informed Recommendation Assistant): AI chatbot offering recommendations and insights.

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Dashboards -Customisable filtering and chart visualisation to match user needs

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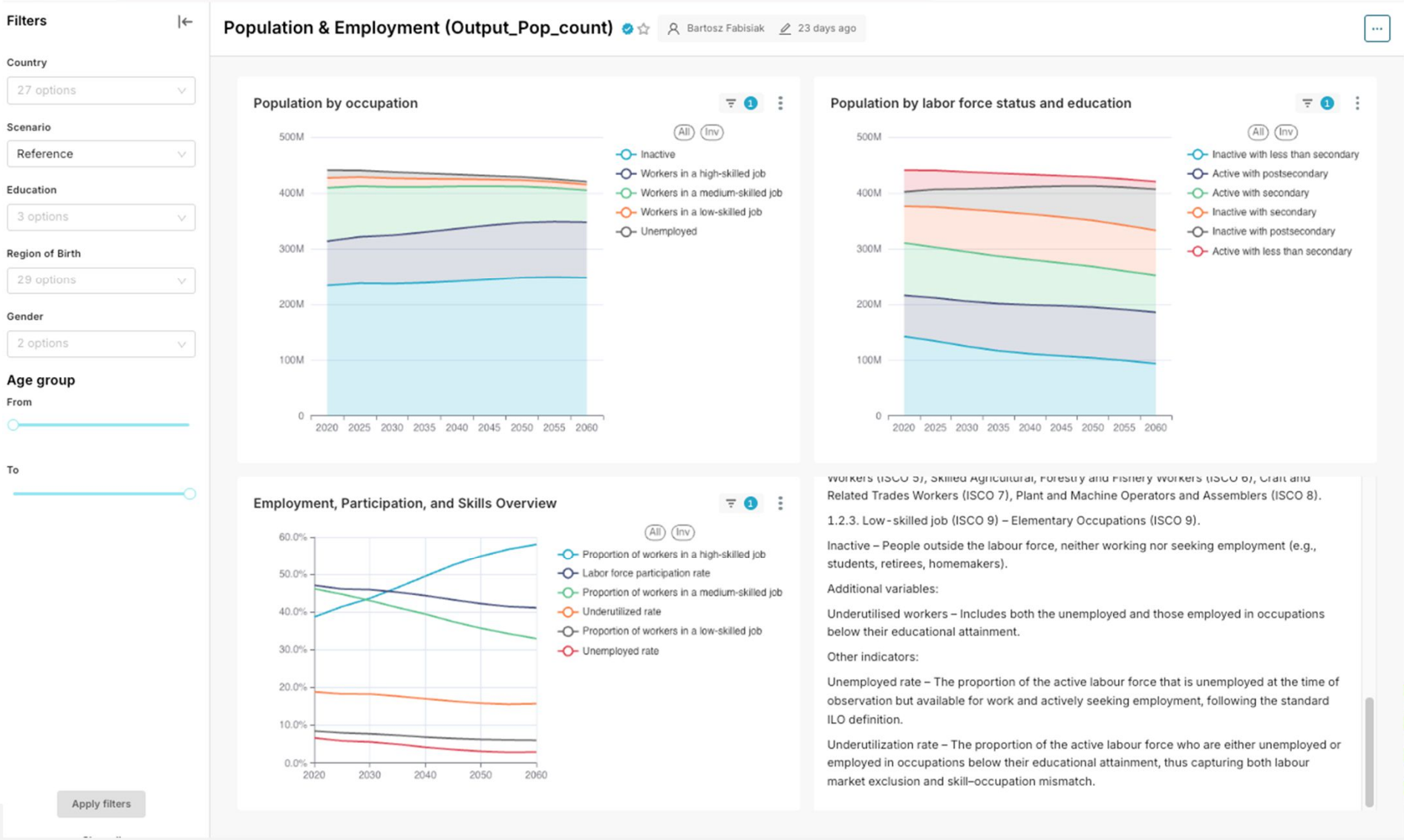

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Dashboards - customisable filtering and chart visualisation to match user needs

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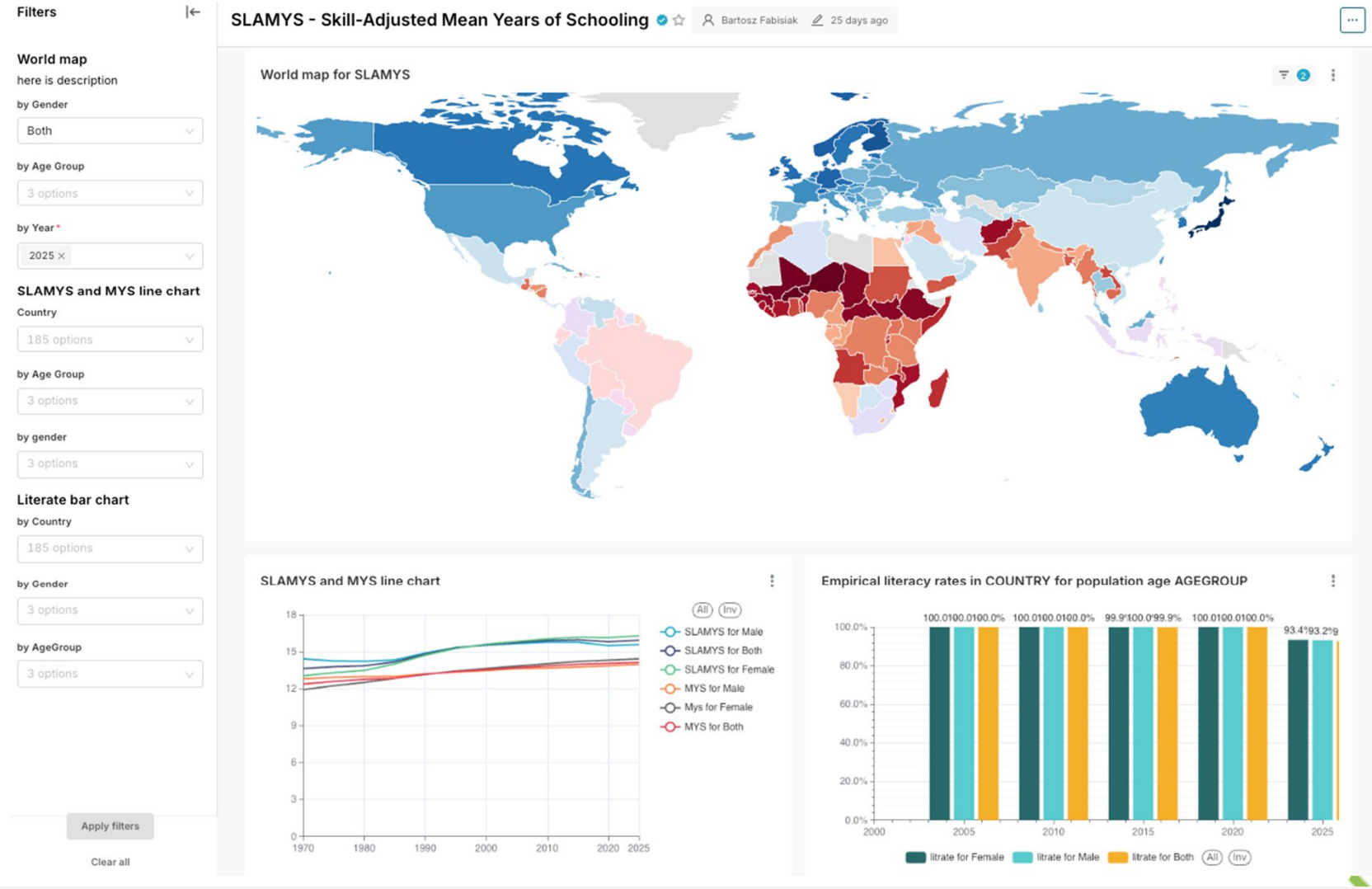

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User-Driven Dashboards with Data and Scenario Comparison

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AI for Supporting Policy Choices

MIRA:

- Based on repository of curated articles and policy documents
- Repository created by Link4Skills experts
- Uses Retrieval-Augmented Generation methodology that formulates replies to user questions based on relevant articles -> avoiding hallucinations
- Replies include sources to articles from Link4Skills repository
- Replies to some questions will be based on statistical data and forecasts in the Link4Skills database

Evaluation:

- L4S Navigator and MIRA will be evaluated by stakeholders
- Evaluation will stress the validation of the tools ability to support policy choices.

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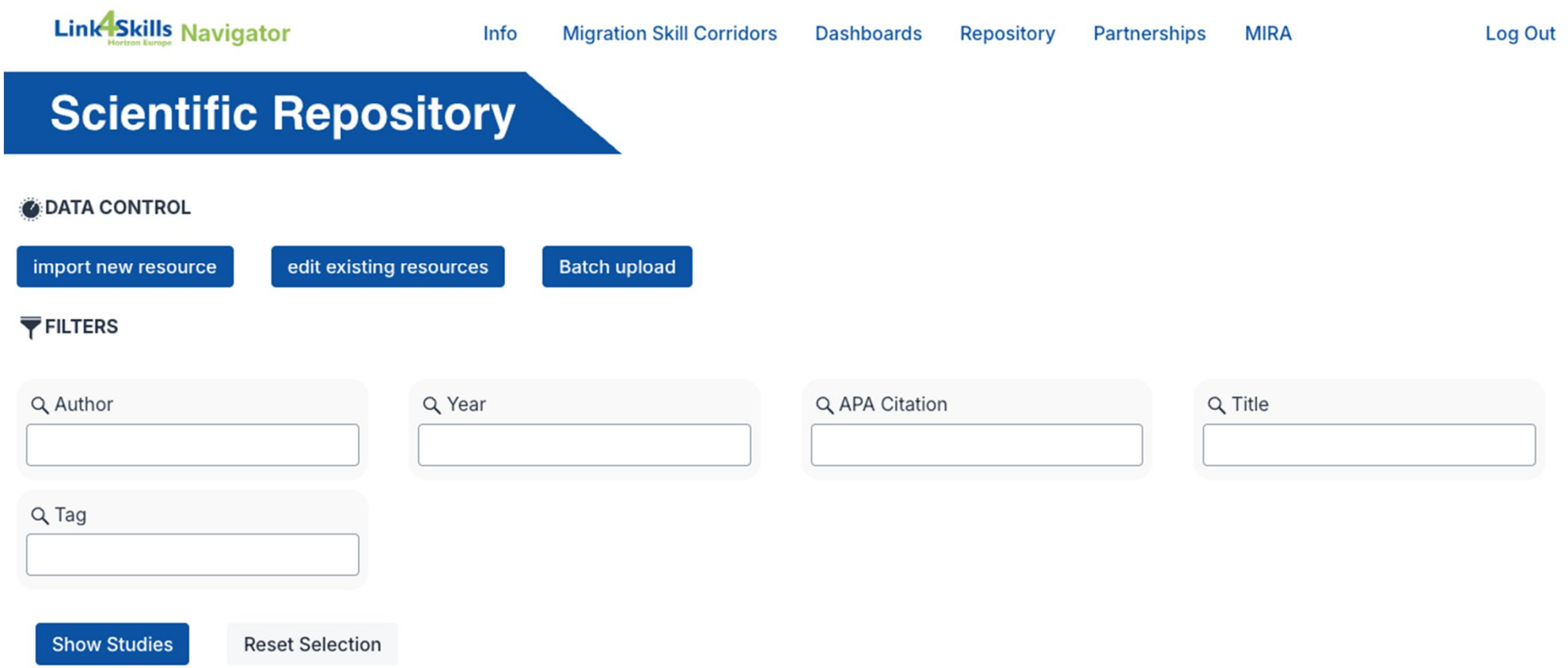
Publication Repository – KBES Resources for MIRA (chatbot)



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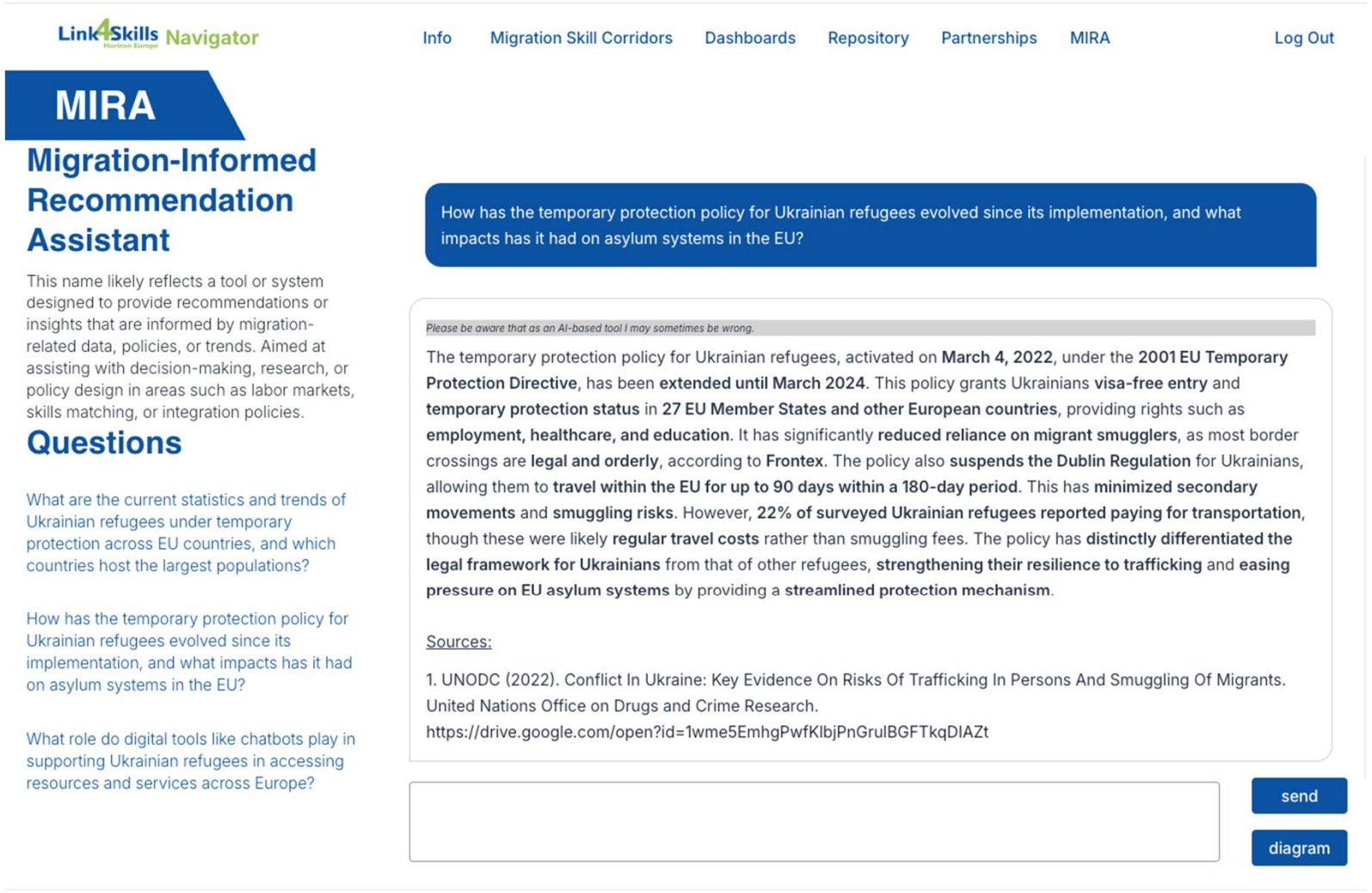
MIRA - Migration-Informed Recommendation Assistant



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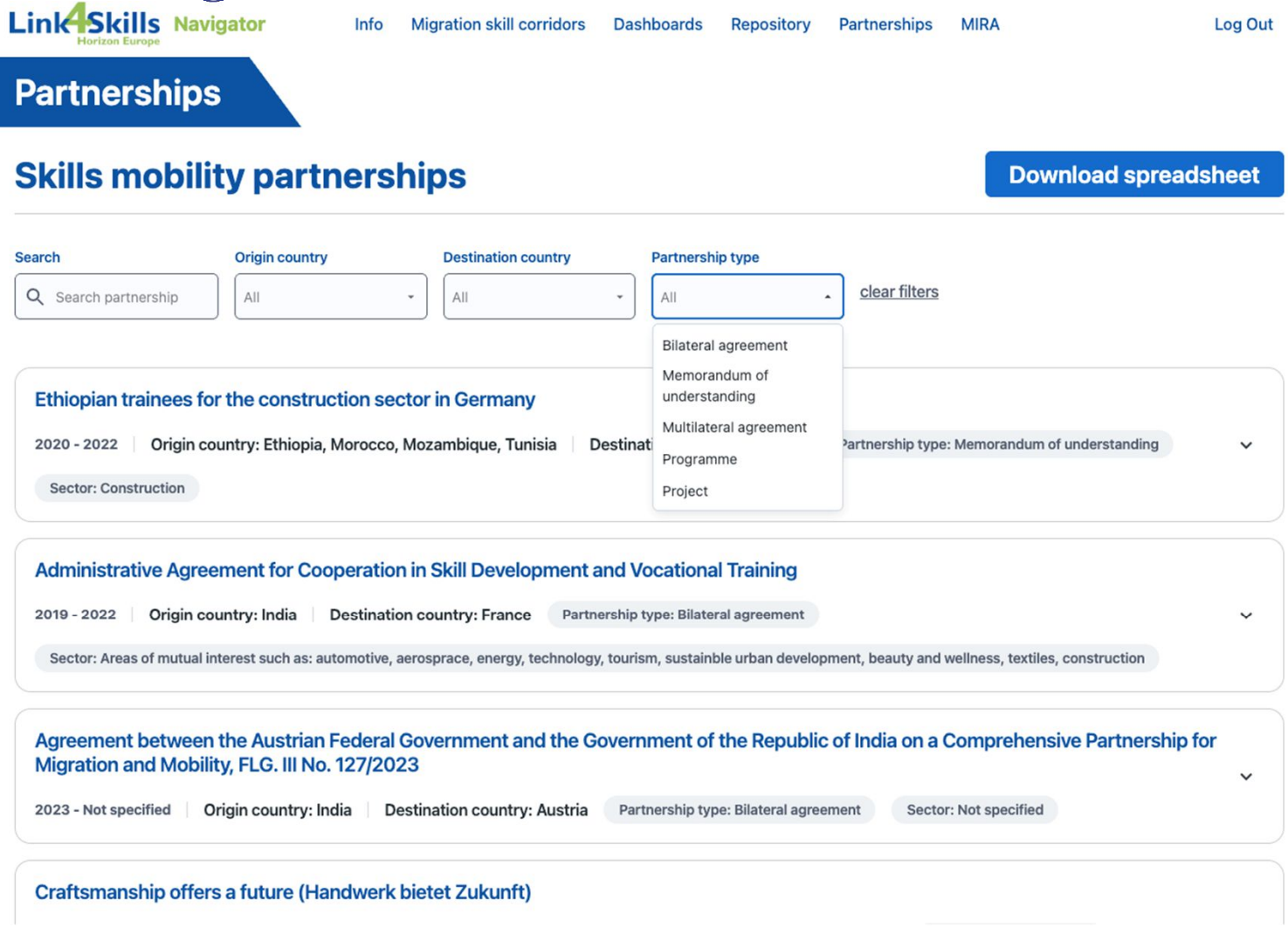
Skill mobility partnerships, incl. Talent Partnerships - user-friendly search and filter options for smooth navigation



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Migration Skill Corridors - start by selecting a country on the map or from the drop-down list

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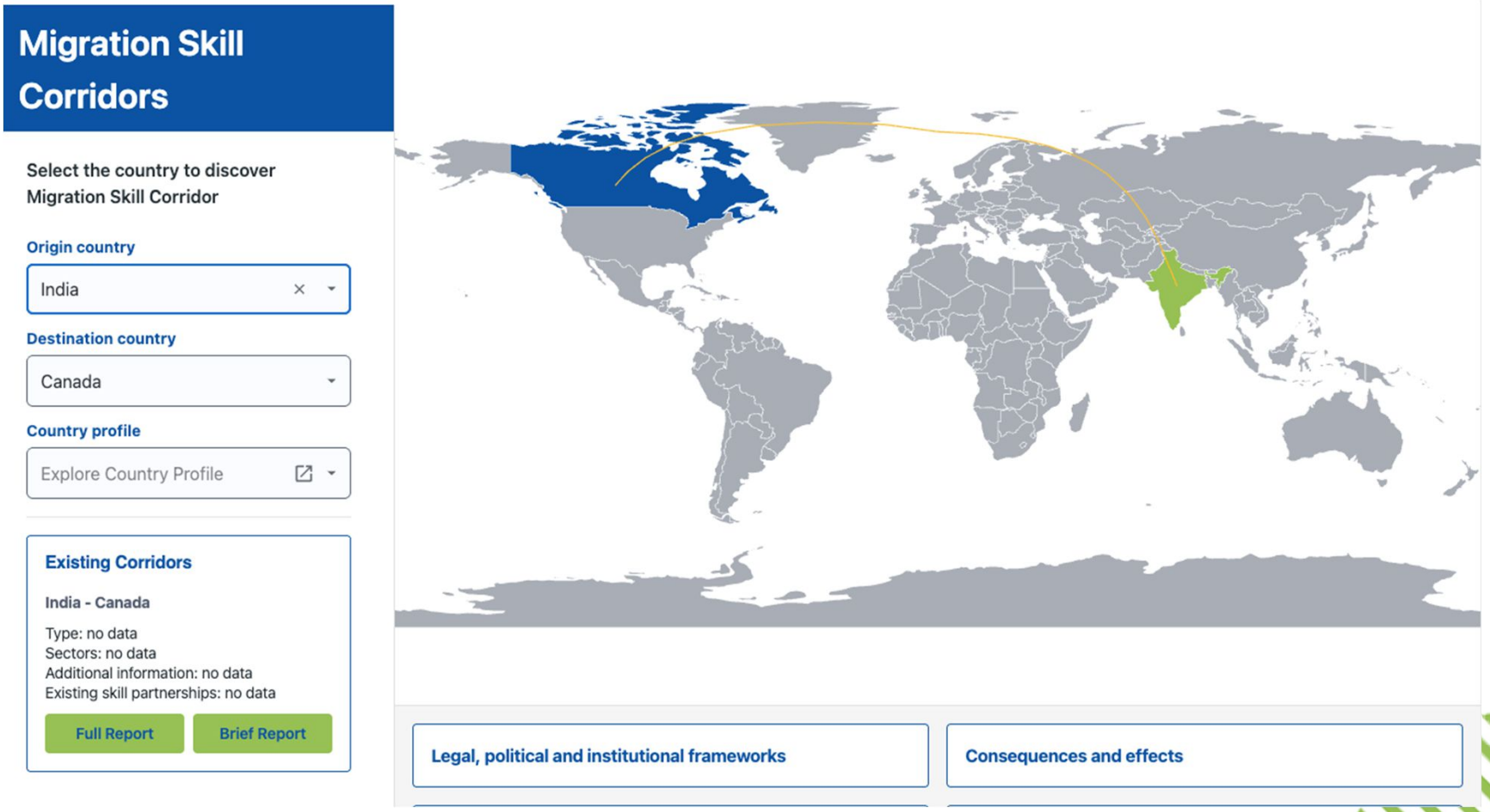

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Creation Process: Tech, Data & Resources

Development Process Highlights:

- Based on Horizon Europe RIA Grant 101132476.
- AI-Assisted Skill Navigator (TRL5) co-developed with project partners and stakeholders.
- Built using open-source technologies (e.g., Apache Superset, custom APIs, metadata search tools).
- Data collected from:
  - EU migration and labour market databases.
  - Partner country surveys and interviews.
  - Literature and policy document reviews.
- Adheres to Horizon Europe ethics guidelines (no personal data shown; anonymous examples used).

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Challenges & Lessons Learned

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Challenges:

- Data harmonization across countries and sources.
- Balancing automation with ethical oversight in recommendation systems.
- Maintaining user-friendliness while offering advanced filtering and analytics.

Lessons Learned:

- Stakeholder involvement is crucial in tool design and usability testing.
- Need to anticipate digital literacy gaps in user groups.
- Emphasis on transparency in algorithmic decision support is vital for trust (that is why we are building expert-knowledge based, validated chatbot that responds to questions with curated source articles).

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Way Forward

- Piloting with stakeholders: policy makers, recruiters, employers
- Presenting policy options (policy mix) in dashboard for addressing global skill shortages
- Talks with European Commission and its agencies who can take it over after the end of the project (e.g. JRC, ELA (?)
- Making user-friendly updates of knowledge repository for stakeholders
- Ongoing updates in response to policy feedback and real-world usage.

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