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Study Providing Methodological Support for the European Higher Education Sector Observatory

Final Report

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1 Executive Summary

Today, our society needs more than ever the contribution of its universities. Europe is facing major challenges such as climate change, the digital transformation and aging population. Universities, and the entire higher education sector, have a unique position at the crossroads of education, research and innovation, in shaping sustainable and resilient economies, and in making our society greener, more inclusive and more digital.

The European Strategy for Universities, presented on the 18th January 2022 by the European Commission, and the supportive Council Conclusions of April 2022 on a European strategy empowering higher education institutions for the future of Europe, aims to support universities in this endeavour. The aim of the Strategy is to make higher education institutions thrive and reach their full potential to address present and future challenges and equip students with necessary knowledge and skills.

Europe is home to close to 5,000 higher education institutions (HEIs), 17.5 million tertiary education students, 1.35 million people teaching in tertiary education and 1.17 million researchers. It is crucial for the success of the Strategy to provide evidence-based information on its implementation. This is why the Strategy proposed to set-up a data-focused European Higher Education Sector Observatory and a European Higher Education Sector Scoreboard, with indicators to be developed with Member States and stakeholders. As a data-driven and policy-oriented web portal, the Observatory is expected to be based upon existing European tools and datasets that cover data on higher education institutions.

The Observatory is foreseen to serve the following **aims**:

- Monitoring the implementation of the European Strategy for Universities on key policy priorities. This monitoring, based on strong evidence, will allow for a strategic dialogue between the Commission, the Member States and the stakeholders on progress accomplished and where to focus policies and support in the coming years

- Supporting data needs of the Member States and higher education institutions. Streamlining and upgrading existing internal and some external data sources through the Observatory should enable institutions and governments to strengthen their 'intelligence' on key topics for institutional transformation and adaptation of national policies

- Promoting competitiveness and attractiveness of higher education institutions. The Observatory will enable to compare, analyse and showcase the higher education sector performance within Europe, as well as to the outside world, in a more comprehensive and accurate way than with existing rankings. It will help to attract talents worldwide and to strengthen the sector's performance

With these objectives of the Observatory in mind this methodological study was commissioned by the European Commission and carried out by Technopolis Group. The study aimed to help with the preparations of the design of the Observatory by developing the most suitable data architecture and analytical setting as well as by exploring its exploitation potential by a wide range of users, the Observatory's intended target groups. More specifically, the **tasks of this methodological study** were to:

- Carry out an indicator mapping of existing indicators that are necessary for the monitoring of the European Strategy for Universities and identify the need for new indicators

- Further define the scope of the Observatory and develop its intervention logic

- Analyse the challenges that need to be overcome for the setting up of the Observatory
- Propose a feasible roadmap to achieve the full potential of the Observatory
- Organise stakeholder consultation events linked to the objectives of the Observatory

MAIN FINDINGS AND RECOMMENDATIONS BY THE METHODOLOGICAL STUDY

Intended target groups and their needs, intervention logic of the Observatory

The Observatory is meant to target three distinct groups 1) policy makers, 2) higher education institutions and 3) students. Consultations with the different stakeholder groups revealed a **distinct set of needs, expectations and preferences of the different groups** regarding the Observatory and its future implementation. Stakeholders highlighted their willingness and expectation to be involved in the strategic discussions on the scope and objectives, the indicator framework (descriptive rather than prescriptive) and the long-term perspective for the further development of the Observatory.

Based on the collected user needs and perspectives the study developed three intervention logic versions tailored to the three main intended target audiences, further to an overarching **combined intervention logic for the Observatory**. The differentiation and clear definition of the intervention logic for the three main user groups is vital, as the collection of content, the development of functionalities, technical requirements (backend) and visuals (frontend) need to address the envisaged users and their needs. Below we present the combined intervention logic of the Observatory.
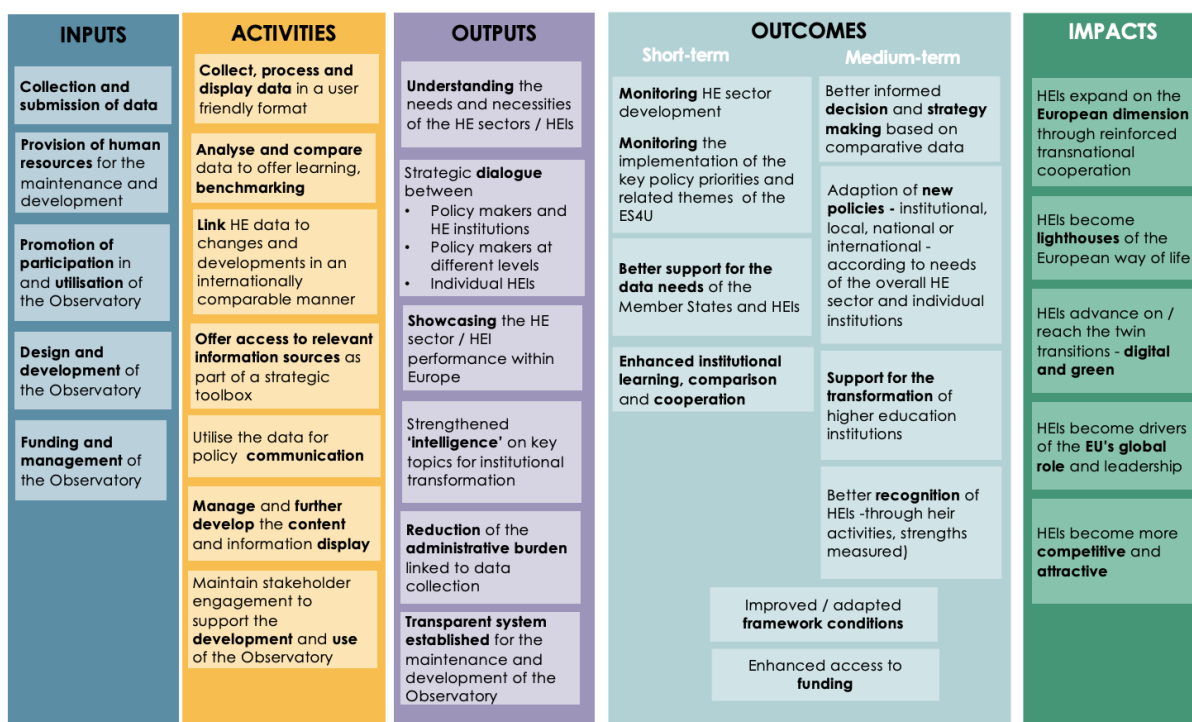
Source: Technopolis Group

Suggestion for the indicator framework to be included in the Observatory

Based on the review of existing data sources and interviews conducted with key data providers the study team assessed the quality, relevance and challenges related to access, retrieval, and processing of data from various sources. Based on this review, the study developed a suggestion for an indicator framework for the Observatory, focusing on existing data sources,

while also recommending some new development areas, that might be implemented over time. The table overleaf summarises the data sources and the number of indicators that are suggested to be included in the Observatory. It takes into account that in a first instance only available data sources should be used for the purposes of the Observatory, without additional data collection taking place. In total, there are **66 indicators** put forward for inclusion in the HE Sector Observatory, of which there are:

- 37 existing indicators categorised as 'core' indicators

- 22 existing indicators categorised as 'useful to have' to provide additional information

- Seven not yet existing indicators. They should be developed in the future, as they address aspects for which core indicators are missing

Name	Geographical coverage	Accessibility of the data	Data sources	Data granularity	Time frame, frequency of update	No of indicators selected	Of which core indicators
European Tertiary Education Register (ETER)	27 EU MSs and EEA/EFTA Candidate countries: Albania, Turkey, Bosnia-Herzegovina, Kosovo, North Macedonia, Montenegro, Serbia Andorra, UK Total: 41 countries and 3,439 HEIs	Most data publicly available, metadata downloadable in .xlsx and through its API Financial data upon registration	National Statistical Authorities HEI	HEI (with OrgReg ID)	2011-2019 Data are updated at regular intervals (last update for 2019 data)	20	17
U-Multirank	2022 release covers 2,202 HEIs from 96 countries around the world	After registration and acceptance of Terms of Use data can be requested	National Statistical Authorities UMR own survey of HEIs and students – self-reported data Bibliometric databases	HEI (with OrgReg ID) Subject – can be aggregated to HEI level Country	2014-2019 Latest data release: 2022	24	9
Eurostudent	Most EU MSs (w/o Spain, Latvia, Estonia, Hungary, Belgium) Turkey, Georgia, Norway	Through online data explorer Excel files can be downloaded	Own survey - data is collected in coordination with national partners in each participant country	Country	Data collection in rounds of three years, available for 5th round: 2012 – 15 6th round 2016-18 7th round 2018-21	5	2
Eurograduate	19 EU MSs+ EFTA/EAA countries	Can be accessed publicly only via reports	Own survey	Country	In phases 1st survey: 2018-2019 2nd survey: 2022-2024	4	4
EUROSTAT	EU MS, plus additional countries for different datasets/indicators	Data freely accessible through an API or bulk download	National Statistical Authority	Country	Over six decades Data updated annually, with different timelines for different indicators	1	1
V-dem	All countries of the world	Data freely accessible	Composite indicator: existing sources combined with	Country	Data are provided on an annual basis	1	1

Name	Geographical coverage	Accessibility of the data	Data sources	Data granularity	Time frame, frequency of update	No of indicators selected	Of which core indicators
			validation through own data collection				
Erasmus+	All countries of the world	Data are hosted by the EC	Own data collection, reporting by the national authorities	HEI Country	Multiple updates per year	3	2
Cordis	All countries of the world	Data freely accessible	Own data collection	HEI Country	Multiple updates per year	1	1

Source: Technopolis Group

Bringing together data from these different sources provides significant advantages, and eases access to reliable evidence on the European higher education sector. It, however, also poses a number of challenges which have to be addressed for the successful development of the Observatory. One of the main challenges in the construction of the underlying Higher Education Sector Observatory database (which will be the source of customised statistics and indicators) is the data streamlining process; integrability, potential overlap, and consistency of data has to be closely monitored and addressed to ensure high-quality results. Since the creation of a full database for the Observatory is beyond the scope of this methodological study, the **study team developed a check list** that can be used to assess each data source to facilitate the data streamlining process and it can also be used in the future to guide data processing.

From these data sources, a number of **indicators were iteratively selected** and **put forward as suggestions for inclusion in the Observatory**, benefitting from a series of consultations with a wide range of stakeholders. The selected indicators were assessed for quality using the **RACER criteria** (high / medium / low) assessing the relevance of the indicator, availability of data, the clarity of the indicator, the ease of data collection, and the robustness of the indicator. The study team also reviewed the data points available for each of the selected indicators for the last available year to assess data gaps and the overall quality of the information available for an indicator. It is important to note that indicators with 'low' assessment for ease of data collection and robustness were also included in the selection where their relevance was deemed high, and an expected potential in the future to enhance the data quality.

The existing indicators were mapped against the key themes of the European Strategy for Universities. Furthermore, they were categorised based on their content (main category – teaching / research / funding / personnel) and by the type of indicator (input / output / activity). The full list of suggested indicators, their assessment with the RACER criteria as well as their definitions are included in the main report.

For the Observatory to be implemented successfully, the **structure of its website** and the **visualisation** have to reflect the preferences of its intended target groups. The suggestions for the structure of the Observatory's website distinguish between:

(1) A **scoreboard** that offers various filtering and data display options on all or selected indicators, where the section can be linked to the specific themes, categories, geographical areas or time frames (please note that the figures on the visualisation are fictional and do not represent real values)

(2) A **toolbox** that offers access to **existing tools and resources** of interest of the user community of the future Observatory, that could be displayed targeted to different stakeholder groups e.g. students (example of the right hand side) or grouped based on themes e.g. internationalisation in higher education

The study also looked into the **lessons learnt from other similar initiatives**, which highlight that:

- Success in terms of usage and acceptance is related to trust in the content, its usefulness and user-friendliness. However, trust comes with a price tag, i.e. the content is adhering to quality processes - clear definitions of the indicators, the use of agreed terminology and taxonomies also help build trust in the quality of the collected data - and standards which are balanced with the requirements to ensure timeliness of information provision
- Realising the potential of a monitoring system requires time. It requires collecting time series of data and information that enables analyses. Linked to this, stability of collected content (indicators) is key for the availability of longer time series
- A dedicated pool of people for steering, providing oversight, and making timely decisions is needed
- There is a need to set up and operate a dedicated and distributed quality assurance system

To benefit from already existing expertise, ensure sufficient outreach by the Observatory, secure buy-in from the targeted user groups, and help maintain the relevance of the Observatory over a longer term, the **communication strategy** developed for the Observatory should combine three elements

1) A **consultation component**: which focuses on seeking the input from selected key stakeholders and using their insights in the design and implementation of the Observatory

2) An **engagement component**: maintaining interaction with the key stakeholder representatives and data providers once the Observatory is launched. Ensure future revisions are in line with the current and future user needs. Build synergies and attract new users/data providers to the Observatory

3) A wider **promotion component**: generating awareness of the HE Sector Observatory amongst **new stakeholder representatives and users** to ensure utilisation of the Observatory and its wider promotion

The strategy is accompanied by a monitoring framework, as monitoring and tracking the effectiveness of different communication activities is an important element of a communication strategy.

The main phases and key steps in the development and subsequent running of the Observatory are summarised in an indicative **high-level roadmap** and a more **detailed timeline** with roles, responsibilities and timelines assigned. They were refined after consultation with the Commission services and participants of the stakeholder workshops.

The purpose of the timeline is to guide the actions of the implementation team at the European Commission. The four main phases suggest a step-by-step approach for the development of the Observatory by the European Commission, as summarised in the figure.

European HE Sector Observatory   Roadmap

Objectives of the Observatory
- Monitoring the implementation of the European Strategy for Universities on key policy priorities
- Supporting data needs of the Member States and higher education institutions
- Promoting competitiveness and attractiveness of higher education institutions

Roadmap Objectives:
To communicate the objectives and steps in implementation to audiences beyond the implementation team

Main phases and steps of the roadmap

Preparation 1	Development 2	Implementation 3	Assessment 4
Step 1.1 - Finalisation of the methodological study incl. recommendations	Step 2.1 - Technical development – front end and back end	Step 3.1. Technical implementation and maintenance, update schedules	Step 4.1 Regular review and assessment for future improvements – external and/or support group
Step 1.2 - Decision on the content and format of the Observatory, incl. scoreboard and the strategic toolbox	Step 2.2 - Content development - existing data and new data collection, indicator development as needed	Step 3.2. Communication activities	Step 4.2. Scheduled updates to ensure continued improvements and built in flexibility for adopting new themes and topics
Step 1.3 - Putting MoUs or agreements in place with data providers	Step 2.3.- Pilot testing before live launch (user testing)	Step 3.3. Project management	
Step 1.4 - Establishing the governance structure – support group - representatives and forms of interaction, mandate	Step 2.4 - Communication activities - communication strategy and implementation plan in place	Step 3.4. Operating the Governance structure and mechanisms incl. support group	
Step 1.5 - Commissioning the implementation of the Observatory (technical, design and content development)		Step 3.5 Monitoring and reporting on the Observatory	

2 Introduction

This methodological study was commissioned to help with the preparations of the design and development of the Observatory by developing the most suitable data architecture and analytical setting as well as by exploring its exploitation potential by a wide range of users, the Observatory's intended target groups.

Our methodology for the implementation of the study was guided by **two principles**:

- The need to go beyond theoretical assumptions and follow a more hands-on approach that also allows for testing the feasibility of the implementation of the future Observatory
- The need to put stakeholder consultations at its core to ensure buy-in from the potential future users of the Observatory

The chart below provides a visual presentation of the main tasks and objectives.

Figure 1 Main objectives of the study
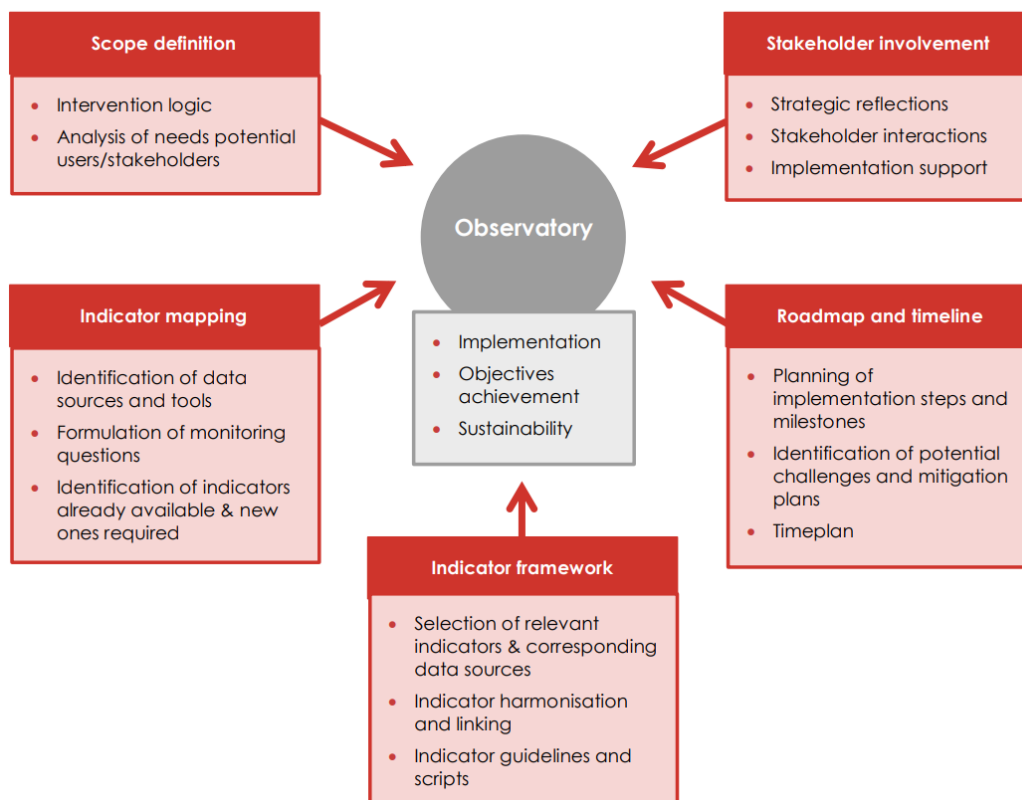
The subsequent sections describe the activities that were carried out during the study.

- Chapter 2 recaps on the aims and objectives of the study and provides an overview of the methodology
- Chapter 3 summarises the study findings and conclusions by task
- The appendices provide further information and methodological descriptions

2.1.1 WP1 – Indicator development and statistical analysis

2.1.1.1 WP1.1 – Mapping of indicators for the monitoring of the implementation of the European Strategy for Universities

As part of this work package the study team carried out a few iterative steps which consisted of the review of existing data sources and interviews with key data providers. The latter served to assess the quality, relevance and challenges related to access linked to the different data sources. This initial review resulted in a long list of indicators (676) that were mapped against the priorities and themes of the ES4U (four Key Objectives divided into sub-categories) and whether they could be used as contextual indicators. At this initial stage, the quality of the indicators was not yet assessed. The study team first wanted to understand the overarching coverage, existing gaps and overlaps, potential complementarities, the data collection processes, as well as data harmonisation, integration and quality assurance procedures.

The next step in the indicator mapping entailed further streamlining the indicators by:

- Identifying duplicates or identical indicators displayed across the databases as well as assessing the indicators that are available with different value formats e.g., different currencies used for the same measure or academic staff in FTE and headcount
- Grouping indicators where totals and breakdowns are all available e.g., academic staff (total), academic staff (men) and academic staff (women) were grouped into academic staff (by gender)
- Removing indicators that were available, but were deemed less relevant e.g., the DOI of academic publications
- Identifying "context Indicators" i.e., indicators that are not directly relevant to any Key Objective but are important to understand the overall environment

As a result, the indicator list was reduced to 140 indicators. This list of indicators was then used as a basis for discussion during a first stakeholder workshop with invited participants to check their relevance and importance from the potential user groups' points of view.

Taking into account the results of the workshop, the study team repeated the indicator review step, focusing predominantly on European Commission owned data sources, including Eurograduate, Eurostudent, ETER, U-Multirank and Erasmus+, and complemented it with the development of monitoring questions for the themes of the ES4U to better assess the match with the content of the existing indicators. Furthermore, the currently existing indicators were then assessed for quality using the RACER criteria[1] (high / medium / low) assessing the relevance of the indicator, availability of data, the clarity of the indicator, the ease of data collection, the robustness of the indicator, as well as their geographical coverage including existing data gaps.

The initial mapping and the first stakeholder workshop also highlighted the need to create some new indicators as there are areas that cannot be measured yet. While developing these

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[1] RACER - Relevant, Acceptable, Credible, Easy, Robust, see chapter 3.2.3 for further information

new indicators is outside of the scope of this methodological study, the areas which would benefit from new data collection include:

- How is entrepreneurship and venture creation promoted in higher education?
- How are young people and lifelong learners equipped with digital skills (digital literacy) and skills for the green transition - climate, environmental literacy?
- How are microcredentials being offered and used?
- What do academic institutions offer as flexible and attractive career pathways?

In addition, no current indicators were deemed suitable to assess progress for Key Objective 4 of the Strategy i.e. Reinforcing universities as drivers of the EU's global role and leadership.

Based on this further prioritisation, a set of core indictors were identified, complemented by additional indicators, considered as "useful to have" to offer a more comprehensive picture. The results of these steps were then presented as a draft indicator framework and discussed at the second stakeholder workshop. The feedback from the second stakeholder workshop and the European Commission fed into the finalisation of the indicator framework, together with the comments on the draft final report. The final indicator framework is presented in this final report.

Once the set of indicators was established for inclusion in the future Observatory, the study team in consultation with the European Commission selected five data sources and eleven indicators to carry out the technical steps of indicator harmonisation and linking in practice. This task focused on providing the methodological guidelines on how to access the different data sources and to retrieve and process the relevant information. The study team also prepared a methodological guide indicating how indicators were brought together from the different data sources. The study team created a test database and developed Python scripts for nine indicators covering four different data sources: ETER, U-Multirank, Eurostudent and V-dem.[2] They are submitted as a MS-Excel database and separate scripts as part of this deliverable. The database and scripts are accompanied by methodological notes included in Appendix A.1 of this report.

The main steps that were undertaken as part of this work package are summarised in the chart below.

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[2] Note: at the time of writing this final report access to Erasmus+ data has not been granted yet

Figure 3 Steps within WP 1.1

Step 1	**Objective**: Scoping interviews and review of available information **Activities**: Collect input from relevant stakeholders and review relevant information for the HE observatory

Step 2	**Objective**: Elaboration of monitoring questions **Activities**: Alignment with DG EAC on the indicators to be monitored by the HE observatory

Step 3	**Objective**: Development of indicator framework **Activities**: Produce a structured framework for the indicators (according to RACER framework) connecting the objectives to the intervention logic using the programme theory model

Step 4	**Objective**: Indicator harmonization and linking **Activities**: Select the choice of indicators to be used, provide rationale for including them, define data processing and cleaning steps

Step 5	**Objective**: Guidance and implementation material for the indicator framework **Activities**: Provide detailed **documentation** of the previous analytical tasks as well as **Python scripts** that implement the required procedures (data gathering, data cleaning, data transformation, assignment of UIDs, database construction, indicator calculation …)

2.1.1.2   WP1.2 - Intervention logic, roadmap, and timeline of the Observatory

The second part of this work package focused on the development of an intervention logic for the Observatory, an accompanying roadmap and a timeline, setting out the key milestones for the development of the Observatory.

An intervention logic makes explicit the causal links between the needs and objectives of the initiative, the inputs and activities, and its intended outputs, results, and impacts. The study team developed three intervention logics, tailored to the targeted audiences: policy makers, higher education institutions and students. They were then refined iteratively following feedback from representatives of these stakeholder groups. Once the intervention logics were finalised, the study team developed the roadmap and timeline. They were refined after consultation with the Commission services and the participants of the stakeholder workshops.

The roadmap is a high-level visual representation of the different activities needed to deliver the different objectives of the Observatory. It communicates the objectives and milestones and assigns different tasks to the relevant stakeholder groups. It is based on the intervention logic and uses the same language as far as possible. The roadmap is accompanied by a timeline which includes what needs to be developed by whom and when, as well as risk- and resource management considerations. The purpose of the timeline is to guide the actions of the implementation team at the European Commission. The timeline is aligned with the roadmap and uses the same high-level headings and terminology. The intervention logic together with the roadmap and the timeline are presented in chapter 3 of the report.

2.1.2   *WP2 – Exploration of challenges of the Observatory*

The second work package focused on exploring the challenges that might arise during the development of the Observatory. Challenges can relate to data quality, data collection and harmonisation, implementation issues, and the continuity and sustainability of the Observatory.

The identification of challenges was conducted through a mixed-method approach combining desk research, the study team's experience with similar assignments and evaluations and the perspectives of consulted stakeholders. In addition, since the study team carried out the data processing for selected indicators in practice, challenges related to data collection, cleaning, harmonisation and linking are described in this report based on this practical experience.

2.1.3   WP3 - Communication strategy and stakeholder interactions

This work package focused on communication-related activities supporting the design, implementation, and exploitation of the Observatory. As described in the methodological overview earlier, stakeholder engagement was essential for the study, and it formed the core of this work package. The activities within this work package were highly intertwined with the other tasks and work packages and served the following two main objectives:

● Ensuring the usefulness of the Observatory and its website

● Ensuring the future use and exploitation of the Observatory by a broad range of stakeholders

The study team addressed the first aim by undertaking a series of consultation activities with the stakeholders (data providers) and potential user groups of the Observatory to understand their needs and expectations regarding the Observatory and devised a structure and content for the Observatory's website that reflects their interest. The second aim (i.e., significant exploitation of the Observatory's website) was addressed by undertaking a stakeholder mapping exercise and developing a communication strategy tailored to the different target audiences.

The project team conducted two rounds of interviews with representatives of key stakeholder organisations to identify their needs and preferences with respect to the Observatory. In total, in addition to the European Commission, several representatives of 23 different organisations and associations were consulted. They represent academia, national and international policy maker and student organisations as well as HE data providers. The latter group was highly insightful as they accumulated long standing and in-depth understanding of stakeholder needs and preferences regarding the data they have been collecting and providing. Figure 4 provides an overview of the consulted organisations.

Figure 4 List *of stakeholder organisations consulted through interviews and workshops*

Name of the organisation of the stakeholder	Type of stakeholder for the purposes of the Observatory
Ministry of Education, Youth and Sports of the Czech Republic	Policy maker
French Research and Education Ministry (MESR)	Policy maker
Ministry of Education and Research in Sweden	Policy maker
European Commission, DG EAC, Erasmus+	Policy maker/ data provider
European Commission, JRC	Data provider
Cedefop – Mobility Scoreboard	Data provider
OECD - Educational Directorate	Policy maker/ data provider
U-Multirank	Data provider
ETER - European Tertiary Education Register	Data provider
EUROSTUDENT - German Centre for Higher Education Research and Science Studies (DZHW)	Data provider / student perspective
European Students' Union	Student Organisation
Erasmus Student Network (ESN)	Student Organisation
European University Association (EUA)	Data provider / Academic Community
Swedish Rectors' Conference (SUHF)	Academic Community
EQAR - European Quality Assurance Register for Higher Education	Academic Community
University of Pisa	Academic Community

Name of the organisation of the stakeholder	Type of stakeholder for the purposes of the Observatory
European Alliance for Social Sciences and Humanities (EASSH)	Academic Community
The Guild of European Research-Intensive Universities	Academic Community
European Association of Institutions in Higher Education (EURASHE)	Academic Community
Dublin City University (ECIU member university)	Academic Community
Coimbra Group	Academic Community
Eurodoc	Academic Community
CESAER	Academic Community
Polish Rectors' Conference (KRASP)	Academic Community

Source: Technopolis Group

As part of this work package the study the team also organised two online stakeholder workshops. Each of the 2.5 hour long online workshops were prepared by developing an input paper and followed up by preparing notes of the workshops and sharing the presentation used with the participants. The workshops were highly interactive and required active participation by the participants, as they used small group discussions, online collaborative and polling tools to engage the audience. The team also presented the progress and the study results at the CZEDUCON International Conference on Strategy and Policy in Higher Education organised by the Czech Presidency of the EU in November 2022 and at the ETER Advisory Board meeting in March 2023.

3 Key findings of the study

This chapter summarises the findings of the study. It is set out in the following structure:

- Chapter 3.1 starts with the description of the different user needs, followed by a discussion of the key challenges and suggested mitigation action that fed into the development of the intervention logic of the Observatory
- Chapter 3.2 puts forward the suggested indicator framework for the Observatory and provides detailed description on each indicator
- Chapter 3.3 provides suggestions for the visualisation of the website of the Observatory
- Chapter 3.4 sets out the communication strategy for the Observatory
- Finally, chapter 3.5 sets out the timeline and roadmap for the development of the Observatory

3.1 Intervention logic of the Observatory based on stakeholders' needs assessment

3.1.1 Stakeholders' need assessment

The Observatory is meant to target three distinct groups 1) policy makers, 2) higher education institutions and 3) students. Understanding the needs and expectations of these user groups was essential for this methodological study. The collection of content, the development of functionalities, technical requirements (backend) and visuals (frontend) need to address the needs of these potential user groups for the Observatory to be implemented successfully.

Consultations with the different stakeholder groups through the interviews and online workshops revealed that each stakeholder group has a **distinct set of needs, expectations and preferences** regarding the Observatory and its future implementation, content, functionality, display, and more generally objectives, scale and scope. Furthermore, these broad stakeholder groups do not represent homogenous groups, but show high levels of variety even within. Therefore, while the needs of these user groups can be summarised broadly, such a description has to be read with caveats as it contains a level of generalisation. Based on the consultations undertaken, the key interest areas by stakeholder group and their concerns are summarised in the paragraphs below.

Policy makers – local / regional / national and international level:

- Interested to monitor developments in the higher education sector in their country/region. However, national data collection and reporting systems cover these needs to a very high extent in the countries, therefore this is not the key area of interest for national policy makers
- International comparison and data linked to the EU participations and cooperation among institutions such as in the European University Alliances, regarding the implementation of the European Strategy for Universities, or the use of the European Student Card initiative are of interest to this group as these represent information that is more difficult to collate currently
- Stressed the importance of increasing transparency of data across Member States and academic institutions. Thus, they see the added value of the Observatory in making data easily accessible and transparent in one central portal (one-stop-shop)
- In terms of the level of details and data format, high level overviews would be appreciated that show trends and changes over time in a comparable manner

- Appreciate if the Observatory allowed to detect fundings sources and mechanisms for the HE sector and provide data on HE performance across specific areas to inform the design of future policies
- Despite their general support to the creation of the Observatory, they have also expressed some concern, especially around the investment and cost (i.e., time, effort, expertise for data collection and harmonisation) that might be associated with making the Observatory a usable and effective tool as they feel that their needs are highly catered for by national data collection and analysis already
- Another important consideration is that the Observatory needs to showcase clear added value to gain full support, given the large number of already available tools for the higher education sector

Academic and research organisations:

- Interest areas related to the Observatory could be endless depending on the individual stakeholder asked. However, there are a number of themes where information collection and provision are less advanced. These could be areas for the Observatory to address. For example, information on academic freedom and integrity, higher education governance, working conditions for researchers, or data on contribution of the higher education sector towards digital and green transition. In addition, data that support evaluation of the quality at universities in Europe and its comparison with non-EU universities, knowledge valorisation and technology transfer, cooperation opportunities and international networks in the higher education sector are areas that would increase the usefulness and added value of the Observatory for this stakeholder group
- In terms of scope, there is a call for the Observatory to look beyond the European Strategy for Universities and explore topics that are relevant for the HE sector in general, and long-term, such as student mobility, inclusion and education, or online learning
- From a management perspective, funding flows, international and national rankings are also of high interest. However, the latter is already well covered, and it does not seem to be the role for the Observatory to address
- Regarding the format of accessible information, this stakeholder group appreciates large quantities of data on the higher education sector and at the lowest level possible. This enables this group to use the data for research purposes. Data should also enable comparison and benchmarking and include both quantitative and qualitative data, where possible
- Ensuring the credibility of data (data quality), the transparency of formula used, and transparency of the structure (metadata) behind the Observatory are all important considerations that were highlighted
- Access to microdata in a database format as well as interactive dashboards with visualisation and filtering options are called for
- Similar to policy makers, this group expects the Observatory to utilise available tools and further enhance their visibility rather than creating new ones

Students:

- Students are rarely aware of the tools available in the higher education sector and use them in a limited way, unless they enquire for their studies/subjects or represent students at institutional / national / European levels. For student representatives, we interpret their needs similar to the researchers (i.e. academic and research institutions above) or policy makers respectively

- Students are a highly diverse group; therefore their needs differ depending on their country / location of origin, degree pursued, type of study programme they wish to undertake, their gender and age
- Data presented in ranking tables and short, user-friendly summaries about higher education institutions are preferred by individual students. They often access information through social media and enjoy small information pieces. In terms of information access and use, they differ to the other stakeholder groups
- In general, students are interested in information related to student financing, quality of life of a specific university and location, tools and institutions that provide various support to them (particularly on choosing a university or a study programme), as well as employability and opportunities for engagement with public and academic institutions
- Similar to other interviewed stakeholder groups, it has been stressed that the Observatory is expected to bring together available tools and link them

The diversity of expectations and needs poses challenges for developing a **uniform vision** for the Observatory and the content and features it should have. Furthermore, while the first two stakeholder groups have overlaps in their needs and expectations towards the Observatory, students represent a very distinct group.

Based on the consultations, the study team captured a set of challenges that have to be addressed and mitigated for the Observatory. The table below provides a summary of the key challenges, and it also provides mitigation strategies suggested by the study team, which are further elaborated in the subsequent chapters.

Figure 5 Challenges and potential mitigation strategies regarding the implementation and sustainability of the Observatory

	Challenge	Consequence	Mitigation strategy	Suggested solutions, actions already taken
Implementation related challenges	Too many (unnecessary) or too limited number of indicators	A high number of indicators may overwhelm users, or difficult the overview of the whole collection of indicators. At the same time, too few indicators may render impact the utility and attractiveness indicator framework	The number of indicators should be appropriate for the purpose of the Observatory and stakeholder needs. The number of indicators should be condensed to an adequate number of indicators that respond to the main focus of the Observatory and the needs of the stakeholders. Stakeholder engagement and consultations are key to ensure this.	The indicator framework suggests 'core' and 'useful to have' indicators Continued stakeholder consultation and engagement through the support group is crucial
	Indicators not directly connected to real concerns	The lack of relevant indicators and meaningful data could be an important obstacle to the mobilisation of stakeholder interest in the Observatory and its value as an information source among students, HEIs and policy makers.	The operation of the Observatory and the indicators should be practical and relevant to the needs of each group of stakeholders and potential users. Continued stakeholder / user consultation should be part of the mitigation strategy.	The indicators were assessed by the RACER criteria to ensure that only relevant indicators are put forward
	Lack of clear outcomes	Without clear outcomes, the users' and stakeholders' needs will not be catered for and interest and support might wane.	From the beginning, and in subsequent phases of the implementation, the Observatory should be clear on what it will produce and for what purposes. The	The Observatory will need to ensure maintained relevance based on user input and through the support group

	Challenge	Consequence	Mitigation strategy	Suggested solutions, actions already taken
			intervention logic, roadmap and timeline developed for the Observatory have a pivotal role in addressing this challenge area	
Sustainability challenges	Lack of transparency in the indicator framework	The Observatory could be perceived as a 'black box' of indicators.	The Observatory should communicate transparency in its purpose and objectives, the rationale behind the selection of indicators, the data sources, the methodology for data collection, processing and aggregation, the definitions of indicators, etc. (Inclusion of metafile)	The communication strategy addresses the importance of explaining the objectives of the Observatory Continued stakeholder consultation and engagement through the support group is crucial for transparency as well
	No clear mission, vision or objectives	Without a clear mission, vision and objectives, stakeholders may fail to understand the utility of the Observatory. As a consequence, the purpose of the Observatory might not be championed by the stakeholders.	To succeed at any scale, a committed team dedicated to the implementation of the Observatory should thoughtfully consider the mission, long-term vision, and clear concrete objectives from its conception.	The workshops organised as part of this methodological study provided the platform to discuss the objectives of the Observatory with stakeholders The communication strategy addresses the importance of explaining the objectives of the Observatory Continued stakeholder consultation and engagement through the support group is crucial
	Lack of stakeholder and / or institutional support	The offering of high-quality information and the accomplishment of the goals of the Observatory may be compromised in case there is a lack of stakeholder and/or institutional support.	This should be carefully assessed, and plans should be developed to regularly examine the honest perception of the activities of the Observatory by the stakeholders and supporting institutions.	The communication strategy includes different forms of stakeholder engagement to ensure buy-in
	Lack of coordination among partners/data owners	This might be difficult or create obstacles to a wide range of activities of the Observatory, from the accessibility of data, the communication of information or the definition of purpose.	Since the Observatory will count on onboarding resources from partners (e.g., in form of data), these should be involved from early on in the preparation and informed about the importance and functions to the Observatory. This will facilitate collaboration to accomplish shared objectives.	Data sources are mostly limited to those where the EC has influence over the content and further development, which facilitates coordination. The mandate of the support group should address such coordination issues as well
	Lack of sound communication strategy	Without a proper communication strategy, the work of the Observatory might not reach its intended audience.	The Observatory needs to ensure that its work is recognised by the stakeholders through user-friendly and demand-driven products and outputs. For this, stakeholders and users need to be consulted to provide information on their information needs and accessibility of information.	There is a dedicated communication strategy developed for the Observatory supported by a stakeholder mapping
	Lack of linkage between the	The linkage between data and evidence with	The choice of indicators needs to remain relevant	Ensuring that there are feedback loops and

	Challenge	Consequence	Mitigation strategy	Suggested solutions, actions already taken
	Observatory and decision-making structures	policy decisions is key to bridging issues, promoting improvements and engendering political support. This is very relevant in particular for the implementation of the European Strategy for Universities.	and updated and reflecting the needs of stakeholders and key policy strategies. Thus, periodic updates are key, allowing to choose new/delete obsolete indicators, or update time- series	mechanisms built in is important to maintain user interest and the relevance of the Observatory. In this respect, the support group can play an important role

3.1.2   *Intervention logic of the Observatory*

The intervention logic of the Observatory needs to be based on the user perspective and user needs. Therefore, the study team developed four versions of the intervention logic; in addition to **an overarching intervention logic** for the Observatory **three intervention logics, targeting the main intended user groups** - policy makers, higher education institutions (and various international associations and representative bodies in the HE sector), and students, were developed. The differentiation and clear definition of the intervention logic for the main user groups is vital, as the collection of content, the development of functionalities, technical requirements (backend) and visuals (frontend) need to follow the envisaged users and policy needs. The following chapters describe the content of the different intervention logics developed for the three main potential user groups of the Observatory.

3.1.2.1   **Policy makers**

The group of policy makers can be divided in local, regional, national and EU / international policy makers. In terms of the **inputs**, all four types will submit data available to them (e.g., from national statistic offices, international surveys, etc.) and initiate/support the collection of new data (e.g., by encouraging HEIs to participate in data collection processes). The management and funding of the Observatory can also be seen as an input from policy makers at EU level, which can go hand in hand with training staff in the application/usage of the Observatory.

The **activities** undertaken by policy makers with regard to the Observatory - thereby fulfilling the needs of this user group - are focused on:

- Accessing and analysing information and data, e.g. assessing the development of HEIs or of the HE sector within the respective area or region

- Comparing / benchmarking HEIs and their activities, developments and achievement

- Linking the data to changes and developments at individual HEIs as well as the HE sector e.g. in a specific region or within a specific type of HEIs

- Finally, the policy makers will also be able to use the Observatory/data for communication efforts, e.g., when designing and lobbying for new policies

The direct results of the activities are the **outputs**, as the basis for achieving the Observatory's outcomes. Policy makers will be able to:

- Understand the needs of the HE sector (at different geographical dimensions and for different HEI categories)

- Use the data and data analysis from the Observatory to enter into a dialogue with other policy makers at different levels, or with HEIs (e.g., regional policy makers might want to understand or validate the data of HEIs within their region or in the context of negotiating performance-based funding agreements)

- Showcase the data / findings of their own HE system within the European higher education sector.
- Use the data in order to strengthen knowledge / intelligence on key topics of the transformation of the HE sector as well as institutional transformation.
- Finally, a major output for the policy makers is also a reduction of administrative burden, as data relevant to them will be made available via the Observatory and therefore the need to search for data and collect via different sources will be minimalised.

The **outcomes** of the Observatory can be achieved in a short and medium timeframe. It is vital to keep in mind that the outcomes and impacts can never be attributed to the intervention (the Observatory) alone as there will be several exogenous factors which influence the chain of results. For instance, the adaptation of new policies according to the needs to the HE sector may be partly based on the data found in the Observatory, but will most likely also be based on a range of other, possibly unrelated variables. Overall, the main outcome of the Observatory follows its main objective: to provide evidence-based monitoring of the implementation of the (key policy priorities of the) European Strategy for Universities and related topics. At the same time, another outcome is that policy makers support the (data) needs of HEIs / Member States. In the medium-term perspective, the Observatory will thus allow informed decision making of policy makers, the design and implementation of new policies for the HE sector, improve framework conditions and thereby support the transformation of the HE sector.

The ultimate (intended) **impacts** of the Observatory are very much focused on the positioning and strengthening of HEIs in the European and international higher education, research and innovation ecosystem. They are, therefore, directly linked to the achievement of the main objectives of the Observatory and of the European strategy for universities as such. They can be summarised as:

- Due to better understanding of and cooperation between HEIs themselves as well as actors related to the HE sector, the European dimension in HE and research will be enhanced. This goes in line with positioning the European HE sector globally and making HEIs more competitive and attractive
- Due to better strategic, institutional development and better policies as well as framework conditions for HEIs, they will be enabled to become lighthouses of the European way of life

Being able to analyse the HEIs developments, current challenges and opportunities as well as establishing benchmarking and best practices via the utilisation of the Observatory's data, HEIs will benefit from the data to advance on / reach the twin transitions (digital and green). At the same time, the whole HE sector will be supported in its transition to address current challenges.

Figure 6 Intervention logic of the Observatory for policy makers

POLICY MAKERS	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		IMPACTS
				Short-term	Medium-term	

INPUTS

Collect and submit data
- Submitting available data
- Issuing new data collection

Promote the participation in and **utilisation** of the Observatory

Contribute to the **design and development** of the Observatory

Training staff in the use of the Observatory

Funding and management of the Observatory

Target audience: (international, regional, national, local) POLICY MAKERS

ACTIVITIES

Access, analyse and **utilisation** of the information / data

Comparison and **benchmarking** of data

Linking HE data to changes / developments in the sector / at HEIs

Participation in the steering group of the Observatory

OUTPUTS

Better understand the needs and necessities of HEIs in an international context

(Strategic) **dialogue** between
- Policy makers and HE institutions
- Policy makers at different levels (local, national, international)

Showcase the HE sector / performance within Europe

Strengthening the **'intelligence'** on key topics for institutional transformation

Reduction of the **administrative burden** due to access to a one-stop-shop data source

OUTCOMES

Short-term

Monitor the implementation of the (key policy priorities of the) European Strategy for Universities and related themes

Support the data needs of the Member States and HEIs

Medium-term

Better informed **decision making**

Adaption of **new policies** (local, national or international) according to needs of the overall HE sector and individual institutions

Better support of the transformation of higher education institutions

Improved / adapted **framework conditions**

IMPACTS

HEIs expand on the **European dimension** through reinforced transnational cooperation

HEIs become **lighthouses** of the European way of life

HEIs advance on / reach the twin transitions - **digital and green**

HEIs become drivers of the **EU's global role** and leadership

HEIs become more **competitive** and **attractive**

Source: Technopolis Group

3.1.2.2   Higher Educations Institutions

Similar to the user group of policy makers, higher education institutions (HEIs) can be split into the sub-groups of HEI administration, HEI leadership, academic staff and researchers. The **inputs** from HEIs are clear in the sense that they need to submit the data for the Observatory, either directly or indirectly through already existing data collection exercises or through the mixture of these two. In addition, HEIs might promote the participation in the Observatory as well as its utilisation. They might also have a role in the design and further development – especially through representative bodies of national and international HE sectors and groups – or in the steering of the Observatory.

The **activities** of the HEIs can be understood as the following:

- Accessing and analysing the data / information
- Comparing and benchmarking the data
- Linking data to institutional changes and developments
- Utilising the data for communication purposes and marketing
- While some of these activities are particularly interesting for HEI leadership and administration, the accessing and analysing of the data might also be a relevant activity for researchers using the data for research activities and projects.

The direct results of the activities are the **outputs**, as the basis for achieving the Observatory's outcomes. Leadership and administration of the HEIs will be able to:

- Understand the needs and necessities of their individual institution and possibly of their researchers better by accessing international context
- Use the data and data analysis from the Observatory to enter into dialogue with other HEIs, for example to exchange information on best practices or approaches applied by other HEI that led to better results, as well as with policy makers e.g. to voice to national/regional policy makers needs of the individual HEI

- Use the data to strengthen knowledge / intelligence on key developments / transformations of the individual institution
- Showcase the data and findings of the data e.g., in newsletters, on the webpage, in communication with external partners or even policy makers
- Finally, a potential output for the HEIs – specifically the subgroup of HEI administration – is the reduction of administrative burden of data collection, if the relevant data are collected via one instrument – the Observatory – this might contribute to reduced administrative burden longer term

The **outcomes** of the Observatory for the user group of HEIs can be summarised as follows: through the access to as well as analysis and comparison of the HEI data, institutional learning as well as benchmarking can be achieved. In the long term, this can also lead to better, evidence-based strategy making and new institutional policies, in line with the needs identified. At the same time, institutional cooperation can be a result of strategic dialogue with other HEIs while better framework conditions a result of dialogue with policy makers. Other outcomes are better recognition of the HEIs, which goes hand in hand with increasing attractiveness.

For details on the ultimate (intended) **impacts** of the Observatory, please see the respective section above.

Figure 7 Intervention logic of the Observatory for HEIs
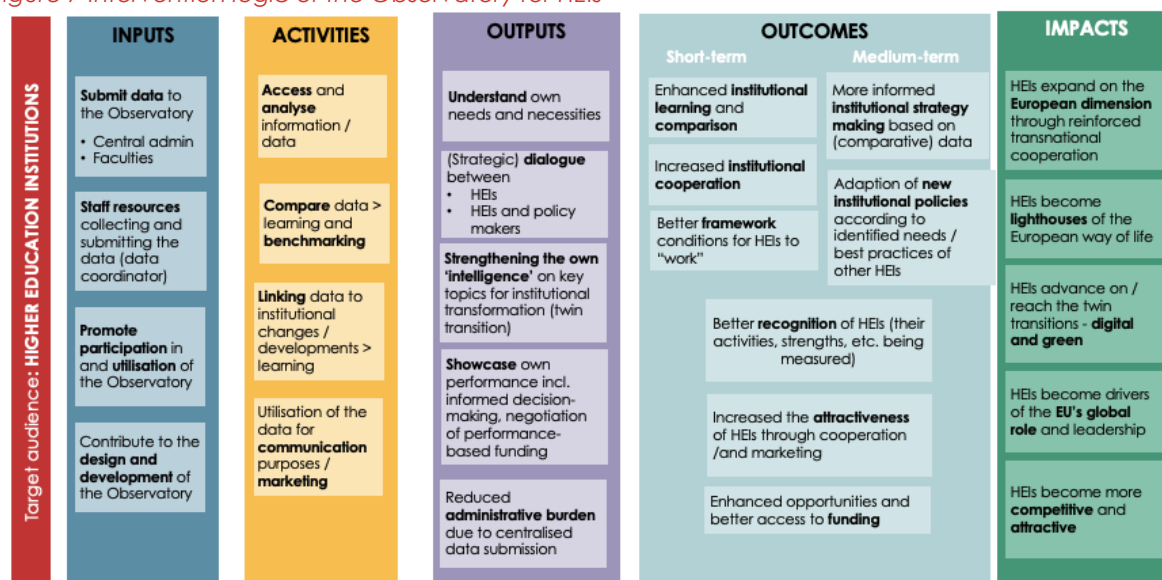
Source: Technopolis Group

3.1.2.3 Students

The study team developed an intervention logic for the students for the Observatory. The main interest of students entering higher education is to find the suitable higher education institution for their studies, while for current students it is of interest to find an international mobility placement or change HEI. Thus, the main interest of students is to access data such as available programmes, higher education institutions' achievements, social profile of higher education institutions etc in order to compare higher education institutions.

The data needs are rather different to the other user groups, especially in comparison to what is foreseen within the Scoreboard of the Observatory terms of content and level of granularity.

There are already existing tools and data sources which are of interest to students (such as Study in Europe, U-Multirank, Eurograduate and Eurostudent). They should be linked to the Observatory via the **Toolbox** (see Section 3.3.2.2). Considering the specific needs of this user group, we recommend that students will be able to use the Observatory as an entry-point to these existing tools and data sources through links (Figure 26).

Figure 8 Intervention logic of the Observatory for students
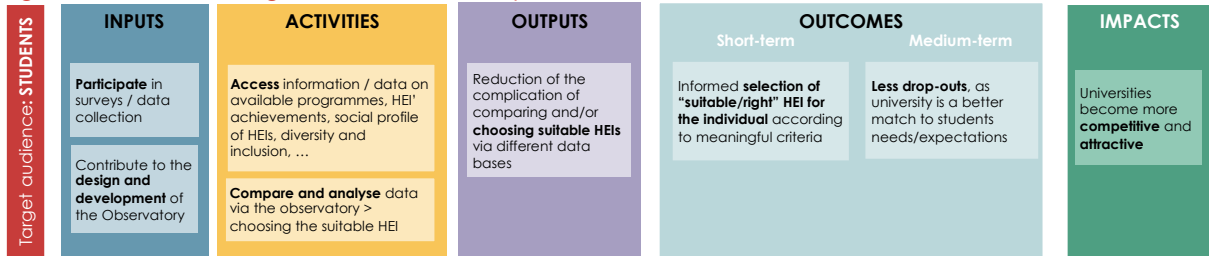
Source: Technopolis Group

Combined intervention logic

The study team also developed an overarching intervention logic for the Observatory. It combines the two intervention logics of the two main stakeholder groups, and is complemented with the inputs and activities needed to develop and maintain the Observatory. This intervention logic is displayed below.

Figure 9 Combined intervention logic for the Observatory

Source: Technopolis Group

3.2 Suggestion for the indicator framework to be included in the Observatory

This chapter provides an overview of the suggested indicator framework for the Observatory. First it describes the data sources and the RACER criteria that were used for the assessment of

the indicators. Then it provides an overview of the indicator framework including each suggested indicator together with its definition.

3.2.1 Overview of the data sources used, including timing of data series

As described in the methodological chapter, the study team reviewed a large number of data sources and selected indicators from eight data sources:

- **European Tertiary Education Register (ETER)** provides data on HEIs, students, graduates, and personnel. It aims to provide the national HE authorities, national ministries, and the European Commission with the necessary evidence to formulate effective higher education policies at national and regional levels. The micro data provided by ETER since 2011 is a supplement to the education statistics provided by EUROSTAT

- **U-Multirank** is a multidimensional, user-driven approach to international rankings of HEIs, launched in 2014. It compares the performances of HEIs in five dimensions: (1) teaching and learning, (2) research, (3) knowledge transfer, (4) international orientation and (5) regional engagement

- The **EUROSTUDENT** project collects and analyses comparable data on the social dimension of European higher education since 1994. A wide range of topics related to students' social and economic conditions are covered. The project strives to provide reliable and insightful cross-country comparisons

- The **EUROGRADUATE** Pilot Survey was launched in 2017 to create and implement a regular, comprehensive, comparable, and longitudinal European data collection on HE graduates. A second pilot survey is ongoing as part of the European Graduate Tracking Initiative of the EC and implements the recommendations of the EC expert group on graduate tracking on consecutively building a European graduate tracking mechanism

- **EUROSTAT** is the statistical office of the European Union. It produces European statistics in partnership with National Statistical Institutes and other national authorities in the EU Member States. This partnership is known as the European Statistical System (ESS)

- **Varieties of Democracy (V-dem)** provides a multidimensional and disaggregated dataset that reflects the complexity of the concept of democracy as a system of rules that goes beyond the simple presence of elections

- **Erasmus+ Dashboard,** the European Commission's database on participations in the Erasmus+ programme provides data on projects, budgets, organisation details and participants for project management, reporting and monitoring purposes

- **Community Research and Development Information Service (Cordis)**, the European Commission's database on participations and project results of EU funded research projects

There are differences in the time and geographical coverage, access and data update, as well as frequency across these data sources, which is summarised in Figure 10.

Figure 10 Overview of the data sources and indicators reviewed

Name	Geographical coverage	Accessibility of the data	Data sources	Data granularity	Time frame, frequency of update	No of indicators selected	Of which core indicators
European Tertiary Education Register (ETER)	27 EU MSs and EEA/EFTA Candidate countries: Albania, Turkey, Bosnia-Herzegovina, Kosovo, North Macedonia, Montenegro, Serbia Andorra, UK Total: 41 countries and 3,439 HEIs	Most data publicly available, metadata downloadable in .xlsx and through its API Financial data upon registration	National Statistical Authorities HEI	HEI (with OrgReg ID)	2011-2019 Data are updated at regular frequency (last update for 2019 data)	20	17
U-Multirank	2022 release covers 2,202 HEIs from 96 countries around the world	After registration and acceptance of Terms of Use data can be requested	National Statistical Authorities UMR own survey of HEIs and students – self-reported data Bibliometric databases	HEI (with OrgReg ID) Subject – can aggregate to HEI level Country	2014-2019 Latest data release: 2022	24	9
Eurostudent	Most EU MSs (w/o Spain, Latvia, Estonia, Hungary, Belgium) Turkey, Georgia, Norway	Through online data explorer Excel files can be downloaded	Own survey - data is collected in coordination with national partners in each country	Country	Data collection in rounds of three years, available for 5th round: 2012–15 6th round 2016-18 7th round 2018-21	5	2
Eurograduate	19 EU MSs+ EFTA/EAA countries	Can be accessed publicly only via reports	Own survey	Country	In phases 1st survey: 2018-2019 2nd survey: 2022-24	4	4
EUROSTAT	EU MS, plus additional countries for different datasets/indicators	Data freely accessible through an API or bulk download	National Statistical Authority	Country	Over six decades Data updated annually, with different timelines for the indicators	1	1
V-dem	All countries of the world	Data freely accessible	Composite indicator: existing sources combined with	Country	Data are provided on an annual basis	1	1

Name	Geographical coverage	Accessibility of the data	Data sources	Data granularity	Time frame, frequency of update	No of indicators selected	Of which core indicators
			validation through own data collection				
Erasmus+	All countries of the world	Data are hosted by the EC	Own data collection, reporting by the national authorities	HEI Country	Multiple updates per year	3	2
Cordis	All countries of the world	Data freely accessible	Own data collection	HEI Country	Multiple updates per year	1	1

Source: Technopolis Group

3.2.2 Challenges to the Observatory and mitigation strategies

Bringing together data from different sources provides significant advantages: it decreases reporting burden on institution by decreasing parallel data collections, allows expanding the breadth and depth of policy-relevant questions that can be answered, and eases access to reliable evidence on the European higher education sector. It, however, also poses a number of challenges, which have to be addressed for the successful development of the Observatory. One of the main challenges in the construction of the HE Sector Observatory database (which will be source of customised statistics and indicators) is the data streamlining process; integrability, potential overlap, and consistency of data has to be closely monitored and addressed to ensure high-quality results.

The data sources suggested for the Observatory apply different processes to access the data (as described in Figure 10). For instance, EUROSTAT and ETER datasets can be downloaded fully automatically with a script that extracts the information through an API. Other datasets can only be accessed through spreadsheets from their websites, while information from Eurograduate can only be accessed publicly via reports.

To facilitate the data streamlining process, the study team developed a check list that can be used to assess each data source. Since the creation of a full database for the Observatory is beyond the scope of this study, the checklist is suggested to be used by the future contractor to guide data processing. The study team already used the checklist when analysing the data sources and the suggested indicators. The methodological notes for each data set is included in the appendix.

Figure 11 Checklist of data and data processes challenges

Data level	Checklist	Comments based on the creation of a pilot database using four data sources: ETER, U-Multirank, V-dem and Eurostudent
Datapoint level	• Identification and flagging of inconsistent values • Value correctness • Standardised format • Standardised units	• These were explored for 11 selected indicators for which the study team carried out the practical implementation of the retrieving and processing data • Standardised units are HEI and country level data points within each data set as they are all retrieved from quality assured data sets
Dataset level	• Identification and treatment of duplicate or redundant records • Identification and flagging of inconsistent values • Homogeneous flagging of missing values and any consideration to be noted/communicated in specific data points • Overlap of values with values of other datasets • Completeness/coverage of the dataset • Completeness of the metadata • Legal constraints in the use/modification/publication of the dataset	• The indicator framework does not contain duplicate or redundant records • This step has to be examined once data are retrieved, however all datasets used are already quality assured by the data owners • The pilot database created includes flags for missing values • Overlap has been accounted for and excluded from the indicator framework • The coverage and completeness of the datasets vary as included in Figure 10 • Legal constraints do not apply as all data used are from publicly available sources
Entire database	• Identification of possible data aggregations • Identification of possible links between datasets/datapoints • Data normalisation for the definition of a database schema	• Datasets and datapoints can be linked as most of the datasets are available on country level, while the datasets that have. HEI level information already ensured compatibility and work with the same unique ID from OrgReg

3.2.3 International standards and the RACER criteria

The selected indicators were assessed for quality using the RACER criteria (high / medium / low) assessing the relevance of the indicator, availability of data, the clarity of the indicator, the ease of data collection and the robustness of the indicator. The table below provides an overview with explanation of how the criteria were used to assess the indicators.

Figure 12 Use of the RACER framework

Criterion	Description	Explanation of the assessment used
Relevant	There is a clear link and strong correlation between the indicator and theme it aims to measure	H – the indicator provides complete and relevant information on a theme M - the indicator provides relevant information on a theme L – the information is of low relevance to the theme
Acceptable	The indicator is widely accepted by stakeholders	H – the indicator is widely used internationally as a metric for a given theme / topic M – the indicator is used as a metric for a given theme / topic L – the indicator is only used by selected stakeholders / on selected geographical areas
Credible	There are clear definitions for the indicator including statements of what the indicator shows i.e. interpretation is unambiguous	H - internationally accepted definition exists for the indicator M - there are variations in the interpretation of the definition of the indicator e.g. across different countries L – there is no commonly accepted definition of the indicator
Easy	The indicator is easy to collect, and the data collection is proportionate to the results	H – the indicator provides high level of data coverage internationally M – there are some data gaps for the indicator L – there are many data gaps available for this indicator
Robust	The indictor is calculated in a robust manner i.e. does not allow for manipulation	H – the indicator is calculated in a robust manner e.g. numeric values, counts M – the indicator includes complex calculations and high number of variables e.g. some composite indicators L – the indicator is based on self-reported information with room for differences in interpretation

Source: Technopolis Group

The assessment with the RACER criteria was carried out using the following principles:

- Relevance was always judged upon the themes and topics to which the indicator was attributed. Most indicators are highly relevant, the few considered of medium relevance is because although they are relevant, they do not correspond directly to the themes and topics to which they are attributed, but they are the best possible proxy

- Acceptance is also 'High' and seldom 'Medium'. 'Medium' is mainly reported in the case an indicator is almost exclusively used in the EU and not beyond

- Credibility is considered 'Low' in the case of surveys, where there is a lot of room for interpretation of how to provide information for the questions

- Easiness is considered 'Medium' or 'Low" when there are difficulties to collect the indicator at the level best suited for the Observatory, hence the country is used as a proxy, or there are a lot of data gaps due to the combination of various issues linked to data collection

- Robustness is considered 'Medium' or 'Low' where the combination of collected information into one indicator is assessed as problematic or where responses are based on limited and often biased responses

At the end of the chapter the study team put forward suggestions for some of the indicators that scored low in some of the RACER criteria, in an attempt to highlight potential paths for improvement. When appropriate, suggestions for the development of new indicators are also proposed as considerations for future developments of the Observatory.

3.2.4 Suggested indicator framework

The selected indicators comprise a set of core indicators and additional 'useful to have' indicators. In total, there are 66 indicators put forward for inclusion in the HE Sector Observatory, of which there are:

- 37 existing indicators categorised as 'core' indicators

- 22 existing indicators categorised as 'useful to have' to provide additional information

- 7 not yet existing indicators. They should be developed in the future as they address aspects for which core indicators are missing

In addition to mapping these indicators to the key themes of the ES4U, the study team categorised them along their content (main category – teaching / research / funding / personnel) and by the type of indicator (input / output / activity). The table below provides an overview of the final list of indicators suggested for inclusion in the Observatory. It also highlights the areas where no suitable indicators exist, therefore development of new indicators is suggested. The local indicator ID was assigned by the study team for easy identification and use within the context of this study.

Figure 13 Overview of proposed indicators for inclusion in the Observatory

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
EHESO_1	Context indicators	Teaching	Inputs / activities	Students	Students enrolled - national / foreigner / resident / mobile / men / women / gender unclassified (core) and total for ISCED 5-7 (core)

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
EHESO_2				Students	Graduates - total by ISCED level (5-8) and by fields e.g. Natural sciences, mathematics and statistics, ICT, Education, Arts and Humanities, Social sciences, journalism and information, Business, administration and law, Engineering, manufacturing and construction, Agriculture, forestry, fisheries and veterinary, Health and welfare, Services - all fields (core)
EHESO_3				Investment	Total core budget (core)
EHESO_4		Funding			Public third-party funding (NC) / (EURO) / (PPP) (core)
EHESO_5					Private third-party funding (NC) / (EURO) / (PPP) (core)
EHESO_6					Third-party funding from abroad (NC) / (EURO) / (PPP) (core)
EHESO_7		Research		Research	Research active institution (core)

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
EHESO_8		Personnel		Staff	Total personnel (FTE) & (HC) (core)
EHESO_9				Staff	Full professors / academic staff (HC) & (FTE) (core)
EHESO_10		Legal status	Legal status	Legal status	Legal status (core)
ES4U Key objective 1 - Enhancing the European dimension in higher education and research					
EHESO_11	International mobility of staff	Personnel	Inputs / activities	Staff	EU-FP Staff mobility (core)
EHESO_12					Erasmus incoming / outgoing staff (core)
EHESO_13					Share of foreigner academic staff (core)
EHESO_14	International mobility of students			Students	Erasmus incoming / outgoing students (core)
EHESO_15					Share of foreign students / graduates; PhD students / PhD graduates
EHESO_16					Share of mobile students / graduates; mobile PhD students / graduates
EHESO_17	Transnational cooperation in research	Research	Inputs / Activities / Outputs	Research	International research grants (core)
EHESO_18					Number of EU-FP participations (core)
EHESO_19					Erasmus joint programmes

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
					between universities, education and research focused cooperation (core)
EHESO_20	International cooperation in education	Teaching	Activities	Academic programme	International orientation of bachelor / master programmes (core)
EHESO_21					International doctorate degrees
EHESO_22		Personnel	Inputs / activities	Students	Tuition fees for international students / Revenues from international student fees

ES4U Key objective 2 - Supporting universities as lighthouses of our European way of life					
EHESO_23	Fostering diversity, inclusiveness and gender equality	Personnel	Inputs / activities	Students	Students with children - Share of students with children
EHESO_24					Students' parents' educational background
EHESO_25				Staff	Academic personnel - total (HC) / men (HC) / women (HC) / gender unclassified (HC) and share of total (core)
EHESO_26					Academic personnel - national (HC) /

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
					foreigner (HC) / citizenship unclassified (HC) (core)
EHESO_27					Number of full professors -total / men / women / unclassified (HC and share of total) (core)
EHESO_28					R&D personnel and researchers by sector of performance, educational attainment level and sex (core)
New_EHESO_1	Flexible and attractive academic careers - new indicator to be developed				
EHESO_29	Academic values and freedom of scientific research	Research	Outputs	Publications	Publications cited in patents (core)
EHESO_30					Art related output (core)
EHESO_31					Interdisciplinary publications
EHESO_32					Open Access Publications (core)
EHESO_33				Context	Academic freedom index (core)
EHESO_34	Cooperation with industrial ecosystems	Teaching	Outputs	Contact with work environment	Student internships in a region (core)
EHESO_35					ERASMUS international traineeships (core)
EHESO_36					Students' motivation for employment alongside studies -

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
					All reasons to work (aggregated)
EHESO_37					Students who work alongside studies in order to gain experience on the labour market (core)
EHESO_38					Relationship between students' field of study and their employment (core)
EHESO_39		Research		Patents	Industry co-patents (core)
EHESO_40				Publications	Co-publications with industrial partners (core)
EHESO_41		Teaching	Outputs	Contact with work environment	Innovation, entrepreneurship and adequate skills (core)
EHESO_42					Match between education and job (core)
EHESO_43	Strengthening the quality and relevance for future-proof skills	Personnel	Inputs / activities	Students	Domains of competencies (core)
EHESO_44					Required and acquired competences (core)
EHESO_45					Students' enrolment by fields of study and ISCED levels
EHESO_46	Promoting entrepreneurship	Research	Outputs	Spin-offs	Spin-offs
EHESO_47					Graduate companies

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
New_EHESO_2		New indicator to be developed - Innovation focused activities, joint ventures with industry, presence of incubators/start-up clusters on campus (core)			
EHESO_48	Supporting universities as lighthouses of our European way of life	Personnel	Inputs / activities	Students	Outreach programmes
ES4U Key objective 3 - Empowering universities as actors of change in the twin green and digital transitions					
New_EHESO_3	Equipping young people and lifelong learners with digital and green skills	New indicator to be developed - Digital and green skills (core)			
EHESO_49		Personnel	Inputs / activities	Students	Erasmus+ green (virtual) mobility
EHESO_50	Promoting value of teaching and pedagogical innovation	Teaching	Activities	Teaching / learning experience	Innovative forms of assessment
EHESO_51					Overall learning experience
EHESO_52					Contact with teachers
EHESO_53					Skills Labs
EHESO_54					Inclusion of practical experience/clerkships
EHESO_55					Quality of courses & teaching
EHESO_56					Assessment of the organisation of a programme
EHESO_57					Research orientation of teaching
EHESO_58	Equipping young people		Inputs		Digital education investment (core)

Local indicator ID	Themes	Main category	Sub-category	Grouping	Indicators
EHESO_59	and lifelong learners with digital and green skills		Activities		Digital teaching
New_EHESO_4	Promoting value of teaching and pedagogical innovation – new indicator to be developed: micro-credentials (core)				
ES4U Key objective 4 - Reinforcing universities as drivers of the EU's global role and leadership					
New_EHESO_5	Excellence in research and innovation on a global scale - new indicator to be developed (core)				
New_EHESO_6	Promoting global outreach and strengthening partnerships and mobility globally - new indicator to be developed (core)				
New_EHESO_7	Strengthening of HE system in (non-EU) partner countries in line with EU values - new indicator to be developed (core)				

Source: Technopolis Group

3.2.4.1   Context Indicators

These indicators provide information on the HEIs to enable comparison gauging the institutions' size and legal status along a set of metrics. Additional indicators, such as the geographical location of the HEI within the country could be also considered, for which information is available from ETER on NUTS 2 and 3 levels.

Figure 14 Context indicators

ID	Indicators	Source	Granularity
EHESO_1	Students enrolled - national / foreigner / resident / mobile / men / women / gender unclassified (core) and total for ISCED 5-7 (core)	ETER	HEI
EHESO_2	Graduates - total by ISCED level (5-8) and by fields e.g. Natural sciences, mathematics and statistics, ICT, Education, Arts and Humanities, Social sciences, journalism and information, Business, administration and law, Engineering, manufacturing and construction, Agriculture, forestry, fisheries and veterinary, Health and welfare, Services - all fields (core)		
EHESO_3	Total core budget (core)		
EHESO_4	Public third-party funding (NC) / (EURO) / (PPP) (core)		
EHESO_5	Private third-party funding (NC) / (EURO) / (PPP) (core)		

ID	Indicators	Source	Granularity
EHESO_6	Third-party funding from abroad (NC) / (EURO) / (PPP) (core)		
EHESO_7	Research active institution (core)		
EHESO_8	Total personnel (FTE) & (HC) (core)		
EHESO_9	Full professors / academic staff (HC) & (FTE) (core)		
EHESO_10	Legal status		

Source: Technopolis Group

All these indicators come from the ETER database; the definitions of the indicators were extracted from the ETER Handbook.[3]

- **EHESO_1 - Students enrolled - national / foreigner / resident / mobile / men / women / gender unclassified (core) and total for ISCED 5-7:** Number of enrolled students and graduates total for ISCED 5-7 and by gender, citizenship, mobility, fields of education, age group and part-time/full-time and level of study

  - Content of the indicator: numeric, count - number of students

- **EHESO_2 - Graduates - total by ISCED level (5-8) and by fields e.g. Natural sciences, mathematics and statistics, ICT, Education, Arts and Humanities, Social sciences, journalism and information, Business, administration and law, Engineering, manufacturing and construction, Agriculture, forestry, fisheries and veterinary, Health and welfare, Services - all fields (core):** Numbers of graduates per institution at ISCED level 5, 6, 7 levels by fields of education (with separate figures for long ISCED 7 degrees), gender, mobility, citizenship and age groups. Breakdowns by gender, fields of education and citizenship/mobility and age groups, are provided separately by the level of education but not combined in order to reduce the burden for data collection

  - Content of the indicator: numeric, count - number of graduates

- **EHESO_3 - Total core budget (NC) / (EURO) / (PPP):** Core funding is defined as funding available for the operations of the whole institution, which is not earmarked to specific activities and whose internal allocation can be decided freely by the institution itself. Thus, the main criterion to separate core funding and third- party funds is that the former is managed at the level of the whole HEI, and there is discretion to which activities to devote to them. In contrast, third-party funds are usually attributed and managed directly by organisational subunits. Core funding is divided into two distinct and non-overlapping categories, i.e. basic government allocation and other core funding. If the breakdown is not available, the total should be entered in the aggregated variable

  - Content of the indicator: numeric value in national currency, EURO, or PPP

- **EHESO_4 - Public third-party funding (NC) / (EURO) / (PPP):** third party funding from public sources, that includes grants from national and international funding agencies as well as contracts from public bodies for specific research and education activities

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[3] https://www.eter-project.com/wp-content/uploads/2022/02/ETERIV_Handbook.pdf

- Content of the indicator: Numeric variable, in national currency, EURO, or PPP
- **EHESO_5 - Private third-party funding (NC) / (EURO) / (PPP):** funding by private entities on contract research and contract education, including private businesses and non-profit organisations, religious organisations, charitable organisations, business and labour associations, and well as households
  - Content of the indicator: Numeric variable, in national currency, EURO, or PPP
- **EHESO_6 – Third-party funding from abroad (NC) / (EURO) / (PPP):** funding from abroad, like funding from international research programmes and companies abroad. The amount should therefore correspond to funding from abroad in the EUROSTAT definition
  - Content of the indicator: Numeric variable, in national currency, EURO, or PPP
- **EHESO_7 - Research active institution:** Research-active institutions are those that have institutionalised research activities. Criteria for inclusion are the following:
  - The existence of an official research mandate
  - The existence of research units is institutionally recognised (for example, on the institutional website)
  - The inclusion in R&D statistics (availability of R&D expenditure data) as a sign of institutionalised research activity
  - Awarding doctorates or ISCED 8 degrees
  - Consideration of research in institutions strategic objectives and plans
  - Regular funding for research projects either from public agencies or from private companies
  - Institutions fulfilling at least three of these criteria should be included. It is generally expected that non-research active HEIs have no or very low numbers of ISCED 8 students and graduates
    - Content of the indicator: Binary (0=non-research active; 1=research active)
- **EHESO_8 - Total personnel (FTE) & (HC):** Total personnel includes three categories: (i) academic personnel, (ii) teaching and research assistants, and (iii) support and administration personnel
  - Content of the indicator: numeric, count – number in FTE and HC
- **EHESO_9 - Full professors / academic staff (HC) & (FTE):** Following the UOE manual, academic personnel includes:
  - Personnel employed at the tertiary level of education whose primary assignment is instruction and/or research
  - Personnel who hold an academic rank with such titles as a professor, associate professor, assistant professor, instructor, lecturer, researcher or the equivalent of any of these academic ranks
  - Personnel with other titles, (e.g. dean, director, associate dean, assistant dean, chair or head of a department), if their principal activity is instruction or research
  - Full professors is a sub-category of academic personnel. Full professorship requires the main position as a tenured professor (minimum 75%) and corresponds to the single highest grade/post at which research is normally conducted, corresponding usually to national classifications like ordinary professor, full professor etc. (not including associate professors and assistant professors)

- Content of the indicator: numeric, percentage of full professors of total academic staff calculated from HC and FTE
- **EHESO_10 – Legal status:** The classification between public and private is made according to whether a public agency or a private entity has ultimate control over the institution.
  - Ultimate control is decided with reference to who has the power to determine the institution's general policies and activities and appoint the officers managing the school. Ultimate control will usually also extend to the decision to open or close the institution
  - As many institutions are under the operational control of a governing body, the constitution of that body will also have a bearing on the classification. Private institutions should be further divided between government-dependent – either receiving more than 50% of their core funding from government agencies or whose teaching personnel is paid by a government agency – and independent private
  - Content of the indicator: nominal (public=0, private=1, private government-dependent=2)

3.2.4.2 Key objective 1 - Enhancing the European dimension in higher education and research

There are **12** indicators put forward to help monitor progress for the different themes addressed by key objective 1 of the ES4U. The indicators address four main themes:

- **International mobility of staff**: this set of indicators aims to provide information on the cross-border mobility of academic staff and researchers, as well as the proportion of foreign academic staff
- **International mobility of students**: focuses on the role played by the Erasmus+ Programme, in mobility of students and staff and cross-border mobility for internships. Furthermore, it includes information on the proportion of foreign and mobile students in the degree programmes at different levels of education (graduates and PhD students)
- **Transnational cooperation in research**: explores the current state of the strategic transnational and international research and education cooperation between countries or HEI
- **International cooperation in education**: overview of the progress for international orientation of study programmes at HEIs at different levels (time series)

Figure 15 Indicators suggested for key objective 1

ID	Indicators	Source	Granularity	R	A	C	E	R
EHESO_11	EU-FP Staff mobility (core)	ETER	HEI	H	H	H	H	H
EHESO_12	Erasmus incoming / outgoing staff (core)	ETER*	HEI	H	H	H	H	H
EHESO_13	Share of foreigner academic staff (core)	ETER	HEI	H	H	H	M	H
EHESO_14	Erasmus incoming / outgoing students (core)	ETER*	HEI	H	H	H	H	H
EHESO_15	Share of foreign students / graduates; PhD students / PhD graduates	ETER	HEI	H	H	H	M	H

ID	Indicators	Source	Granularity	R	A	C	E	R
EHESO_16	Share of mobile students / graduates; mobile PhD students / graduates	ETER	HEI	H	H	H	H	H
EHESO_17	International research grants (core)	U-Multirank	Subject HEI	H	M	H	L	M
EHESO_18	Number of EU-FP participations (core)	Cordis	HEI	H	H	H	H	H
EHESO_19	Erasmus joint programmes between universities, education and research focused cooperation (core)	Erasmus+ data	HEI	H	M	M	L	L
EHESO_20	International orientation of bachelor / master programmes (core)	U-Multirank	Subject HEI	H	H	H	H	M
EHESO_21	International doctorate degrees	U-Multirank	Subject HEI	H	H	H	H	H
EHESO_22	Tuition fees for international students	U-Multirank	Subject HEI	M	M	H	H	H

Source: Technopolis Group, notes: * data are available from the European Commission's E+ database as well, however due to the ease of access we suggested to retrieve the data from ETER

The indicators were selected from four different data sources: ETER, U-Multirank, Cordis and Erasmus+ data. Definitions for the indicators were extracted from the respective manuals.[4] The table above also includes the assessment of these indicators based on the RACER criteria.

- **EHESO_11 - EU-FP Staff mobility (core):** The number of researchers supported by the EU-FP programme
  - Content of the indicator: count – numeric
- **EHESO_12- Erasmus incoming / outgoing staff (core):** These variables provide information on personnel mobility supported by the Erasmus+ programme. The number of support mobility of personnel by the Erasmus+ programme
  - Content of the indicator: count – numeric
- **EHESO_13 - Share of foreigner academic staff (core):** Foreign academic staff is defined as academic staff not having the citizenship of the country in which the HEI is established. The indicator provides information on the share of foreign academic staff as a percentage of the total academic personnel

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[4] https://www.umultirank.org/export/sites/default/press-media/documents/Indicator-Book-2022.pdf

- Content of the indicator: numeric, percentage, calculated as share - number of foreigner academic staff / total academic staff i.e. number of foreigner academic staff + number of national academic staff

- Note on RACER criteria – 'ease' assessed as Medium: problems with double nationalities in particular when they change during the career of people

- **EHESO_14 - Erasmus incoming / outgoing students (core):** Erasmus incoming students corresponds to the number of Erasmus students hosted by the HEI during the respective academic year. This includes students' mobility at ISCED levels 5 to 8, disaggregated by ISCED level, as well as totals for all levels. Erasmus outgoing students corresponds to the number of Erasmus students sent out by the HEI during the respective academic year. This includes students' mobility at ISCED levels 5 to 8, disaggregated by ISCED level, as well as totals for ISCED5-8

  - Content of the indicator: count – numeric

- **EHESO_15 - Share of foreign students / graduates; PhD students / PhD graduates:** corresponds to the number of foreign enrolled students/ graduates by level of education, programme destination and field of education

  - Content of the indicator:

  – Share of foreign students (or graduates) = number of foreign students / (number of foreign students + number of national students)

  – Share of foreign PhD students (or PhD graduates) = number of foreign PhD students / (number of foreign PhD students + number of national PhD students)

  - Note on RACER criteria – 'ease' assessed as Medium: problems with double nationalities in particular when they change during the career of people

- **EHESO_16 - Share of mobile students / graduates; mobile PhD students / graduates:** corresponds to the number of mobile enrolled students/ graduates by level of education, programme destination and field of education

  - Content of the indicator: Share of mobile (PhD) students (or graduates) = number of mobile students / (number of mobile (PhD) students + number of resident (PhD) students)

- **EHESO_17 - International research grants (core):** The proportion of external research revenue from abroad – including public and private funding organisations and businesses.

  - Content of the indicator: Share - external research funds from international sources / total external research funds

  - Note on RACER criteria- 'ease' scored as low: Such indicators are very difficult to collect because private funding may come from different channels (local subsidiaries) but also because not all HEIs collect such data systematically

- **EHESO_18 - Number of EU-FP participations (core):** Number of participations in EU Framework Programme projects

  - Content of the indicator: count - numeric

- **EHESO_19 – Erasmus joint programmes between universities, education and research focused cooperation (core):** there are data that focus on the number of Mundus mobility periods that are delivered by HEI consortia. However, in the future, there is a need to enhance the scope of this measure and include for example participation in the European University Alliances, and other relevant EU funded programmes and initiatives

  - Content of the indicator: to be further discussed by the European Commission services

- Note on RACER criteria – if the indicator is based only on Erasmus data it does not reflect all Joint programmes and it is not even indicative because it constitutes a response to incentives. It is European and not international.

- **EHESO_20 - International orientation of bachelor / master programmes (core):** A composite measure taking into account (1) the existence of joint/dual degree programmes; (2) the inclusion of study periods abroad; (3) the percentage of international (degree and exchange) students; and (4) the percentage of international academic staff at different levels of studies: BA / MA levels

  - Content of the indicator: Index (from 1 to 18) based on five categories: (i) Student Mobility: Outgoing; (ii) Student Mobility: Incoming; (iii) International experience of academic staff; (iv) Teaching in foreign language; and (v) Degree theses in a foreign language

- **EHESO_21 - International doctorate degrees**: The percentage of doctorate degrees that were awarded to international doctoral candidates

  - Content of the indicator: Average (between 2018-2020) of (doctorate degrees awarded to candidates with foreign nationality (HC) / doctorate degrees awarded (HC))

- **EHESO_22 - Tuition fees for international students / Revenues from international student fees (core)**: Tuition fees per year in euro, charged to international students.

  - Content of the indicator: values in Euro

  - Note on RACER criteria – the way how international students are defined for the purposes of tuition fees varies country by country and based on the origin of the student (e.g. EU vs non-EU)

3.2.4.3 Key objective 2 - Supporting universities as lighthouses of our European way of life

There are **26 existing indicators** put forward to help monitor progress of the different themes addressed by key objective 2 of the ES4U. The indicators address six broad themes:

- **Fostering diversity, inclusiveness and gender equality**: overview of the representation of students in different levels of HE (e.g., graduates at ISCED levels 6,7,8), as well as academic staff / full professors /R&D personnel, by demographic metrics such as sex, age, country of origin (and income level of parents, for students)

- **Academic values and freedom of scientific research**: overview of the HEI's self-assessment of important academic values such as open access publications

- **Cooperation with industrial ecosystems**: relevance of HE education for work experience in different sectors. It also reflects on how HEI collaborate with industrial partners to achieve research outputs

- **Strengthening the quality and relevance for future-proof skills**: overview, in quantitative terms, the mismatch between skill supplies and demand

- **Promoting entrepreneurship:** understanding on how entrepreneurship and venture creation are promoted in higher education

- **Supporting universities as lighthouses of our European way of life:** overview of how universities are promoting the European way of life

Figure 16 Indicators suggested for key objective 2

ID	Indicators	Source	Granularity	R	A	C	E	R
EHESO_23	Students with children - Share of students with children	Eurostudent	Country	M	M	H	M	H
EHESO_24	Students' parents' educational background	Eurostudent	Country	H	L	M	L	H
EHESO_25	Academic personnel - total (HC) / men (HC) / women (HC) / gender unclassified (HC) and share of total (core)	ETER	HEI	H	H	H	H	H
EHESO_26	Academic personnel - national (HC) / foreigner (HC) / citizenship unclassified (HC) (core)	ETER	HEI	H	H	H	H	H
EHESO_27	Number of full professors -total / men / women / unclassified (HC and share of total) (core)	ETER	HEI	H	H	H	H	H
EHESO_28	R&D personnel and researchers by sector of performance, educational attainment level and sex (core)	EUROSTAT	Country	M	M	H	H	H
EHESO_29	Publications cited in patents (core)	U-Multirank	Subject	M	L	H	H	H
EHESO_30	Art related output (core)	U-Multirank	HEI	H	M	M	M	M
EHESO_31	Interdisciplinary publications	U-Multirank	Subject	H	M	M	M	M
EHESO_32	Open Access Publications (core)	U-Multirank	Subject	H	H	H	H	H
EHESO_33	Academic freedom index (core)	V-dem	Country	H	H	M	M	M
EHESO_34	Student internships in a region (core)	U-Multirank	Subject	H	H	H	M	H
EHESO_35	ERASMUS international traineeships (core)	Erasmus+	HEI	M	H	H	H	H
EHESO_36	Students' motivation for employment alongside studies - All reasons to work (aggregated)	Eurostudent	Country	M	M	H	M	M
EHESO_37	Students who work alongside studies in order to gain	Eurostudent	Subject	H	H	M	M	M

ID	Indicators	Source	Granularity	R	A	C	E	R
	experience on the labour market (core)							
EHESO _38	Relationship between students' field of study and their employment (core)	Eurostudent	Country	H	H	H	M	M
EHESO _39	Industry co-patents (core)	U-Multirank	HEI	H	M	H	M	H
EHESO _40	Co-publications with industrial partners (core)	U-Multirank	Subject	H	H	H	H	H
EHESO _41	Innovation, entrepreneurship and adequate skills (core)	Eurograduate	Country	H	H	L	L	L
EHESO _42	Match between education and job (core)	Eurograduate	Country	H	H	L	L	L
EHESO _43	Domains of competencies (core)	Eurograduate	Country	H	H	L	L	L
EHESO _44	Required and acquired competences (core)	Eurograduate	Country	H	H	L	L	L
EHESO _45	Students' enrolment by fields of study and ISCED levels	ETER	HEI	H	H	H	H	H
EHESO _46	Spin-offs	U-Multirank	HEI	H	H	H	H	H
EHESO _47	Graduate companies	U-Multirank	HEI	H	H	H	H	H
EHESO _48	Outreach programmes	U-Multirank	HEI	H	H	L	L	L

- **EHESO_22 - Students enrolled - national / foreigner / resident / mobile / men / women / gender unclassified (core):** Number of enrolled students and graduates by gender, citizenship, mobility, fields of education, age group and part-time/full-time
  - Content of the indicator: numeric- count
- **EHESO_23 - Students with children - Share of students with children**: Share of students with and without child(ren)
  - Content of the indicator: Share - in percentage, divided into two categories (students without children and students with children)
  - Notes on the RACER criteria - It is not an indicator that used internationally in a standardised way and data are only available from Eurostudent national reports, therefore at a highly aggregated level. Data collection is carried out in rounds of three years. Not every HEI might be requesting such information

- **EHESO_24 - Students' parents' educational background**: Share of students with parents' educational background: a) Tertiary education (ISCED 2011 5-8); b) No higher tertiary education (ISCED 2011 0-4); c) unknown

  - Content of the indicator: Share - in percentage, divided by the different categories

  - Notes on the RACER criteria – It is not an indicator that used internationally in a standardised way and data are only available from Eurostudent national reports, therefore at a highly aggregated level. Data collection is carried out in rounds of three years. Credibility of the indicator might be affected by response biases as there may be a tendency to overestimate

- **EHESO_25 - Academic personnel - total (HC) / men (HC) / women (HC) / gender unclassified (HC) (core):** Following the UOE manual, academic personnel includes:
  - Personnel employed at the tertiary level of education whose primary assignment is instruction and/or research
  - Personnel who hold an academic rank with such titles as a professor, associate professor, assistant professor, instructor, lecturer, researcher or the equivalent of any of these academic ranks
  - Personnel with other titles, (e.g. dean, director, associate dean, assistant dean, chair or head of a department), if their principal activity is instruction or research
  - Content of the indicator: Count - number of academic personal (HC), Share - number of academic personnel (HC, by gender) / Total number of academic personnel

- **EHESO_26 - Academic personnel** - national (HC) / foreigner (HC) / citizenship unclassified (HC)

  - Content of the indicator: Count - number of academic personal (HC)

- **EHESO_27 - Number of full professors -total / men / women / unclassified (HC and share of total) (core):** Full professorship requires the main position as a tenured professor (minimum 75%). It is only included the single highest grade/post at which research is normally conducted, corresponding usually to national classifications like ordinary professor, full professor etc. (not including associate professors and assistant professors)

  - Content of the indicator: numeric, count - number of full professors (HC), Share - number of full professors (HC, by gender) / Total number of full professors

- **EHESO_28 - R&D personnel and researchers by sector of performance, educational attainment level and sex (core):** R&D personnel data is mostly available in full-time equivalent (FTE) and in head count (HC), and for some breakdowns as a percentage of total employment, and as a percentage of active population. The data is further broken down by professional position; educational attainment; sex; field of research and development (FORD); economic activity (NACE Rev.2)

  - Content of the indicator: numeric, count (HC and FTE)

- **EHESO_29 - Publications cited in patents (core):** corresponds to the percentage of the department's research publications that were cited in the reference list of at least one international patent (as included in the PATSTAT database)

  - Content of the indicator: Share - score on publications cited in patents / 100 total publication output *100

  - Notes on the RACER criteria – the indicator is only available at subject level, not HEI level and there are a small number of data points (370 in total) available for 2022. The indicator can be also used in combination with citations of publications

- **EHESO_30 - Art related output (core):** the number of scholarly outputs in the creative and performing arts, relative to the full-time equivalent (FTE) number of academic staff
    - Content of the indicator: Average - AVG from t-2 to t (art related research output) / AVG from t-2 to t (academic staff (FTE)t - doctoral candidates counted as staff (FTE))t) Average from 2018 to 2020. t=standard reference year (2020)
    - Notes on the RACER criteria – this is a highly relevant indicator, but it covers only a narrow field, therefore it is not of interest for everyone. Accordingly, there are only 385 data points available for 2022 in total
- **EHESO_31 - Interdisciplinary publications**: corresponds to the percentage of the department's research publications within the field's top 10% publications with the highest interdisciplinarity scores
    - Content of the indicator: numeric, percentage
    - Notes on the RACER criteria - Highly relevant because this is where progress comes from, but it is very complex to measure accurately that it is seldom reported, not universally accepted and hence not robust, 410 data points available for 2022
- **EHESO_32 - Open Access Publications (core):** Share of open access publications out of all publications of an institution
    - Content of the indicator: numeric, percentage - share - academic publications published in open access journals / total publications *100
- **EHESO_33 - Academic freedom index (core)**: A composite indicator based on seven specific indicators: freedom to research and teach; freedom of academic exchange and dissemination; institutional autonomy of universities; campus integrity; constitutional provisions for the protection of academic freedom; freedom of academic and cultural expression; states' international legal commitment to academic freedom under the International Covenant on Economic, Social and Cultural Rights
    - Content of the indicator: Index - varies from 0 to 1
- **EHESO_34 - Student internships in a region:** out of the students who did an internship, the percentage for which the internship was with a company or organisation located in the region
    - Content of the indicator: numeric, average - AVGt from t-2 to t (students in internship in the region in t / total students in internships in t) *100; t=standard reference year(2020)
- **EHESO_35 - ERASMUS international traineeships (core):** Time spent in an enterprise or organisation in another country, with a view to acquiring specific competences that are needed by the labour market, gaining work experience and acquiring more understanding of the economic and social culture of that country
    - Content of the indicator – number of mobility periods
- **EHESO_36 - Students' motivation for employment alongside studies - All reasons to work (aggregated):** out of students with a regular or occasional paid job, the share of students who work alongside studies to: to cover living costs; to gain experience on the labour market; to afford to be a student; or to support others.
    - Content of the indicator: numeric, percentage - share - in percentage, divided by the four categories. Sum of % can be higher than 100%, as students can choose more than one option. It includes a 1-5 scale to measure the validity of the question (e.g., applied totally versus not at all)

- Notes on the RACER criteria – similar to other indicators from Eurostudent, the indicator is highly relevant, but it is not used internationally in a standardised way and data are only available from the national reports, therefore at a highly aggregated level. Data collection is carried out in rounds of three years

- **EHESO_37 - Students who work alongside studies in order to gain experience on the labour market (core):** out of students with a regular or occasional paid job, the share of students (in %) rating the statement "[my work] applies to gain experience on the labour market"

  - Content of the indicator: numeric, percentage - share - in percentage, divided into five categories (from "Does not apply at all" to "Applies Totally [to gain experience on the labour market]"

  - Notes on the RACER criteria – similar to other indicators from Eurostudent, the indicator is highly relevant, but it is not used internationally in a standardised way and data are only available from the national reports, therefore at a highly aggregated level. Data collection is carried out in rounds of three years

- **EHESO_38 - Relationship between students' field of study and their employment (core):** out of students with a regular or occasional paid job, it measures on a 1-5 scale how close students' jobs are in relation to their studies

  - Content of the indicators: numeric, percentage - share - in percentage, divided into 5 categories (from not at all to very closely)

  - Notes on the RACER criteria - Difficult to capture relationship because of interdisciplinarity

- **EHESO_39 - Industry co-patents (core):** The percentage of the number of patents assigned to (inventors working in) the university over the period 2010-2019, which were co-applied with at least one applicant from the industry

  - Content of the indicator: numeric, percentage – share, Share - number of co-patents with industry / number of patents *100

  - Noted on the RACER criteria – difficulties to measure because of different IP/patenting policies in universities, there are 580 data points available for 2022

- **EHESO_40 - Co-publications with industrial partners (core)**: The percentage of a department's research publications that list an author affiliated with an address that refers to a for-profit business enterprise or private sector R&D unit (excludes for-profit hospitals and education organisations)

  - Content of the indicator: numeric, percentage -share - score on co-publications with industry / total publication output *100

- **EHESO_41 - Innovation, entrepreneurship and adequate skills (core):** respondents' satisfaction with the skills gained across six categories:
  - Social skills
  - Entrepreneurial skills
  - Advanced literacy skills
  - Advanced numeracy skills
  - Advanced ICT skills
  - Managerial / leadership skills

  - Content of the indicator: Index that goes from 0 to 100%. Higher values mean higher satisfaction

- Notes on the RACER criteria - Information is self-reported satisfaction which might be influenced by many unrelated factors. The data are reported on a country level, while it would be more beneficial to have it on an HEI level. The last round of data collection was in 2016-17, therefore somewhat out of date

- **EHESO_42 - Match between education and job (core):** the Education – Job match is measured on basis of two questions in the EUROGRADAUTE survey: (i) what type of education do you feel is most appropriate for this work?; and (ii) what field of study do you feel is most appropriate for this work?. Based on these two questions, four types of education-job matches are defined:

  - Horizontal and vertical match: Respondent reports that at least the level graduated from is most appropriate & Respondent reports that exclusively the own field of study, or a related field of study is most appropriate

  - Horizontal mismatch: Respondent reports that at least the level graduated from is most appropriate & Respondent reports that no particular field or a completely different field is most appropriate

  - Vertical mismatch: Respondent reports that a lower degree level than graduated from is most appropriate & Respondent reports that exclusively the own field of study, or a related field of study is most appropriate

    ◦ It is important that in this sense, respondents that report that a higher degree level is required than graduated from (e.g. BA-level graduates working in a job that actually requires a MA- level degree) are not considered as vertically mismatched

  - Double mismatch: Respondent reports that a lower degree level than graduated from is most appropriate & Respondent reports that no particular field or a completely different field is most appropriate

  - Content of the indicator: numeric, percentage - presented as percentage allocated to each of the above categories (up to 100%)

  - Notes on the RACER criteria - The data are reported on a country level, while it would be more beneficial to have it on an HEI level. The last round of data collection was in 2016-17, therefore somewhat out of date

- **EHESO_43 - Domains of competencies (core)**: respondents are queried about their skill and competency domains: Field-specific; Communication; Team-working; Foreign language; Learning; Planning; Customer handling; Problem solving; Advanced ICT. There is also an aggregate index including the 9 categories

  - Content of the indicator: Each category varies from 0 to 100% and higher percentages mean higher competences

  - Notes on the RACER criteria - The data are reported on a country level, while it would be more beneficial to have it on an HEI level. The last round of data collection was in 2016-17, therefore somewhat out of date

- **EHESO_44 - Required and acquired competences (core):** assessment of respondents whether they are equipped / required a specific competence

  - Content of the indicator: numeric, percentage - percentage of respondents indicating they are equipped / required a specific competence - varies from 0 to 100%

  - Notes on the RACER criteria - very hard to measure, the country level is not relevant for the HEI itself, as HEIs within the same country differ significantly between them. The last round of data collection was in 2016-17, therefore somewhat out of date

- **EHESO_45 - Students' enrolment by fields of study and ISCED levels:** Number of enrolled students total for ISCED 5-7 (separate for ISCED 7 long) by subject areas e.g. Education, Arts and Humanities, Social sciences, journalism and information, Business, administration and law, Natural sciences, mathematics and statistics, ICT, Engineering, manufacturing and construction, Agriculture, forestry, fisheries and veterinary, Health and welfare, Services

  - Content of the indicator: numeric, percentage - share - in percentage, divided by the different categories

- **EHESO_46 - Spin-offs:** The number of spin-offs (i.e. firms established on the basis of a formal knowledge transfer arrangement between the institution and the firm) recently created by the institution (per 1000 FTE academic staff, excluding FTE doctoral candidates counted as staff)

  - Content of the indicator: AVG between t-2 and t (spin-off firms in t) / AVG between t-2 and t (academic staff (FTE) - doctoral candidates counted as staff (FTE)) in t * 1000; t=standard reference year (2020); average 2018-2020

- **EHESO_47 - Graduate companies:** The number of companies newly founded by graduates per 1,000 graduates.

  - Content of the indicator: AVG between t-2 and t (companies newly funded by graduates in t) / AVG between t-2 and t (total number of academic degrees awarded in t) *1000

- **EHESO_48 - Outreach programmes:** A rating indicator based on the existence of various forms of outreach programmes to underrepresented groups of students. This includes: (i) partnerships with secondary schools; (ii) summer schools; (iii) media-/ recruitment campaigns; (iv) providing guidance and advice to potential students; (v) partnerships with neighbourhoods or regions; (vi) other initiatives

  - Content of the indicator: numeric, Index (from 0 to 6) - Universities get a point for every outreaching activity they offer: Partnerships with secondary schools; Summer schools; Media-/ recruitment campaigns; Providing guidance and advice to potential students; Partnerships with neighbourhoods or regions; Other initiatives

  - Notes on the RACER criteria - Difficulties to measure accurately, it does not provide any information on quality or the extent of outreach but provides a numerical value based on the number of types of outreach activities carried out across the six categories. There are 401 data points available for 2022

3.2.4.4 Key objective 3 - Empowering universities as actors of change in the twin green and digital transitions

There are **11** indicators put forward to help monitor progress of the different themes addressed by key objective 3 of the ES4U, however most of them are 'useful to have; indicators and there is only one existing indicator that is suggested as a 'core indicator' on these themes. The main reason for most of these indicators suggested as 'useful to have' is linked to the assessment of the indicators with the RACER criteria. The assessment highlighted the difficulties to measure these areas, as the survey responses often include bias and a high degree of subjectivity in the interpretation of the questions and answer options. Furthermore, the available data points for most of these indicators are very low - partially due to the fact that some of the indicators are specific for the field of medicine - and vary between 139 and 201 for 2022.

There are two broad themes addressed by this key objective:

- **Equipping young people and lifelong learners with skills for the digital and green transition** – how far is education equipping young people and lifelong learners with skills for the digital

and green transition and prepares them to have digital literacy and climate, environmental literacy

- Promoting **value of teaching and pedagogical innovation:** explores questions such as: How much are different education research results incorporated and recognised in teaching and learning methods? How far are micro-credentials used and promoted?

Figure 17 Indicators suggested for key objective 3

ID	Indicators	Source	Granularity	R	A	C	E	R
EHESO_49	Erasmus+ green (virtual) mobility	Erasmus+	HEI	M	H	H	H	H
EHESO_50	Innovative forms of teaching and assessment (core)	U-Multirank	Subject	H	H	M	L	L
EHESO_51	Overall learning experience	U-Multirank	Subject	H	H	M	M	L
EHESO_52	Contact with teachers	U-Multirank	Subject	H	H	M	M	L
EHESO_53	Skills Labs	U-Multirank	Subject	H	M	M	M	L
EHESO_54	Inclusion of practical experience/clerkships	U-Multirank	Subject	H	M	L	L	L
EHESO_55	Quality of courses & teaching	U-Multirank	Subject	H	H	M	M	L
EHESO_56	Organisation of a programme	U-Multirank	Subject	H	H	M	M	L
EHESO_57	Research orientation of teaching	U-Multirank	Subject	H	H	M	M	L
EHESO_58	Digital education investment (core)	U-Multirank	HEI	M	M	H	M	H
EHESO_59	Digital teaching	U-Multirank	Subject	H	H	M	M	L

-
- **EHESO_49 - Erasmus+ green (virtual) mobility indicators:** Virtual exchanges projects consist of online people-to-people activities that promote intercultural dialogue and soft skills development

  - Content of the indicator: the exact categorisation of green (virtual) mobility is still under development, but it will be available in the near future

- **EHESO_50 - Innovative forms of teaching and assessment (core):** The percentage of examinations (in medical doctor training programmes) which use innovative forms of assessment (assessment of practical work by faculty and structured clinical cases). This indicator is calculated only for the dentistry, medicine and veterinary sciences and is available only for 2020

- Content of the indicator: numeric, percentage - % faculty rating + % objective structured examination

- **EHESO_51 - Overall learning experience:** An assessment of the quality of the overall learning experience based on a student satisfaction survey

  - Content of the indicator: X (average) = 1/ N * X (overall learning experience) N = students; X = overall learning experience

- **EHESO_52 - Contact with teachers**: An assessment of the feedback given by teachers, based on a student satisfaction survey. The categories are: Social climate between students and teachers, feedback on homework, assignments and examinations, advice in preparing theses or oral presentations

  - Content of the indicator: $\bar{X} = \frac{1}{N} \sum_{i=1}^{3} X_i$, where N = students; X_i = different categories assessed by the students. The same formula is used – adjusted to the number of areas assessed – for all EHESO_53 to EHESO_57 and EHESO_59 indicators

- **EHESO_53 - Skills Labs:** An assessment of the skills labs and training centres concerning maintenance, accessibility, technical facilities and mentoring, based on a student satisfaction survey. This indicator is calculated only for the subjects medicine, dentistry, nursing and veterinary science. There are six categories and data are only available for 2020. These categories are: Maintenance of labs, Capacity, Accessibility, Technical facilities, Mentoring, (Variety of actors simulating sick patients).

  - Content of the indicator: numeric value

- **EHESO_54 - Inclusion of practical experience/clerkships:** An assessment of the integration of practical experience with patient contact into the learning experience, based on a student satisfaction survey. This indicator is calculated only for the subjects medicine, dentistry, nursing and veterinary science, if there are periods of continuous clinical or practical / practice work of at least 3 months included in the study programmes

  - Content of the indicator: numeric value

- **EHESO_55 - Quality of courses & teaching:** An assessment of the quality of teaching provision, based on a student satisfaction survey. Categories assessed are: Didactics in subject, accompanying material provided, willingness of staff to enhance their teaching, breadth of content of teaching offerings, adequate teaching of basic courses, international orientation, interdisciplinary elements, choose opportunities, teachers` helpfulness / commitment, easiness of interaction with teachers, integration of project- / problem based learning

  - Content of the indicator: numeric value

- **EHESO_56 - Organisation of programme:** An assessment of the organisation of the programme, based on a student satisfaction survey. Categories assessed include: Transparency of entrance regulations, access to classes, feasibility of study programme, transparency of the examination system, adjustment of course content to examination subjects, feedback by teachers, matching of course contents within a module

  - Content of the indicator: numeric value

- **EHESO_57 - Research orientation of teaching:** An assessment of degree to which the education is informed by research in the field, based on a student satisfaction survey. Categories assessed are: Introduction to methods of scientific work, inspiration for own critical reflection on the subject, inclusion of central and innovative research results, training of scientific thinking in general, encouragement to give conference papers

  - Content of the indicator: numeric value

- **EHESO_58 - Digital education investment (core):** Investment in digital education as a percentage of the total budget of the institution
  - Content of the indicator: numeric, percentage - average, $AVG_{t-2}^{t}\left(\frac{digital\ education\ investment_t}{total\ revenues_t}\right)*100$
- **EHESO_59 - Digital teaching:** An assessment of the quality of digital teaching, based on a student satisfaction survey. Categorised assessed are: Diversity of digital teaching formats, technical conditions for digital teaching, didactical concept for digital courses, transparency of requirements and learning goals for digital courses, digital feedback by lecturers
  - Content of the indicator: Numeric value

3.2.5 Recommendations on next steps and future indicator developments

There are a number of indicators which are rated 'low' in terms of Clarity and/or Robustness. While it is less urgent to create new indicators for these, since there are at least some indicators offering responses, even if not fully satisfactory to policy questions, their rating suggests that it is time to start thinking about how they can be improved. In the case of comparatively low clarity better explanations and improved connections can help. However, some of these indicators were assessed low as they are reliant on surveys and pilot surveys and such surveys often contain the bias of respondents.

Artificial intelligence gives now plenty of opportunities to create robust indicators, yet this needs a whole new approach to these indicators and in the context of this assignment – which was tasked to assess existing indicators for the purposes of the Observatory - one can only point at the need rather than suggesting new indicators per question. During the systematic search for the appropriate indicators, which was described in the previous chapter, the team came across pertinent monitoring questions which either remain unanswered or are only partially answered with indicators from the existing data sources. They revealed needs, which are worth further pursuing, even if this would be only as a challenge for future thinking or research.

The indicators that need further thought are composed of two types: Figure 18 depicts themes and monitoring questions for which no indicators could be found; then, those themes and monitoring questions are presented, where indicators have room for improvement based on the assessment with RACER criteria.

The lists below are indicative and by far not exhaustive; they are compiled in the spirit of trying to respond to the needs of stakeholders as reflected during the research and consultations, workshops carried out by the study team. Stakeholders highlighted their willingness and expectation to be involved in the strategic discussions on scope and objectives, the indicator framework (descriptive rather than prescriptive) and long-term perspective for the further development of the Observatory.

The table below shows that there are sufficient indicators to address questions related to policies envisaging the Enhancing of the European dimension in higher education and research, whereas there are gaps in the themes addressed by the other three key objective areas.

- In the case of Supporting universities as lighthouses of our European way of life we lack indicators on what would make European universities attractive.
- In the case of Empowering universities as actors of change in the twin green and digital transitions there are many indicators available but there is a lack of specific evidence on youth and on teaching and pedagogical innovation. The latter would be an indicator helpful for raising ambitions and indicating good practices in Europe.

- Finally, it is clear that we completely lack indicators in the area of Key objective 4 - Reinforcing universities as drivers of the EU's global role and leadership. Creating at least one indicator in the observatory for this Key Objective would then be necessary.

Figure 18 Themes and monitoring questions for which no existing indicators could be identified

ID	Themes	Monitoring questions	Indicators needed	Level	Examples
Key objective 2 - Supporting universities as lighthouses of our European way of life					
New_EHESO_1	Flexible and attractive academic careers	What do academic institutions offer as flexible and attractive career pathways?	Can be Y/N on specific opportunities or shares of people using them	Country HEIs	One can demonstrate different levels of flexibility: ➢ Temporary leave to work in the private sector (Yes/No or number of years) ➢ Incentives for attractive funding from the private sector/abroad ➢ Recognition of special skills for promotion
New_EHESO_2	Promoting entrepreneurship Promoting value of research	How is entrepreneurship and venture creation promoted in higher education?	Innovation focused activities, joint ventures with industry, presence of incubators/start-up clusters on campus (core)	HEI	Coordinated country surveys by Eurostat ➢ Number of start-ups/number of graduates ➢ Revenue from profits and acquisitions of start-ups compared to research grants or total budget ➢ Share of funds the university dedicates to incubation facilities ➢ Share of funds the university earmarks for patenting costs
Key objective 3 - Empowering universities as actors of change in the twin green and digital transitions					
New_EHESO_3	Equipping young people and lifelong learners with digital skills - digital literacy and green transition - climate, environmental literacy	How far are young people and lifelong learners equipped with relevant green and digital skills?	Digital and green skills (core)	HEI Country	➢ Degrees on digital/green disciplines (Y/N or number compared to all disciplines) ➢ Courses on digital/green skills for students (Y/N, numbers compared to all courses) ➢ Adult education courses for digital/green transition (Y/N, numbers compared to all adult education courses) ➢ Numbers of graduates of all above courses ➢ Costs of these courses (who pays for them?)
New_EHESO_4	Promoting value of teaching and pedagogical innovation	Micro-credentials (core)	New teaching practices	HEI	➢ Prizes for new teaching practices (Y/N, amounts, frequency) ➢ Committees discussing/encouraging new teaching practices (Y/N; their relevance in the hierarchy)
Key objective 4 - Reinforcing universities as drivers of the EU's global role and leadership					
New_EHESO_5	Excellence in research and innovation on a global scale	How can universities improve their global image?	Both research and innovation indicators are needed	HEI Country	Research indicators are much easier to compile than innovation indicators ➢ Publications in top journals (numbers, shares, ranks, numbers/all publications of university staff) ➢ Revenue from technology transfer to international businesses

ID	Themes	Monitoring questions	Indicators needed	Level	Examples
New_ EHESO _6	Promoting global outreach and strengthening partnerships and mobility globally	How can the university increase its global integration?	Co-publications, co-patenting University subsidiaries	HEI	Can be regularly compiled by OpenAIRE ➤ Co-publications of academic staff with major competitors (USA, China, South Korea, Japan) and groups of countries (Europe, Africa, Latina America, SE Asia) compared to all publications ➤ Co-patenting of academic staff with major competitors (USA, China, South Korea, Japan) and groups of countries (Europe, Africa, Latina America, SE Asia) compared to all patents
New_ EHESO _7	Strengthening of HE system in (non-EU) partner countries in line with EU values	Can (are) the values of the EU HE be transferred to non-EU countries?	Academic freedom Efficient administration	HEI Country	Engagement in bilateral support programmes in developing countries supporting the modernisation of universities

3.3 Suggestion for the structure of the Observatory's website with mock ups

3.3.1 Lessons learnt from other observatories

To better understand the possibilities for the Observatory's development, the study team revisited several different observatories that were developed over the years to draw out lessons learnt and interesting practices. The following summarises the key insights and lessons learned. More details about the individual observatories are included in Appendix C.

While the majority of the observatories studies is entirely publicly funded, the reviewed observatories use different data and information collection means and quality control systems. Their functionalities and presentation modes vary according to user needs. All of the reviewed observatories have interesting features which can inspire the future functionalities of the European HE Sector Observatory. None of them have started with a full-blown website but have issued new functionalities and features, new indicators, new functions etc. over time. For a 'basic version' of the HE Sector Observatory that will start with available, quality controlled databases, and derived indicators for viewing and/or downloading data files, the technical development of a website is minimal. Yet, if the HE Sector Observatory is to become the one stop shop it aims to be, further developments are needed.

The following observations thus relate to the post 'basic version' of the Observatory.

Key lessons from other observatories can be summarised as following:

- Success in terms of usage and acceptance is related to trust in the website and its content, its usefulness and user-friendliness. However, trust comes with a price tag, namely that the content is adhering to quality processes and standards which is balanced with the requirements to ensure timeliness of information provision

- Reaching the potential of a monitoring system requires time. It requires collecting time series of data and information that enables analyses. Through longer time series, developments can be detected, analysed, and understood. Therefore, a substantial investment in setting up the data infrastructure and user interface at the outset is key, but its maintenance and further development over a longer period to fully achieve its potential as a steering tool is equally important

- A dedicated pool of people for steering, providing oversight, and making decisions in time is needed. While it is certainly useful to listen to user groups what they need to enable tailoring the information provision to their needs as much as possible, the key decisions on developments, on the set of indicators, functionalities, the timetable of technical developments etc. should be made top down

- Stability of collected content (indicators) is key for the availability of longer time series. If the tool is to be used for benchmarking, longer time series are helpful in detecting changes over time. Clear definitions of the indicators, the use of agreed terminology and taxonomies also help build trust in the quality of the collected data

- There is a need to set up and operate a dedicated and distributed quality assurance system for swift and smooth quality control when the data comes from different sources and/or is collected differently. If qualitative information is equally collected, clear guidelines for the data collection and analysis will help reducing ambiguity

- The HE Sector Observatory portal may want to offer restricted use of data by different user groups. This may be in connection to the provision of data, the quality control of data, or the analysis of data. Different access rights and use of specific data (such as monitoring data of the EUI universities) may create a higher buy-in of specific user groups

- Updates of monitoring information that is collected through regular surveys: the longer and the more detailed they are, the less frequent they should be. For the updating schedule, a dedicated period should be planned so that updated information for all organisations/countries is available at a given point in time. Other secondary information collected should be updated on a regular basis too

Figure 19 Overview of the key features of the reviewed observatories

Key features	STIP Compass	WEF	ESPON	EIO	ERAWATCH	EOSC
Management						
Overall coordination at high level (e.g. EC, OECD, WEF)	✓	✓		✓	✓	
Methodological development	✓	✓			✓	✓
Data collection						
Survey-based (mainly through own resources)	✓					✓
Network of experts (mainly through dedicated third-party resources			✓	✓	✓	
Network of experts | pro rata	✓					✓
Restricted access areas (Members, Partners)		✓			✓	✓
Use of open sources	✓	✓	✓	✓	✓	✓
Quality control						
By dedicated organisation				✓	✓	
Distributed competences	✓	✓				✓
Access						
No restrictions	✓		✓	✓	✓	✓
Login areas		✓			✓	✓

Source: Technopolis Group

3.3.2 Visualisation of the data Observatory structure and the respective data

We suggest that when accessing the Observatory via a **landing page**, users receive general information on the Observatory as well as explanations on the use of the Scoreboard and the Toolbox (Figure 20). We also propose to add a **filtering question** asking for the data/information the user is searching for (as visualized below). This pre-filtering of the visitors of the observatory allows users to start their journey at the "most suitable" starting point and minimizes the risk of not finding what they were searching for.

Figure 20 Exemplary visualisation of the landing page with filtering questions
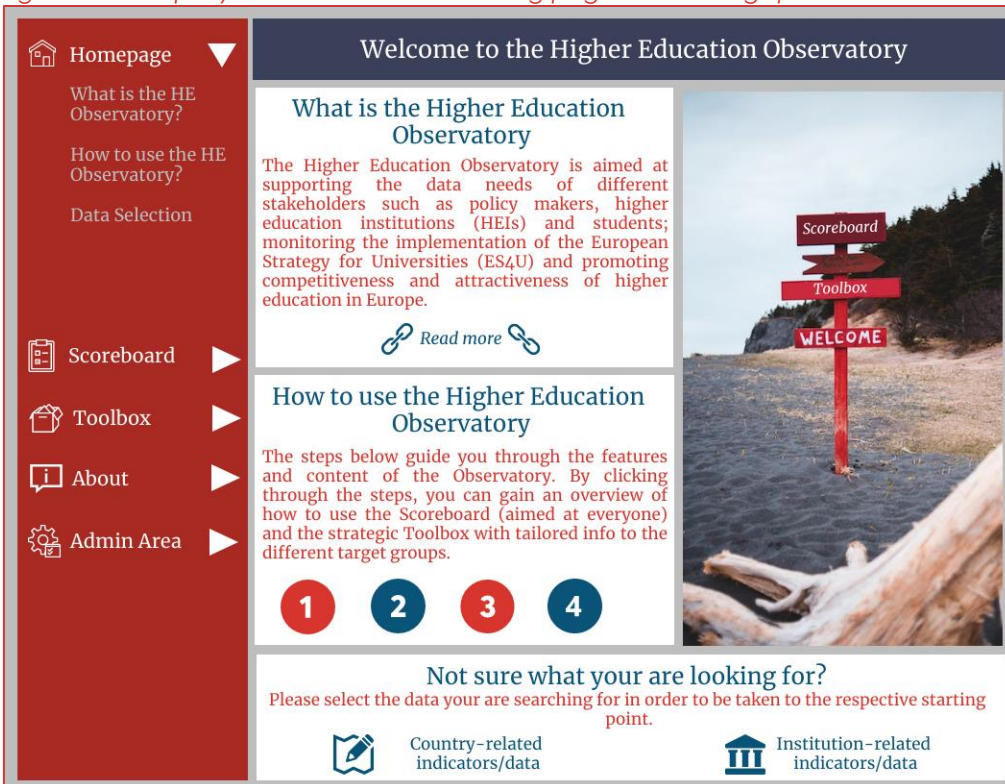
Source: Technopolis Group

3.3.2.1 Scoreboard

The study team proposes to split the Scoreboard according to different **dimensions** which serve as main structuring and visualisation options for the users of the Observatory:

1) Explore **all indicators** (**Error! Reference source not found.**, **Error! Reference source not found.**)

2) Explore **indicators along the Key Objectives of the ES4U** (these policy objectives can be understood as overarching categories that are relevant within the HE sector) (Figure 21)

3) Explore **indicators along higher education themes** that are linked to multiple policy objectives e.g. education-related indicators or personnel-related indicators (Figure 24)

As additional **filtering** options, the users should be able to select the unit of analysis (as available), time period and the geographical coverage of the information they wish to display. The visualisation and selection of data according to geographical criteria would enable the

user to compare across countries (possibly even regions or HE institutions). An engaging method for this is the utilisation of maps in order to visualise geographical choices.

Figure 21 Example of visualisation for a Scoreboard: show selected indicators
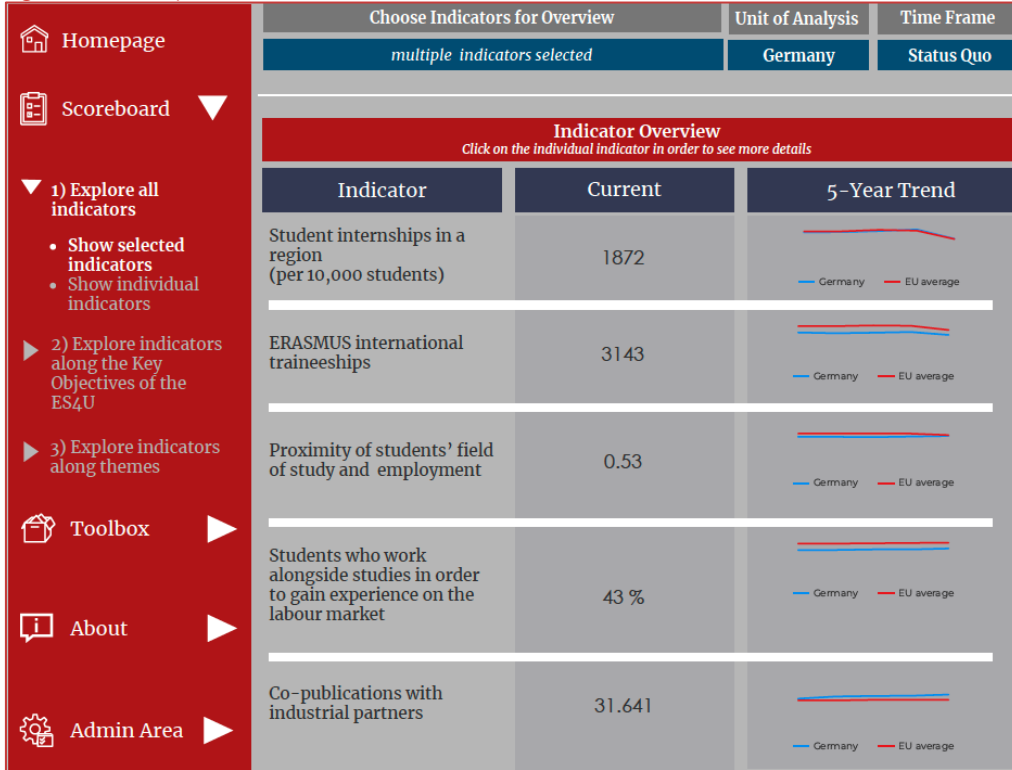
Source: Technopolis' own work

*Figure 22 Example of filtering and displaying one singular indicator | Visualisation over time*
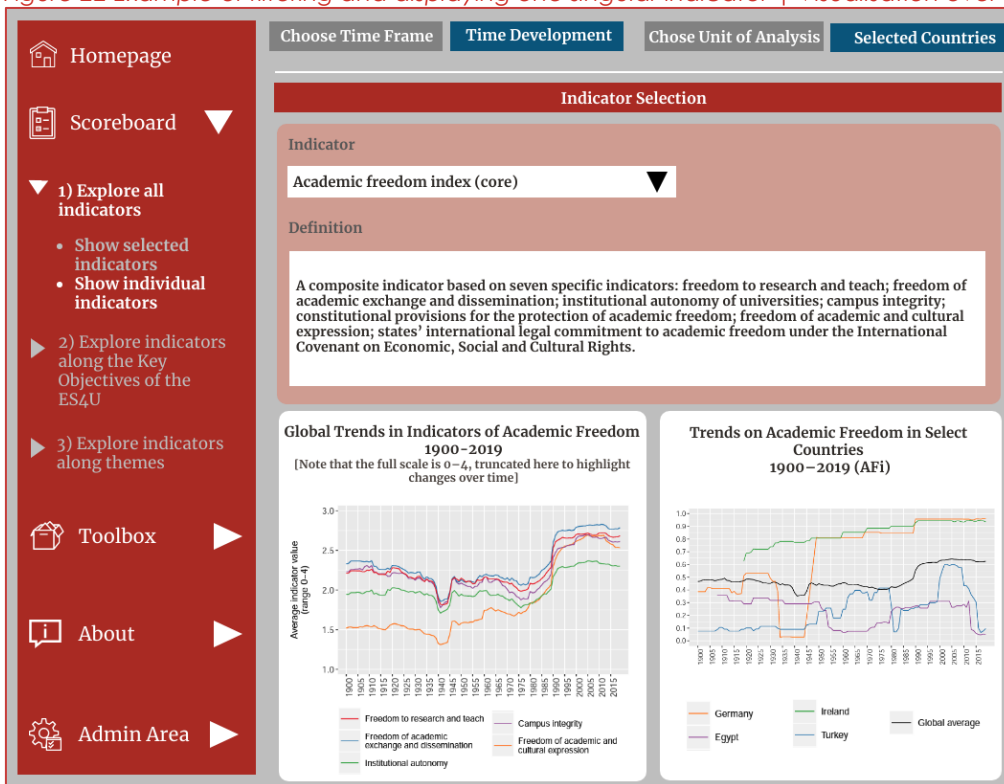
Source: Overall visualisation Technopolis' own work. Data visualisation from AFi project data[5]

While the Observatory is aimed at becoming a useful tool for gaining general/overall information on higher education institutions and the higher education system one of the main subgoals is the measurement of progress of the ES4U. Thus, the **ES4U's key objectives** as well as **higher education themes** should provide the basic structure for the display and selection of data/information. Visualisation of data collected related to HE themes would show how the HE sector, the HE themes, and the key objectives of the ES4U are interconnected and developments depend on each other.

The user would be able to **filter** though the four main objectives or the higher education themes in which they are interested via the scoreboard **legend** on the left. The geographical coverage, unit of analysis as well as the time frame are chosen at the top. Subsequently, a visualisation of the data/indicators related to the individual, specific selection will be displayed including the core indicators related to this objective and theme.

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[5] Spannagel, J., Kinzelbach, K. and Saliba, I., 2020. The academic freedom index and other new indicators relating to academic space: An introduction. V-Dem Working Paper, 26.

Figure 23 Exemplary visualisation of indicators related to Key Objective 1 of the ES4U
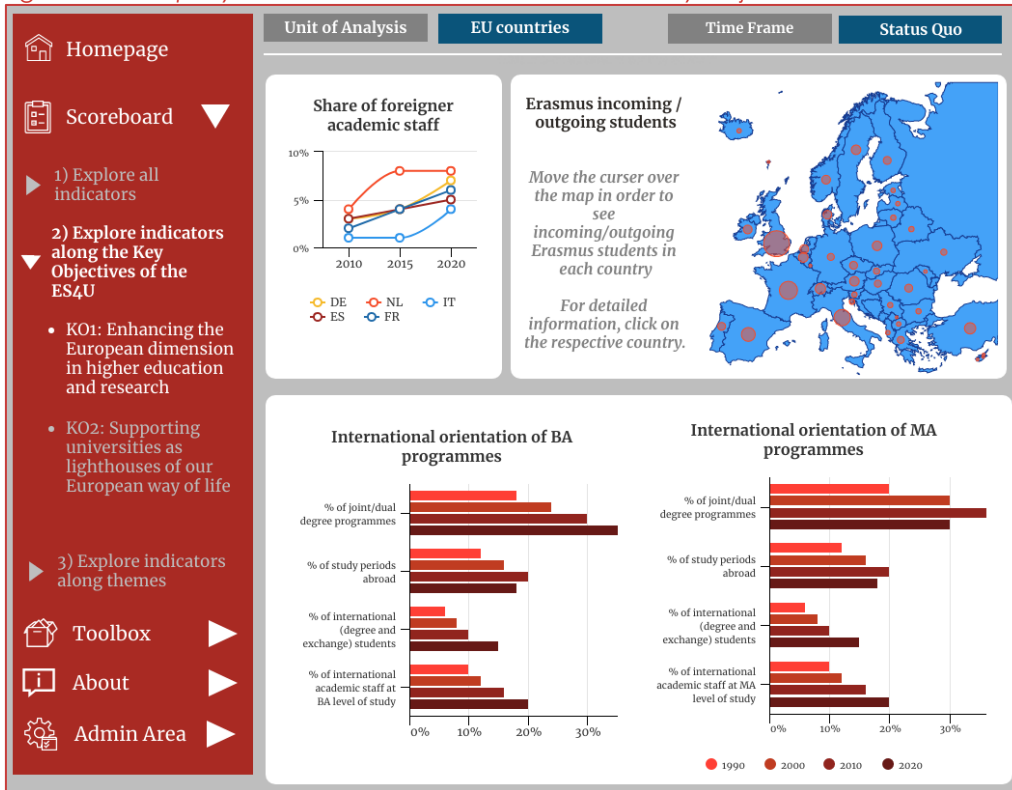
Source: Technopolis Group. Note: The visualised data is exemplary

Figure 24 Exemplary visualisation of a selection of indicators related to HE theme "Teaching"
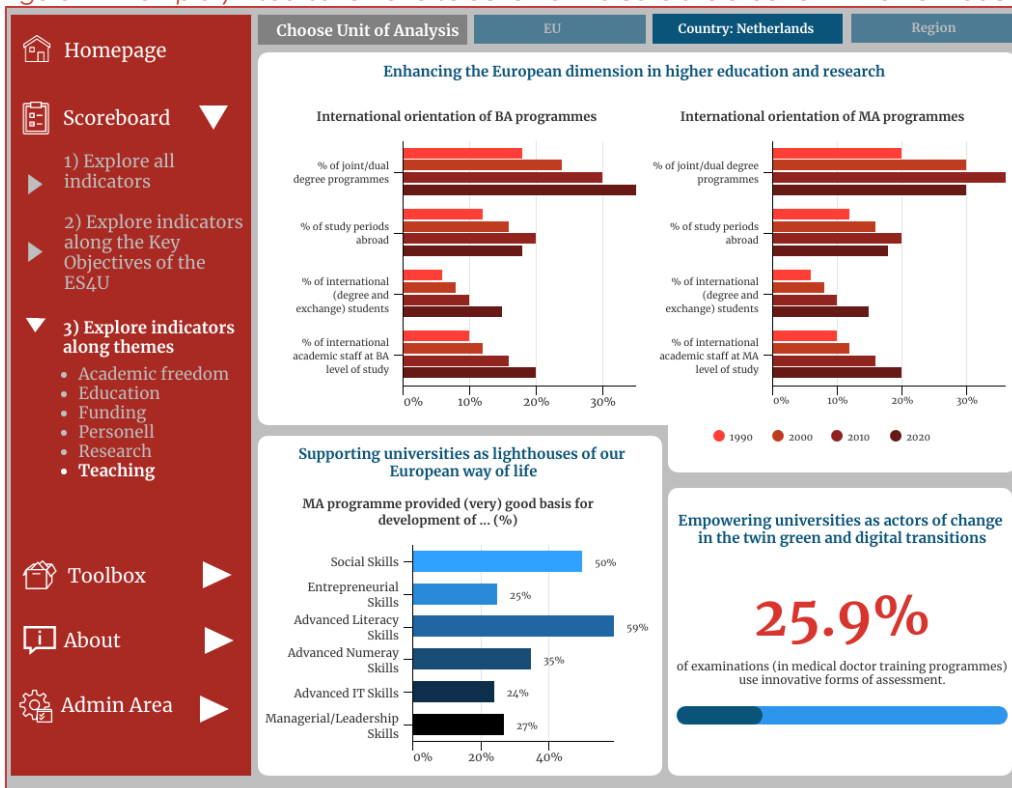
Source: Technopolis Group. Note: The displayed data is exemplary

Study Providing Methodological Support for the European Higher Education Sector Observatory

As outlined in the previous chapters of this report, the potential users of the Observatory have different needs which should be taken into account when considering the **visualisation** of information on the Observatory's future website (see also chapter 3.1) with intervention logics for each user group). Their data needs and expectations towards the functionalities of the Observatory vary as well. In order to reach the Observatory's goal of becoming the "one-stop shop" for i) information on the progress of implementation of the ES4U and ii) providing empirical evidence and support for the HE sector, getting the structure and the functionalities of the Observatory website right is crucial.

Key functionalities of the Observatory/website that have been identified, include:

- **Search** for (specific) data or information - a search tool should allow the user to search for specific terms, data sets and respective sources

- **Downloading** of available data or information - not all data available/displayed through the Observatory might be owned by the EC. It would thus be useful to include as much as possible open access data. Restricted (e.g. accessible upon registration) or no data download (but visualisation) may be necessary on a case-by-case basis

- **Visualisation of the data** – tailorable to the preferences of the users (e.g. filtering to display selected data). The implementation of interactive dashboards allows users to explore and use the data through diverse visualisations that can aggregate different aspects, themes and/or indicators. These dashboards give the opportunity to compare data across several dimensions (see below). Providing various selection options (such as widgets, filtering) allows the users to choose their priorities, which also enhances engagement.

It is a question of the development side, which **widgets** to be chosen. Below, we showcase a few display options prepared recently by Technopolis. It offers a variety of graphical and animated representation forms. Various visualisation options can be pre-defined, but it is also possible that users select their own preferred visual.

Through the definition of concrete/measurable goals, **benchmarks** or benchmark groups the distance to target can be displayed (e.g. via bullet diagrams). Visualising benchmarks with regards to the four policy objectives of the ES4U, would allow the user not only to see the current development of the universities/the sector, but also the distance towards fulfilling the objective. Defining measurable goals for rather general policy objective is a challenge though. Examples for progress visuals (distance to target) can be constructed taking one indicator or a group of indicators. **Error! Reference source not found.** gives an overview of the indicator of the theme "Cooperation with industrial partners". This visualisation could serve as an overview in the first place but include another column in the future visualising target numbers for the individual indicators (possibly also distance to target). In the absence of predefined targets, averages and higher and lower levels of achievements can be visualised.

Another main functionality are **timelines**. In a first step, the Observatory should be able to display the status quo. Yet, for a number of indicators longer time series are already available (see for instance academic freedom index, Figure 38). For those and for envisaged future updates and adding new data - the development of indicators over time should be visualised. This could be configured either that users select their own time series or time series are displayed for them.

Much of the information collected – in particular in the first phase – will be data from various existing databases. Most likely, the different data will be stored in a data cube so that after data manipulation and cleaning, different combinations of analysis and visualisation are enabled.

If the Observatory wants to become a one-stop-shop beyond being a data portal, it is useful to envisage potential specific functionalities. These may only develop in the (near) future and require additional technical developments. An agile architecture may enable the future integration of:

- **Direct information collection**. This could be surveys addressed at HEIs, Member States, or other stakeholders. They would require specific access and logins, potentially a validation and publishing process. The collected information would feed into the underlying database and could be used for new/updated indicators or other complementary information

- A **restricted area.** Specific access rights could be provided to a limited number of persons to access (e.g.) sensitive data or raw data which is not displayed to the public. This could concern for example monitoring data collected from the European University Initiative

- Provision of links to relevant public including (third party) content (e.g., links to other initiatives, public repositories, case studies, reports, other media). This concerns the **Strategic Toolbox element**. This would ask for an exhaustive tagging to complement with relevant information the core Observatory data. If achieved, comprehensive searches on themes/priorities/geographies/target groups etc. could be envisaged.

3.3.2.2   Strategic Transformation Toolbox

As part of the HE Sector Observatory website, the Commission considers the inclusion of an **area dedicated to existing tools and resources** for targeted stakeholders. The workshops also reflected a wider need of stakeholders, which goes beyond data insights. This would be the Strategic Transformation Toolbox.

The ES4U addresses a large number of themes, and the Observatory is foreseen to be used by diverse target audiences. Therefore, it will be important for users of this area of the website to search for tools in a targeted manner, but to not be overwhelmed by filtering options either as this undermines utility of the webpage. It is, therefore, recommended to filter the Toolbox via three channels 1) "Explore tools by themes", 2) "Explore tools by stakeholder groups" and 3) "Explore tools by country coverage". As such, the study team suggests presenting available relevant European tools and resources which can add value for the users of the HE Sector Observatory grouped by themes of interest areas.

Figure 25 provides an example visualisation on how the tool and initiatives of international cooperation in education could be displayed. Figure 26 shows the tools that are identified as being important / relevant to the stakeholder group of students.

Figure 25 Exemplary visualisation of the Strategic Toolbox / Theme: International Cooperation

Source: Visualisation Technopolis' own work

Figure 26 Exemplary visualisation of the Strategic Toolbox / Stakeholder: Students

Source: Visualisation Technopolis' own work

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For additional details on the Toolbox, Figure 27 describes the types of tools and resource that could be foreseen for the Strategic Toolbox on the HE Sector Observatory's website.

The initiatives and tools listed in the table are non-exhaustive, as there are large numbers of activities addressing the themes of the European Strategy for Universities. The study team focused on this exemplary list, including available resources that are owned by or have been supported through the European Commission. For third party initiatives, terms and conditions of use and privacy policy need to be checked for referencing and inclusion to such a Strategic Toolbox.

Figure 27 Overview of tools and resources for Toolbox on Observatory website

Theme	Name of tool	Short description and source	Owner or responsible body	Target group			
				Policy makers	HEIs	Students	Other
Excellence in research and innovation on a global scale	HEInnovate 2.0	HEInnovate is a self-reflection tool for Higher Education Institutions. It aims to help HEIs become more innovative and entrepreneurial. https://www.heinnovate.eu/en	DG EAC, OECD		x		
International mobility of staff International cooperation in education Transnational cooperation in research Promoting global outreach and strengthening partnerships and mobility globally	Erasmus Charter for Higher Education (ECHE)	General quality framework for European and international cooperation activities a higher education institution may carry out within Erasmus+. ECHE is a prerequisite for HEIs looking to engage in student mobility and cooperation for innovation https://erasmus-plus.ec.europa.eu/resources-and-tools/erasmus-charter-for-higher-education	DG EAC	x	x	x	
Transnational cooperation in research International cooperation in education	TEFCE Toolbox	An Institutional Self-Reflection Framework for Community Engagement in Higher Education https://www.tefce.eu/toolbox	Owners: DG EAC Coordinators: Institute for the Development of Education (HR) Technische Universität Dresden (DE))	x	x		
Academic values and freedom of scientific research	ENAI – Academic Integrity	Goal of the network is to promote academic integrity https://www.academicintegrity.eu/wp/	Owners: ENAI network		x	x	
Strengthening the quality and relevance for future-proof skills Cooperation with industrial ecosystems Promoting entrepreneurship Excellence in research and innovation on a global scale	CHARM-EU	A model for co-creation of a European University aligned with the European values and the sustainable development goals (SDGs). CHARM-EU provides toolkits and guiding resources https://www.charm-eu.eu/toolkit	Owners: DG EAC, via Erasmus+		x		x
Excellence in research and innovation on a global scale Strengthening the quality and relevance for future-proof skills	IEP – institutional evaluations	Mission of the Institutional Evaluation Programme (IEP) is to support higher education institutions and systems in developing their strategic leadership and capacity to manage change through a process of voluntary institutional evaluations. https://www.iep-qaa.org/about-iep.html	Owner: IEP		x		

Theme	Name of tool	Short description and source	Owner or responsible body	Target group			
				Policy makers	HEIs	Students	Other
Cooperation with industrial ecosystems Excellence in research and innovation on a global scale Promoting entrepreneurship Strengthening the quality and relevance for future-proof skills	European Open Science Cloud (EOSC) - platform	The ambition of the European Open Science Cloud (EOSC) is to provide European researchers, innovators, companies and citizens with a federated and open multi-disciplinary environment where they can publish, find and reuse data, tools and services for research, innovation and educational purposes. (Source: EC) https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science/european-open-science-cloud-eosc_en	DG RTD	x	x	x	x
Fostering diversity, inclusiveness and gender equality Academic values and freedom of scientific research International cooperation in education Transnational cooperation in research	Open science monitor	EU platform tracking trends for open access, collaborative and transparent research across countries and disciplines. Reports and other resources can be accessed via this website. https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science/open-science-monitor_en	DG RTD	x	x	x	x
Academic values and freedom of scientific research International cooperation in education Transnational cooperation in research	Mutual Learning on Open Science - various resources	This website provides various publications and documents on mutual learning exercises between Member State representatives on open science and its implementation. https://ec.europa.eu/research-and-innovation/en/statistics/policy-support-facility/mle-open-science-altmetrics-and-rewards	DG RTD	x	x		
Strengthening the quality and relevance for future-proof skills Promoting value of teaching and pedagogical innovation Excellence in research and innovation on a global scale	Coalition for Advancing Research Assessment	This coalition is dedicated to more holistic recognition of research outputs, practices and activities to enhance quality and impact of research. The coalition has developed a commitment agreement on reforming research assessment was initiated in January 2022. More than 350 organisations from over 40 countries were involved. Resources and statutes are being developed. https://coara.eu/	Science Europe, EUA, EC		x		
Promoting value of teaching and	(ENERIe) Community on	Research Ethics (RE) and Research Integrity (RI) is a network of researchers and relevant stakeholders to facilitate better communication and collaboration and offer practical resources and tools for researchers' research ethics	European Network of Research Ethics Committees		x	x	

Theme	Name of tool	Short description and source	Owner or responsible body	Target group			
				Policy makers	HEIs	Students	Other
pedagogical innovation Academic values and freedom of scientific research Fostering diversity, inclusiveness and gender equality	research ethics and integrity	committees and research integrity offices. The website includes an RI Handbook, an RE&RI manual and Decision Tree as well as links to the community website. https://eneri.eu/					
Strengthening the quality and relevance for future-proof skills Cooperation with industrial ecosystems Promoting value of teaching and pedagogical innovation Excellence in research and innovation on a global scale	STIP Compass - trends in science	STIP Compass is a joint initiative of the European Commission (EC) and the OECD that aims to collect together in one place qualitative and quantitative data on national trends in science, technology and innovation (STI) policy. The portal supports the continuous monitoring and analysis of countries' STI policies and seeks to become a central platform for policy research and advice supporting government officials, analysts and scholars. Through its various interfaces, you may seamlessly explore and download data to analyse country policies on a wide range of STI policy issues. Data is freely accessible following the FAIR principles (Findable, Accessible, Interoperable, and Re-usable). https://stip.oecd.org/stip/pages/about	OECD and EC	x	x	x	x
Promoting value of teaching and pedagogical innovation	EduHack	EduHack is a capacity-building programme for university educators who wish to learn how to produce digitally-supported learning experiences experimenting with innovative approaches and tools. https://eduhack.eu/	Politecnico di Torino (IT), Universidad Internacional de La Rioja (ES), Coventry University (UK), Knowledge Innovation Centre (MT) and ATiT (BE). Supported by Erasmus+ Programme.		x		
Promoting value of teaching and pedagogical innovation Strengthening the quality and relevance for future-proof skills Fostering diversity, inclusiveness and gender equality Promoting entrepreneurship	Open Mind	The Open Mind project aims to promote social entrepreneurship among female learners and students without a business studies background through an innovative, gamified open online course. http://open-mind-project.eu/				x	x
Transnational cooperation in research	Scientifix	Scientix is the number one community for science education in Europe. It aims to promote and support a Europe-wide collaboration among STEM teachers, education researchers, policy makers and other educational stakeholders to		x	x		

Theme	Name of tool	Short description and source	Owner or responsible body	Target group			
				Policy makers	HEIs	Students	Other
International cooperation in education Promoting value of teaching and pedagogical innovation		inspire students to pursue careers in the STEM fields. The community exchanges learning and provides resources to its members. http://www.scientix.eu/about					
Academic values and freedom of scientific research Strengthening the quality and relevance for future-proof skills Promoting value of teaching and pedagogical innovation Equipping young people and lifelong learners with digital skills - digital literacy	EDEN - European Distance and e-Learning Network	EDEN is the smart network for the professional community and a professional community for smart learning. The European Distance and E-Learning Network exists to share knowledge and improve understanding amongst professionals in distance and e-learning and to promote policy and practice across the whole of Europe and beyond. The organisation has more than 180 institutional members and over 1100 members in the Network of Academics and Professionals (NAP) https://www.eden-online.org/	Owners: EDEN non-profit Coordination: Budapest University of Technology and Economics (HU)		x		
Academic values and freedom of scientific research Strengthening the quality and relevance for future-proof skills Promoting value of teaching and pedagogical innovation	EADTU - European Association of Distance Teaching Universities	The European Association of Distance Teaching Universities (EADTU) is the leading institutional university network for online, open and distance higher education. EADTU, as a representative of many leading higher education institutions in online education took the initiative to bundle examples and resource banks of members and related stakeholders to support organisations in offering online teaching. The network offers a variety of tools and resources for distance learning via the EMPOWER project (supported by Erasmus+) https://eadtu.eu/index.php/about	DG EAC, Supported by the Erasmus+ programme	x	x		x
Academic values and freedom of scientific research Strengthening the quality and relevance for future-proof skills Equipping young people and lifelong learners with digital skills - digital literacy	EPALE - European Platform for Adult Learning	EPALE aims at supporting and strengthening the adult learning professions. It enables members to connect with and learn from colleagues across Europe, through its blog posts, forums, the Partner Search tool, complemented with physical gatherings. https://epale.ec.europa.eu/en/why-epale			x	x	
International mobility of students	SALTO - Support, Advanced Learning and Training	SALTO-YOUTH is a network of seven Resource Centres working on European priority areas within the youth field. As part of the European Commission's Training Strategy, SALTO-YOUTH provides non-formal learning resources for			x	x	

Theme	Name of tool	Short description and source	Owner or responsible body	Target group			
				Policy makers	HEIs	Students	Other
Transnational cooperation in research Fostering diversity, inclusiveness and gender equality Strengthening the quality and relevance for future-proof skills Equipping young people and lifelong learners with digital skills - digital literacy	Opportunities - Toolbox	youth workers and youth leaders and organises training and contact-making activities to support organisations and National Agencies (NAs) within the frame of the European Commission's Erasmus+ Youth programme, the European Solidarity Corps, and beyond. SALTO offers a variety of resources including a European training calendar, a toolbox, a partner finding platform and an online community for youth trainers. https://www.salto-youth.net/tools/toolbox/					
International cooperation in education Strengthening the quality and relevance for future-proof skills Academic values and freedom of scientific research	Community of the European Digital Education Hub	Online community of practice for teachers and stakeholders involved with digital education. The community is centred around collaboration, mutual learning and exchange. https://education.ec.europa.eu/news/community-of-practice-stronger-together-in-the-digital-transformation-of-education	European Commission		x		x
Cooperation with industrial ecosystems Strengthening the quality and relevance for future-proof skills Equipping young people and lifelong learners with digital skills - digital literacy	Social Entrepreneurship Toolkit: theory tools training	A resource for youth workers, teachers, communities that would like to go up the ladder and get more information about establishing social enterprises. With new approach: match of "social entrepreneurship" and principles of "open social innovation" https://www.salto-youth.net/tools/toolbox/tool/social-entrepreneurship-toolkit-theory-tools-training.3379/	Inn@SE, supported by Erasmus+ Programme		x	x	x
Strengthening the quality and relevance for future-proof skills Equipping young people and lifelong learners with skills for the green transition - climate, environmental literacy Equipping young people and lifelong learners with digital skills - digital literacy	EU STEM Coalition	Together with policy makers, education providers and industry, we work on promoting new ways of delivering education and finding and sharing evidence-based solutions to skills mismatch in STEM. From reducing shortages of STEM skilled people to fostering new ways in which educational institutions, companies and governments can cooperate, we provide a unique forum and knowledge hub for data and analysis, best-practice sharing and direct support. The coalition offers data insights, policy briefs and tools being implemented by specific members https://www.stemcoalition.eu/about	Coordinated by Dutch national STEM platform (PTvT), supported by the Erasmus+ programme.		x	x	x

Theme	Name of tool	Short description and source	Owner or responsible body	Target group			
				Policy makers	HEIs	Students	Other
Transnational cooperation in research	COST - European Cooperation in Science and Technology	The European Cooperation in Science and Technology (COST) is a funding organisation for the creation of research networks, called COST Actions. These networks offer an open space for collaboration among scientists across Europe (and beyond) and thereby give impetus to research advancements and innovation. COST is bottom up, this means that researchers can create a network – based on their own research interests and ideas – by submitting a proposal to the COST Open Call. https://www.cost.eu/about/about-cost/	Supported by the European Union	x	x	x	
Cooperation with industrial ecosystems Promoting entrepreneurship Promoting global outreach and strengthening partnerships and mobility globally Strengthening of HE system in (non-EU) partner countries in line with EU values Excellence in research and innovation on a global scale	PhD Hub	The PhD Hub centralises research collaboration opportunities in Europe. By connecting researchers, enterprises and society at large, the PhD Hub promotes intersectoral, interdisciplinary or international collaboration and fosters innovation. If you are interested in finding or offering collaboration opportunities in your discipline(s), start by creating an account, browse existing opportunities, and create new collaboration opportunities on the platform. The platform is maintained and promoted by the European University Foundation and is free of charge. https://phdhub.eu/about/	Series of partners, originally supported by Erasmus+ Programme		x	x	
Transnational cooperation in research International cooperation in education Promoting global outreach and strengthening partnerships and mobility globally Strengthening of HE system in (non-EU) partner countries in line with EU values	COFUND (Marie Skłodowska-Curie Action)	The COFUND action provides funding for regional, national and international programmes for training and career development, through co-funding mechanisms. It spreads the MSCA's best practices by promoting high standards and excellent working conditions. COFUND promotes sustainable training and international, interdisciplinary and inter-sectoral mobility. https://marie-sklodowska-curie-actions.ec.europa.eu/actions/cofund	European Commission	x	x	x	x
International cooperation in education	U-Multirank	U-Multirank is a multidimensional, user-driven approach to international ranking of higher education institutions. It compares the performances of higher education institutions – in short: universities – in the five dimensions of university activity: (1) teaching and learning, (2) research, (3) knowledge transfer, (4) international orientation and (5) regional engagement. The U-Multirank web	European Commission's Erasmus+ programme, Bertelsmann Stiftung, Santander Group	x	x	x	x

Theme	Name of tool	Short description and source	Owner or responsible body	Target group			
				Policy makers	HEIs	Students	Other
		tool enables comparisons at the level of the university as a whole and at the level of specific study programmes. https://www.umultirank.org/					
Fostering diversity, inclusiveness and gender equality International mobility of students	European Tertiary Education Register (ETER)	The European Tertiary Education Register (ETER) is a European-level database providing a reference list of Higher Education Institutions (HEIs) in Europe and data at the institutional level on HEIs' activities and outputs, such as students, graduates, personnel and finances, complementary to educational statistics at the country and regional level provided by EUROSTAT . https://www.eter-project.com/project-description/	European Commission	x	x	x	x
International mobility of students International cooperation in education Transnational cooperation in research	Erasmus +	Erasmus+ is the EU's programme to support education, training, youth and sport in Europe. Erasmus+ offers mobility and cooperation opportunities in higher education, vocation education and training, school education, adult education, youth and sport. The website of Erasmus+ contains information on how to take part in the programme, useful resources and tools for mobility and learning.	European Commission	x	x	x	x
Academic values and freedom of scientific research	European University Association's Autonomy Scorecard	The 2023 edition of the Scorecard contains an analysis of university autonomy across the different European higher education systems. https://eua.eu/resources/publications/1061:university-autonomy-in-europe-iv-the-scorecard-2023.html	European University Association	x	x	x	x
Excellence in research and innovation on a global scale	Data Europa EU	Data Europa EU provides access to 1.4 million public datasets from 36 countries (EU, EEA, Switzerland and EU Neighbourhood states). Data resources are indexed by the European Commission from national, regional, local and domain-specific public data providers. The interface is available in six languages. The Data Europa EU Academy supports data discovery, elaboration and preservation. https://data.europa.eu/en	European Commission		x	x	x
International mobility of students	Compass	"COMPASS - orientating you towards your best international mobility choice" aims to offer high quality and inclusive support toward outgoing students, everywhere in Europe. The Compass project is structured around an online platform implementing an automated matching system, completed by easier access to quality information and stronger collaborations between students, associations and Higher Education Institutions. https://compass-youthmobility.eu/	European Commission				x
International mobility of students	Erasmus Generation Portal	The portal is developed by the Erasmus Student Network (ESN) and aims to be the place where anyone wishing to study abroad can easily access all relevant information. It is made by students, for students. The portal includes a grant simulator, testimonials of students, details on mobility programmes. https://erasmusgeneration.org/	European Commission, Erasmus Student Network				x

Source: Visualisation Technopolis' own work, blue highlighted cells show the tools included in the exemplary visualisation in Figure 25 and Figure 26

3.4 Communication strategy

This chapter describes the communication strategy that was devised for the Observatory. The communication strategy is a living document and will need to be updated and adjusted in line with the developments regarding the Observatory.

3.4.1 Objectives and target groups of the communication strategy

The current communication strategy aims to support the European Commission in promoting and raising awareness of the Observatory. There are three main components for a successful communication strategy of the HE Observatory:

- A **consultation component**: this component involves consulting with key stakeholder groups and using their insights in the design and implementation of the Observatory. Engagement in consultation activities will ensure their support in further development and promotion of the Observatory

- An **engagement component**: maintaining interaction with the key stakeholder representatives and data providers once the Observatory is launched is essential for effective updating/upgrading in line with the current and future user needs, for building synergies and for attracting new users/data providers to the Observatory. As such, delineating an engagement approach for maintaining relationships with these key stakeholder representatives and data providers requires special focus

- A wider **promotion component**: generating awareness of the HE Sector Observatory amongst **new stakeholder representatives and users** is essential for ensuring utilisation of the Observatory and its wide promotion

In view of the above-listed components, Figure 28 presents two objectives and suggests actions connected to their achievement. These actions are discussed in more detail in the following sections.

Figure 28 Objectives and actions of the communication strategy

Communication objective	Actions to achieve communication objective
Maintain communication and engagement with the key stakeholders/intermediaries	• Set-up a support group that consists of key user representative organisations/intermediaries (e.g., HEIs and student associations) to reach the end-users (e.g. policy makers, researchers, HEI institutions) and to support continuous co-creation of the Observatory responsive to needs of the stakeholders • Launch a periodic newsletter to inform the support group and its stakeholders about key developments associated with the Observatory • Organise an annual conference/consultation on the development of the Observatory together with the support group and other stakeholders
Promote the use of the Observatory and attract new users and stakeholders	• Widely promote the Observatory via communication channels that have a significant reach (e.g., European Commission social media channels, communication channels of intermediary/user organisations, large relevant events) • Launch a social media / news channel (Twitter) of the Observatory to publish news related to the Observatory and its stakeholders • Stimulate use of the Observatory by organising workshops/webinars, launching citizen science projects, participating in a public campaign that involves the HE sector stakeholders

Source: Technopolis Group

In terms of the **target groups**, the communication strategy will focus on stakeholders/intermediaries that represent the intended user groups, users and data providers:

- Networks and associations of HEIs, HEIs
- Policy makers at regional and national levels
- Policy makers at EU and international levels
- Student representatives and associations
- Data providers
- Other innovation actors related to the higher education sector

3.4.2   Setting-up the support group of key stakeholders

The Observatory is an EU level initiative and as such to reach relevant target groups, making use of the key stakeholder representative organisations, as they act as **intermediary/multiplier organisations for collecting, sharing feedback of users, supporting the design of the Observatory and promoting** it is essential**.** Involvement of key stakeholders in the current study (through interviews and workshops) highlighted the importance of maintained consultations with them for informing the design and implementation of the Observatory, therefore further collaboration between them, the European Commission and the Observatory should be fostered.

Such a group would ideally grow into a community of practice that contributes to the co-creation of the Observatory, building and maintaining relationships to discover key common challenges, to collect data and collaborate, to agree on harmonisation of topics and components of the Observatory. Thus, the Observatory would have an additional added value by stimulating collaboration in the HE sector.

The support group should consist of representatives of all user groups and selected data providers to reflect interests and needs of all users and to be aware of data-related challenges and new data sources. In addition, the composition of the support group should account for geographic, thematic and gender balance. Overall, the **size** of the support group **should be kept** small to ensure effective and efficient operations. In addition to inviting selected stakeholders who participated in interviews and workshops during the project period, the stakeholder mapping included in this report offers further suggestions.

After launch of the support group, its members should decide on the type of activities they will perform for the Observatory, how and how often they will meet. We assume that the support group will also be instrumental for **attracting a wider public to the Observatory and promote its use**. In practice, each member of the group will involve and leverage the network of contacts using own communication/dissemination channels. This network will also be sharing news with their stakeholders/users, and this will multiply the outreach and draw attention of new potential users to the Observatory.

3.4.3   Wider promotion of the Observatory via communication channels with significant reach

Given a lack of stakeholder awareness about the aims, objectives and vision of the Observatory, it is essential to promote it through the existing expert networks of the European Commission as well as the support group members (if created) and other organisations related to the HE sector that have a significant outreach. These include predominantly **EU-level institutions**, such as DG EAC, DG RTD, JRC, ERC, Working Groups on Higher Education, European Parliament, European Council, Eurofound, Cedefop, and the **EU-wide relevant initiatives/projects** that focus on European Universities, students and student mobility,

innovation in education, inclusive and quality higher education for example. Involvement of the EU-level institutions and initiatives is expected to reach the EU Member State stakeholders at all levels (i.e., national, regional, local).

3.4.4 Launch communication channels of the Observatory

In addition to capitalising on existing communication channels of key stakeholders that have a wide outreach, the Observatory should develop its **own communication/dissemination channels** to reduce dependency in sharing information and in promoting itself.

We suggest the Observatory to develop the following channels:

- The HE Sector Observatory website
- E-mailing database that includes the support group members and other relevant stakeholders
- Newsletters for the subscribers (possibility to opt in and receive news of updates for example),
- Social media channel – Twitter – linked to and tapping into existing social media channels of the European Commission

HE Sector Observatory website

The HE Sector Observatory will take the form of a website within the overarching europa.eu website. The website should have a pragmatic, user-friendly structure and will contain data relevant to the needs of HEIs and policy makers and other stakeholders (e.g. international associations and representative bodies). The website itself will form a channel of communication, where users can have access to relevant information and potentially could sign up for updates on new data additions, new or updates or reports etc.

E-mailing database

To maintain engagement with the key stakeholders their email addresses upon given consent should be collected and safely stored (in line with GDPR). The stakeholder mapping conducted during this methodological study could be a useful source. E-mails allow for more personal, targeted communication with interested stakeholders. E-mails should be used to inform stakeholders about new key developments of the Observatory, to ask for assistance/collaboration, or to invite to participate in networking events/workshops hosted by the Observatory. It is suggested to contact the support group and other stakeholders via email no more than twice a month.

Newsletters

The study team also proposes using periodic newsletters (3-4 times a year) to promote and communicate about the status and development of the HE Sector Observatory. In general, newsletters allow maintaining a continuous communication with their audience at a defined or agreed frequency. They also support the expansion of the network of stakeholders. Users have to opt in actively to become subscribers.

In terms of the content, each newsletter should include short user-friendly summaries that highlight key developments and news regarding the HE Sector Observatory. In the initial phase of the newsletter, it is likely to be devoted to raising awareness about its progress in terms of the set-up, support group members, and key developments in the HE sector in general. As the Observatory matures, the newsletter could include more news related to key updates in the HE sector, spotlight on selected indicators, new indicators or functionalities of the Observatory, and developments related to activities of the support group members.

The members of the support group could be asked to commit to share the newsletter. To encourage this, each newsletter could include news related to the activities of the support group members. As a result, the support group members will have a direct interest to share the Observatory's newsletter.

Twitter

Social media channels reach vast audiences at a time and are integral to modern communication strategies. Among the social media channels, creating / tapping into an existing European Commission Twitter account is deemed highly useful. Twitter is used by all types of the Observatory's user groups and it is an effective tool for dissemination of information to a wide audience. Twitter allows to post succinct messages in near real-time and tag other organisations in them. By tagging a specific organisation all Twitter followers of that organisation will see the message posted by the Observatory. Hence, this will stimulate a wider dissemination and outreach. In addition, Twitter allows to follow news/updates of its key stakeholders. In addition, it allows to re-share posts of other organisations. Re-sharing proves to be an effective method of drawing attention of new/potential users.

In view of the above, it is suggested to develop a database of Twitter handles of the support group members, to follow them and tag them in relevant posts. In addition, the Observatory should identify Twitter accounts of other relevant stakeholders to be both informed and to use their audiences for drawing attention to the Observatory.

The Twitter account will be used for the announcement of updates concerning the Observatory, information and links to visualisations and other data reports, the announcement and promotion of conferences, events, seminars which are relevant to the HE Sector Observatory. To keep the Twitter account active, it is suggested to post messages at least twice a week.

Annual conference devoted to the development of the HE Observatory

To keep the wider audience informed about the HE Sector Observatory's development and to consult with them, it is suggested to organise / link to planned annual conferences that are devoted to the **discussion of key updates, challenges, needs of users and data providers, HE trends and policy debates**. The conference will also mark achievement of specific milestones and represent a point for a broad discussion of the HE sector, and the contribution of the HE Observatory to it. In addition, such regular conference will support networking, collaboration among different stakeholders in the HE sector.

3.4.5   Activities to stimulate the use of the Observatory

Stimulation of the Observatory's use and engagement with the direct users might be challenging and resource intensive. As such, we suggest relying on the support group and other user representatives/stakeholders in attracting further users. Some activities could be performed to reach the users directly such as the **organisation of workshops/webinars** that share useful information. In addition, the Observatory could promote or take part in some **public campaigns** that involve HE sector stakeholders. The decision on the selection and organisation of specific activities should be made together with the support group, as they could suggest specific topics, activities that are most demanded by the different groups of users.

3.4.6   Monitoring approach

Monitoring and tracking the effectiveness of different communication activities is an important element of a communication strategy. Learning about which activities are effective and which

are not can help the Observatory to adjust and better tailor the communication efforts. As such, monitoring and evaluation of the communication activities should be carried out at least once a year, website and social media monitoring can be envisaged by the internal tool available to the EC services (Matomo and Talkwalker). The table below presents a monitoring framework for the different engagement and wider communication activities for this communication strategy. KPIs have been defined for the main communication activities below in Figure 29.

Figure 29 Monitoring framework communication activities

Communication activity	KPIs on Outputs	KPIs on Results	KPIs on Impacts
Support group	- Diversity/range of members in the support group - Growth rate of the support group members	- Number and type of activities conducted by the support group - Quality of support provided in HE Observatory-related activities - Level of engagement in relevant activities (in time) - Overall usefulness of the support group - Overall willingness of the support group to continue supporting the HE Observatory	- Percentage of support group members providing a larger contribution to the HE Observatory - Percentage of support group members expressing a stronger commitment to the European Strategy for Universities - Percentage of support group members taking action as a result of HE Observatory-related activities
Website	- Number of registered users - Number of website visits - Users' geographical distribution - Number of views per topic/webpage - Time spent on webpage - Bounce rate	- Number of actions (i.e. downloads of newsletter, reports, clicks on links etc.) - Overall usefulness of the website or of its components - Source of traffic - Scroll behaviour	- Percentage of online visitors having a more positive opinion of the HE Observatory and of published information - Percentage of online visitors that took action (e.g., approached the support group or a local stakeholder) as a result of a website visit - Percentage of visitors that share a positive view of the website publicly - Percentage of visitors having a better opinion about the EU and national strategies/policies in the area of higher education
E-mail database	- Number and type of stakeholders recorded in the database (incl. their geographical distribution) - Growth rate of the e-mail database - Percentage of contacts that express willingness to be included in the e-mail	- Overall usefulness of the e-mail database (for events, activities related to HE Observatory etc) - Quality of the database in terms of relevance of the stakeholders - Quality of the database in terms of updated information	- Percentage of contacts that are actively engaged with the HE Observatory and its stakeholders once they are listed in the e-mail database - Percentage of contacts that share positive feedback about being

Communication activity	KPIs on Outputs	KPIs on Results	KPIs on Impacts
	database from a total number of invites		included in the e-mail database
Newsletters	• Number of newsletters shared per year • Number of posts/articles/items in newsletters • Diversity/range of topics in newsletter • Number of newsletter subscribers and their growth rate	• Number of views of the newsletters • Number of downloads • Overall usefulness of the newsletters • Quality of the newsletters • References/mentions of the newsletters • Percentage/number of shares of newsletters	• Percentage of readers that have a more positive opinion of the HE Observatory and of related topics • Percentage of readers that took action following reading the newsletters
Social media	• Number of posts • Number of followers and their growth rate • Number of organisations that are followed by the Observatory • Type of posts that have highest engagement • Number of video views on social media channels • Number of hashtags or mentions of the HE Observatory	• Number of impressions and engagements (Likes, Comments, Shares and Link Clicks) • Engagement rate • Tone of comments (positive or negative) • Traffic to the website from social media channels	• Percentage of audience having a more positive opinion of the HE Observatory or of related posts/topics published on social media • Percentage of audience that took action following visits of social media channel related to the Observatory • Percentage of audience having a stronger commitment to the European Strategy for Universities
Annual conference and other events	• Number of participants (physical and online) or number of contacts • Number of support group members supporting organisation/content • Number of internal and external news and social media posts about the event • Cost per attendee • Share of attendees to the number of sent invitations	• Quality of the programme (measured by satisfaction and output of participants) • Usefulness of the event for attendees/stakeholders • Percentage of attendees and media that share positive feedback to the organisers or on (social) media • Number of engagements/questions (in a chat, poll, Q&A sessions etc) during events	• Percentage of attendees expressing a stronger support and willingness to contribute to the HE Observatory • Percentage of attendees expressing stronger commitment to the European Strategy for Universities • Percentage of attendees that took action following the event

Source: Technopolis Group

3.5 Roadmap and timeline of implementation for the Observatory

This final chapter describes the roadmap and the timeline for the development of the Observatory. Both of these should be understood as living documents and, thus, should be reviewed and amened as needed. This will ensure responsivity to changes in the external circumstances as well as to the evolving understanding of the Observatory and its context.

3.5.1   Roadmap for the Observatory and timeline for implementation

This final chapter describes the roadmap of the Observatory which provides a high-level overview of the main steps needed to implement and maintain the HE Sector Observatory. It also assigns roles and responsibilities to different stakeholders. A high-level visualisation is provided (see Figure 30), followed by a detailed overview of the different steps. The steps are accompanied by a timeline to provide the Commission services with an overview of the estimated timetable including immediate and future actions as well as activities which should take place after 2024 to fulfil the long-term vision of the Observatory.

The roadmap and attached timeline entail four main phases and a number of steps within:

1) **Preparation** – focuses on the immediate steps and lays the foundation for the development of the Observatory by establishing the aims and objectives, content, structure and overseeing and implementing mechanisms of the Observatory

2) **Development** – focuses on the technical and content development of the Observatory, including a pilot testing phase as well as continued stakeholder engagement. The development phase culminates in the launch of the Observatory

3) **Implementation** – is the phase after the launch of the Observatory and entails five steps focusing on the efficient and effective running of the Observatory (implementation and maintenance), including its monitoring/ stakeholder engagement and communication activities

4) **Review and further development** – to ensure the continuing relevance of the Observatory to its users over time, its content needs to be maintained, its running and management need to be reviewed at regular intervals. Such review ensures that feedback is built into the revisions and updates of the Observatory

Figure 30 Roadmap of the Observatory
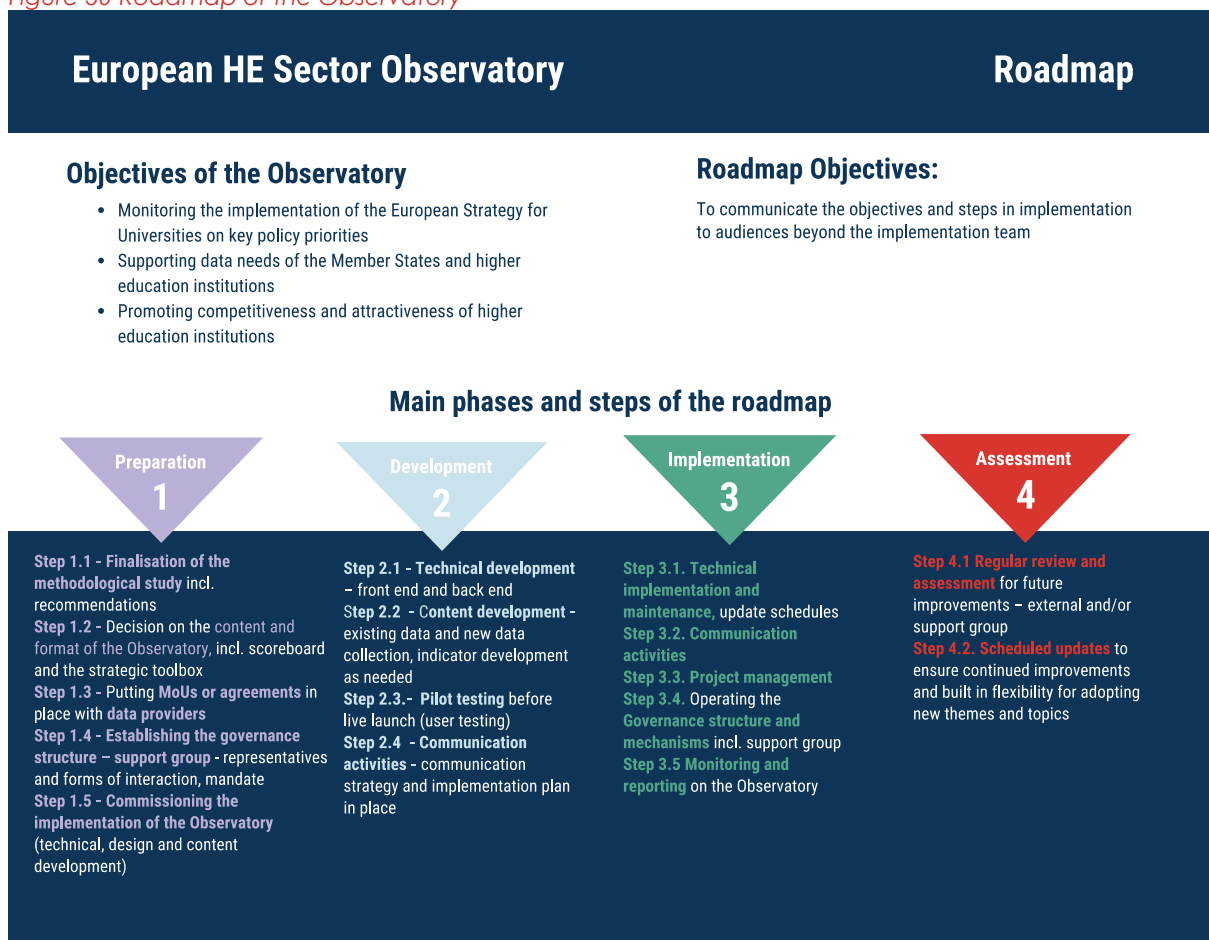
Source: Technopolis Group

The implementation of this roadmap relies on several different types of stakeholders, who have distinct roles and responsibilities regarding the Observatory. The following table provides a summary overview together with a timeline.

Figure 31 Timeline, roles, and responsibilities for the development of the Observatory

Steps	Responsible	Involved	Timeline	Comments
Step 1.1 - **Finalisation of the methodological study** incl. recommendations	Technopolis Group (contractor)	European Commission – approver of the study	Final report to be submitted early April 2023	The study team will provide implementation support until June 2023
Step 1.2 - **Decision on the content and format of the Observatory, incl. scoreboard and the strategic toolbox**	European Commission	n/a	Asap upon receiving this draft final report and discussing it with the study's Steering Group	
Step 1.3 - **Putting** MoUs or agreements **in place with** data providers	European Commission	Data providers with indicators selected for inclusion in the Observatory Owners of the additional initiatives	Upon decision made on Step 1.2, within the next three months	Future sustainability and changes need to be ensured

Steps	Responsible	Involved	Timeline	Comments
		and materials suggested for inclusion to the toolbox.		
Step 1.4 - **Establishing the governance structure** – support group - representatives and forms of interaction, mandate	European Commission	External stakeholders – HE associations and representative bodies, national and international policy makers and other stakeholders (e.g. student associations, data providers, other observatories)	It can start in parallel with step 1.3 within the next 6 months	The study put forward a long list of stakeholders mapped as suggestion
Step 1.5 - **Commissioning the implementation of the Observatory** (technical, design and content development)	European Commission	Either external provider or the EC's in-house development team	Upon decision made on Step 1.2, within the next three months	Time of the public procurement procedure needs to be considered (from TOR to decision). The length of the service contract is crucial as it needs to be able to account for revisions and updates in the first few years of the Observatory
Step 2.1 - **Technical development** – front end and back end	External provider or European Commission	EC provides guidance and approval	Depending on the solution (external / internal provider) chosen this step is estimated to take between 6-9 months to complete. After the pilot testing additional two months might be needed	External providers may have more flexibility than the European Commission, therefore their timeline could be more condensed. Yet, more coordination needed
Step 2.2 - **Content development** - existing data and new data collection, indicator development as needed	European Commission	Relevant indicator working groups, the JRC, data owners and studies commissioned by the EC	Should start asap aligned with already known meeting dates and study milestones, reporting phases	Developing a new indicator with sound methodology and subsequent new data collection can take up to 3 years, therefore the planning for it should start immediately
Step 2.3.- **Pilot testing** before live launch (user testing)	Provider developing the website	European Commission, organisations willing to participate in the testing e.g. members of the support group	Closely linked to step 2.1 as soon as the developments are ready, pilot testing should be carried out – estimated duration is about a month	Selection of the organisations and early engagement with them, further to structured feedback collection are essential to ensure successful testing
Step 2.4 - **Communication activities** - communication strategy and	European Commission	Potentially external communication experts involved in	Continuous – the implementation should start within the next 3 months	There was a communication strategy developed as part of this

Steps	Responsible	Involved	Timeline	Comments
implementation plan in place		the implementation of the strategy	with a major milestone set for the launch of the Observatory	methodological study
Step 3.1. **Technical implementation and maintenance**, update schedules	External provider or European Commission	EC provides guidance and approval	Continuous from after the launch of the Observatory	Update schedules need to be agreed upon during Step 1.5
Step 3.2. **Communication activities**	European Commission	Potentially external communication experts involved in the implementation of the strategy	Continuous, with dedicated events added to the editorial calendar (e.g. workshops, webinars, annual events)	Continuation of step 2.4
Step 3.3. **Project management**	External provider or European Commission	European Commission	Continuous	Running the Observatory on a daily basis, ensuring efficient and smooth operation, addressing Helpdesk enquiries
Step 3.4. **Operating the Governance structure** and mechanisms **incl. support group**	European Commission	European Commission, (as relevant) external provider, data providers and the support group of the Observatory	Continuous	The mandate of the support group should define the means and frequency of communications, meetings (part of step 1.4)
Step 3.5 **Monitoring and reporting** on the Observatory	External provider or European Commission	EC, support group obtain reports	At agreed milestones e.g. every six months	The initial set of KPIs for monitoring and the content of reporting should be agreed on within step 1.5
Step 4.1 Regular review and assessment **for future improvements**	European Commission	Support group, external provider or EC	Annually or linked to the agreed revisions and updates	Ad-hoc updates might be also needed based on user feedback
Step 4.2. **Scheduled updates** to ensure continued improvements and built in flexibility for adopting new themes and topics	External provider or European Commission	European Commission	At pre-agreed intervals	Update schedules need to be agreed upon during Step 1.5 In addition, data content updates will need to be scheduled in line with the availability of new information from the data providers

Appendix A   Methodological guides and Python scripts for the indicator framework

A.1. Methodological guides for retrieving the relevant data from selected data sources

The data sources that were used are:

- ETER
- U-Multirank
- Eurostudent
- V-dem

For all sources, the indicator results from the datasets, the cells containing the value `m` are **missing values** from the data, whereas the cells containing `NaN` or `nan` values are non-numerical values that should be ignored or be considered as zero values.

A.1.1. ETER

This dataset is programmatically downloaded using a free account from the [ETER website](https://www.eter-project.com/data-for-download-and-visualisations/database/).

Data Format and pre-processing:

The ETER dataset is downloaded in CSV format and data cleansing and normalisation was performed based on code information from the [ETER Handbook](https://www.eter-project.com/wp-content/uploads/2022/02/ETERIV_Handbook.pdf).

The dataset is finally converted to a pandas DataFrame for the analysis.

Indicators Implemented:

The indicators implemented for the ETER dataset are the following:

1. Indicator 1: Erasmus incoming / outgoing students (core)

A.1.2. U-Multirank

This dataset was provided via email by the UMutirank team.

Data Format and pre-processing:

The dataset consists of two Excel files (UMR_Data_Download_Institutional_2022.xlsx, UMR_Data_Download_Subjects_2022.xlsx) which contain indicators based on **Institutions** and **Subjects** respectively.

In the **Institutions** file there are six (6) sheets with indicators, one for each year (2017-2022) with different column names each for similar indicators. To solve this issue, a manual mapping of the columns was performed across all six (6) sheets, so that the data can be merged. When a column was not present for a specific year, `NaN` values were added in the cells (which will be converted to `m` values when calculating the indicators).

In the **Subjects** file there is one (1) sheet with indicators, for the years (2020-2022), so no normalisation was required there. We also observed that in the per Subject indicators, each subject is present in a specific year (see `u_multirank.ipynb`).

Each sheet file is converted to a pandas DataFrame for the analysis.

Indicators Implemented:

1. Indicator 1.1: Student Internships in the region (core) : per Subject

2. Indicator 1.2: Student Internships in the region (core) : per HEI

3. Indicator 1.2: Student Internships in the region (core) : per Country

4. Indicator 2: Publications cited in patents (core) : per Subject

5. Indicator 3: Art related output (core) : per HEI (originally this was supposed to be measured per Subject, but this indicator is not present in the **Subjects** file of indicators)

6. Indicator 4: Open Access Publications (core) : per Subject

A.1.3. *Eurostudent*

This dataset is programmatically downloaded from the [Eurostudents website] (https://database.eurostudent.eu/drm/).

It comprised ten (10) topics of indicators. Every indicator in each topic has a specific name (e.g. Topic A : Age profile of students - Age groups) and the following attributes:

- **focusgroup**: The focus group that is being examined (e.g. All students, Age group, Educational Background, Sex, etc)

- **focusgroup item**: The specific item in the focus group that is being examined (e.g. Age Group: <22 years, Sex: female, etc)

- **indicator item**: The specific item in the indicator that is being measured (e.g. Age profile of students - Age groups: <22 years)

- **unit**: The unit of the indicator values (e.g. percentage)

- **country**: The country of the indicator value (e.g. AT, CZ, etc)

Data Format and pre-processing:

Each topic of the dataset is stored in a different Excel file and every indicator is located in a different sheet of that Excel file. The indicators have two (2) versions, one with percentages (%) and one with total numbers (N). In order to programmatically locate and process each indicator from the list located in the `eurostudent.ipynb` file, we have created a function called `load_topic_indicator()`, which automatically reads the correct excel and sheet number for the indicator. Then the function pre-processes the Excel sheet, so that it can clean the data and store it as a pandas DataFrame for analysis.

Indicators Implemented:

1. Indicator 1: Students who work alongside studies in order to gain experience on the labour market (core): per Subject (Topic H, indicator 10)

2. Indicator 2: Relationship between students' field of study and their employment (core): per Country (Topic H, indicator 15)

A.1.4. *V-dem*

The V-dem dataset is programmatically downloaded from the [V-dem website](https://v-dem.net/data/the-v-dem-dataset/country-year-v-dem-fullothers/). To get the download link one may enter some optional information (email, gender, etc) and the format the data should be downloaded. However, afterwards one can use the download link without re-entering these fields.

Data Format and pre-processing:

The dataset was downloaded as a zip file, which when extracted contains a CSV file with the V-dem data, as well as some PDF files with valuable information (especially the **V-dem codebook**). In order to find the required indicator variable inside the V-dem dataset, one must search the variable in the **V-dem codebook** (e.g. Academic freedom index (core): v2xca_academ).

Indicators Implemented:

1. Academic freedom index (core): per Country

A.1.5. Creating the database

All findings from the above calculated indicators were consolidated into a single Excel file, with the name `indicators_db_w_info.xlsx`.

The Excel file contains two sheets. In the first sheet are the indicator findings from all of the above data sources, along with additional information for each indicator (e.g. internal reference number, OrgReg ID, value format). The second sheet contains the definitions for the interpretation of the indicator values.

The structure of the Excel file is as follows:

- Sheet 1 contains:
    - **<u>source</u>**: The data source of the indicator
    - **<u>local indicator id**</u>: The local/internal indicator id (e.g. EHESO_13)
    - **<u>indicator name**</u>: The original indicator name in the data source
    - **<u>levels of indicator**</u>: The levels of the indicator analysis (max 3 levels) (e.g. "country, hei", "subject", etc)
    - **<u>indicator level 1 value**</u>: The value of the first level of indicator analysis
    - **<u>indicator level 2 value**</u>: The value of the second level of indicator analysis
    - **<u>indicator level 3 value**</u>: The value of the third level of indicator analysis
    - **<u>orgreg id**</u>: The OrgReg id of the HEI
    - **<u>year**</u>: The year that the indicator was calculated
    - **<u>time period**</u>: The time period (aggregation of the individual years) that the indicator was calculated
    - **<u>value type**</u>: The type of the indicator value (number, percentage)
    - **<u>value**</u>: The value of the indicator
- Sheet 2 contains:
    - **<u>data source**</u>: The data source of the indicator
    - **<u>local indicator id**</u>: The local/internal indicator id (e.g. EHESO_13)
    - **<u>indicator name**</u>: The original indicator name in the data source
    - **<u>indicator definition**</u>: The definition for the interpretation of the indicator values

Appendix B   Functionalities of existing observatories

B.1. STIP Compass (OECD/EC)

The STIP Compass is a tool for "policy analysis and discovery tool for better decision-making". It is a joint initiative by the OECD and the EC. "The portal supports the continuous monitoring and analysis of countries' STI policies and seeks to become a central platform for policy research and advice supporting government officials, analysts and scholars." Through its various interfaces, users can explore and download data to analyse country policies on a wide range of STI policy issues. Data is freely accessible following the FAIR principles.

The STIP Compass has two main areas: an interactive dashboard and a policy explorer. Furthermore, there is a possibility to download data. Due to the Covid19 pandemic, a new focus was introduced with the Covid-19 Watch. Finally, the 'About' section provides information about the service.
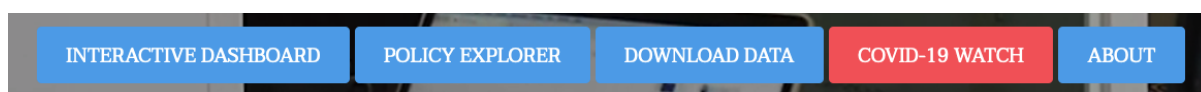
Content basis/data collection

The content – STI policies descriptions of about 50 countries incl. OECD member states and observer countries – is mainly drawn from the bi-annual EC-OECD STI policy survey. The latter is "addressed to national government officials working on STI policies in a range of public administrations, including ministries and agencies."

The OECD has developed templates which are the basis for the descriptions and characterisation of policy initiatives. The templates use taxonomies of policy instruments as well as target groups. The latter are for example the 'research and education organisations', 'researchers, teachers, and students', 'firms by size', or 'social groups'. Themes provide a further way to search for specific aspects such as 'STEM skills' or 'Public research strategies'.

Further content is provided through linking open data sources, in particular to data and to publications (Science Direct and RePEc Econ Papers). The linking is done semantically.

Functionalities

Interactive dashboard - "Interactive dashboards allow you to discover and explore the database through visualisations that aggregate STIP Compass's policy data across its several dimensions". On the landing page, there are interactive widgets, each allowing to either change the layout and/or to drill down further. The widgets are on territories, themes, policy instruments, and target groups.

By selecting under 'Themes' for example the field 'AI', a new page opens and the user obtains information on AI initiatives by country or related themes. The latter, in form of a simple network, shows proximity to other subjects.

Figure 33 Key widgets of the OECD's STIP Compass 'Interactive dashboard'
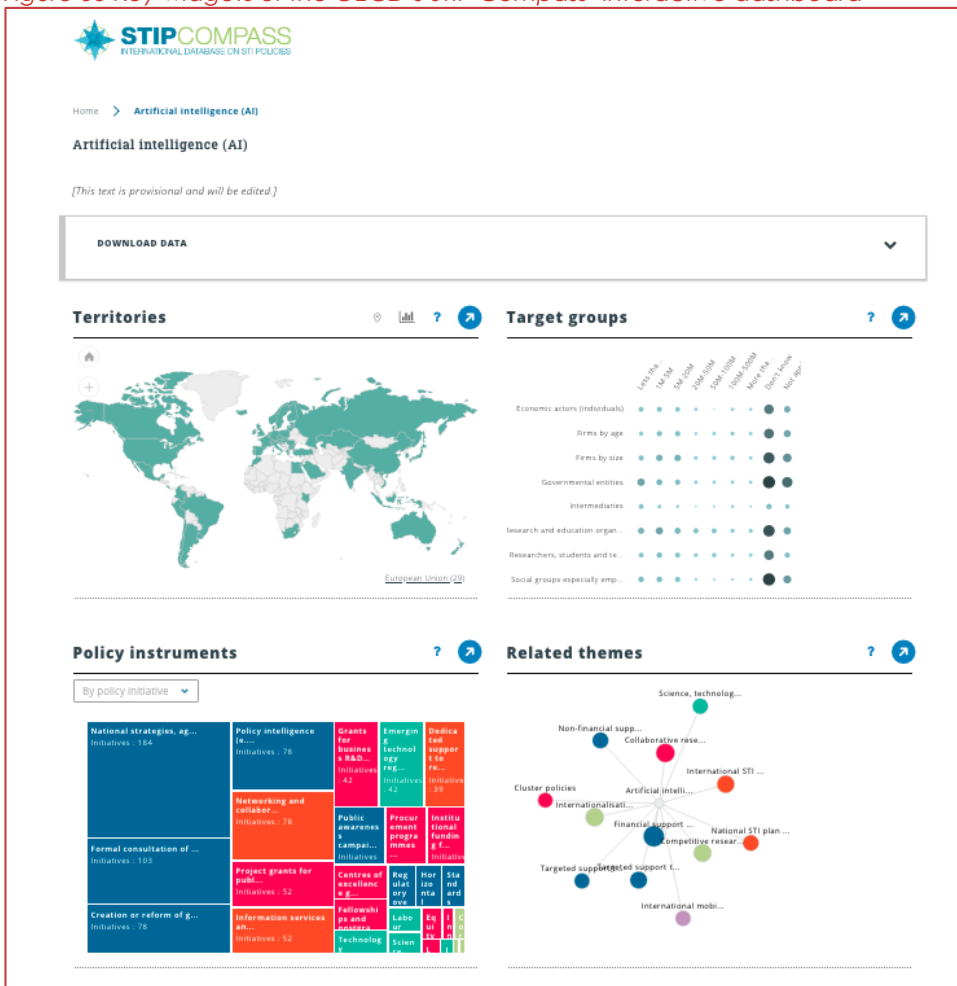
Source: OECD STIP Compass

The policy explorer option lets the user start by selecting whatever keyword the user wishes to use. The example below took 'open science' and the identified documents are displayed.

Figure 34 Outcomes of the search with the 'Policy Explorer' function

Source: OECD STIP Compass

Further developments

With the Covid-19 topic, the website has added a specific focus after it ran for about two years. Scrolling down the homepage, one can discover more dedicated, exploratory areas with a 'Knowledge transfer and co-creation policy explorable guide'; and a ' Mission-oriented innovation policies online toolkit'. In the former, in addition to the main widgets, widgets based on external data are included such as from the European Innovation Scoreboard or identified publications.

Figure 35 Integration of third-party data and information
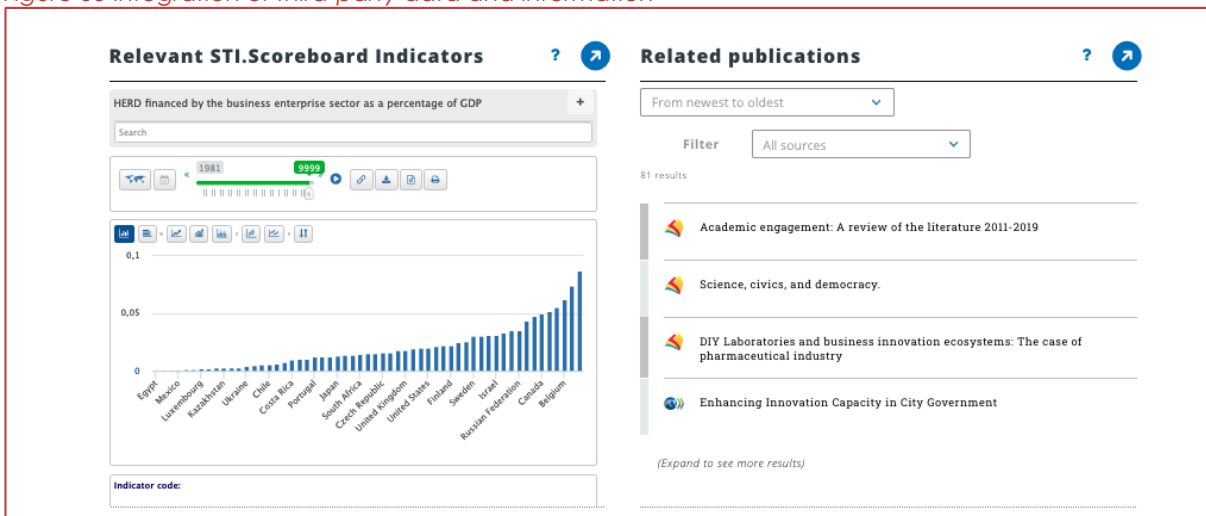
Source: OECD STIP Compass

The STIP Compass is interesting for several aspects:

- Information is collected by public organisations on a bi-annual basis using a common reporting template and guidelines through an online questionnaire tool. However, the level of detail provided on initiatives is rather basic and a large share of them are incomplete

- The collected information can be fully open access and downloadable, see query builder tool

- The website is intuitive, however, when drilling down or selecting, a new window opens and there is no possibility to go back. This is a technical aspect that could be improved in a new development as the Observatory

- Extensive tagging of information allows for impressive agility of the system's content provision. Tagging can be envisaged to be done manually (by those people generating the content), or semi-automatically (through text-mining techniques and automated tags). Tagging can also be linked to the structure of 'themes' (see the following WEF example)

- The taxonomies used are publicly available. The taxonomies and tagging allow for a very agile way of presenting and combining information in different widgets. This allows for the development of user-driven solutions. Potentially, some features are only available to a defined set of (registered) users or user groups

- The OECD STIP Compass is funded partly by the EC (methodological and technical development, management etc.) while OECD members provide the information as an in-kind contribution ('for free'). There tends to be a designated ministry that acts as national information provider (or individual designated organisations under the national representative)

- An advantage of working with a dedicated network of designated/mandated contact points/experts is that there is no further need for a complex quality review process at the management level. Obviously additional quality measures can be envisaged

- Intelligent linking of collected material and open-source data. This model puts less pressure on member states or stakeholder organisations to provide content and could potentially lead to a low commitment of stakeholders. A balanced approach with limited

administrative burden – the OECD survey is done only every two years – may however prevent such a development.

B.2. World Economic Forum's (WEF) Intelligence platform

The World Economic Forum's website has a very broad coverage open to everyone with sections on Agenda – Events– Reports – Platforms. However, it also has a section for which a login is needed, the so-called 'Strategic Intelligence' access point. Many advanced features are available through this section on a paid basis. Within this function, the registered community has access to advanced features such as:

- Receiving customised alerts on emerging trends
- Creating own transformation maps to explore the strategic context most relevant for the individual user
- Exporting dynamic PDF briefings to facilitate presentations and outreach
- Participating in select virtual Forum events

The whole website is structured around 'topics' https://intelligence.weforum.org/topics Besides the WEF's network of experts, these topics are curated by individual universities and international organisations. Additional content is collected through machine analysis of the data provided by content partners (global think tanks, research institutes and publishers). Together, this leads to more than 250 topic areas which bring together a visual of the most relevant content areas, a summary of the topic and publications, videos, data that can be clicked and read.

Figure 36 Topic area, WEF Strategic intelligence

Source: WEF https://intelligence.weforum.org/topics/a1Gb0000000LPFfEAO

Why is the Strategic intelligence feature of interest?

- Defining 'topics' enables to address the various focal points of the political agendas – and equally their interdependencies (through tagging). They can also be linked to a dedicated "Dashboard"

- The governance/management of topics is a shared one: the different topics are curated by a dedicated Member - a role that could be delegated/mandated tor commissioned to HE ecosystem members or service providers. Since it would be a dedicated topic and given interest and knowledge of the curating organisation, the whole system would be based on a distributed allocation of responsibilities, but also visibility and a sense of necessary quality and ownership

- An interesting graphical and structuring feature is the transformation map. There are three levels within, all linked to each other. The first level is the topic. By clicking on any of the 2nd level topics, one obtains a visual including which 3rd level topics are tackled. By clicking, the identified publications (on the right of the page as shown in Figure 36) adapt accordingly. If one then clicks on a 3rd level term, the identified publications change together with the 2nd level key terms. This is a highly intuitive and user-friendly solution. This feature requires an extensive linking of information (through tags)

- New material can be added (tagged) at any time. Thus, the transformation wheels are dynamic and can be used to make the service attractive and relevant, in particular, if questionnaires/surveys to member states or organisations would happen on an annual or bi-annual basis

B.3. Eco-innovation Observatory (EIO)

The Eco-innovation Observatory has started as a grant from DG Environment in 2010 and since it has evolved as a platform providing structured collection and analysis of an extensive range of eco-innovation information from across the European Union and other countries. The Observatory was intended as a monitoring tool for the performance of the EU-MS. Beside a set of indicators (that developed over the years), the EIO regularly produces country profiles. They provide overviews on relevant trends and effects at the national level.

Figure 37 Eco-innovation Observatory
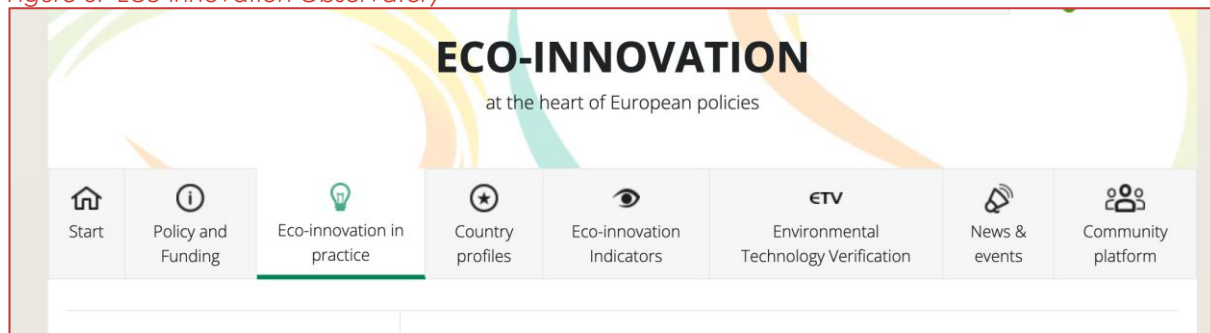
Source: https://ec.europa.eu/environment/ecoap/about-eco-innovation/policies-matters/new-eco-innovation-observatory-monitoring-member-states_en

In addition to producing the country profiles, the Observatory has two key features: the eco-innovation scoreboard and the eco-innovation index. Both are integrated on the Europa server. The scoreboard includes 16 indicators, collected since 2012 therefore allowing for analysing longer term developments.

Figure 38 European Eco-Innovation Scoreboard interactive tool
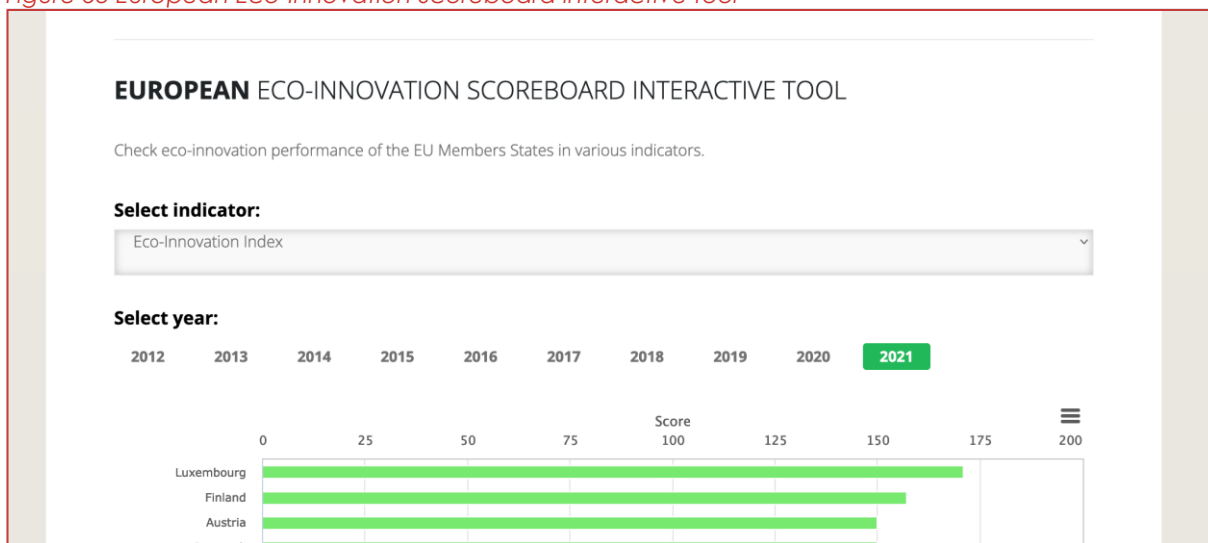
Source: https://ec.europa.eu/environment/ecoap/indicators/index_en

Persuasive tool

The HE Sector Observatory with its multiple objectives, but overall aim to help the transformation of the HE system in Europe, might find in the EIO a useful example. The EIO approaches eco-innovation as an increasingly "persuasive" force present in all economic sectors. It has thus allowed for a broad conceptual understanding of the topic.

Indeed, the EIO has been a major contributor to this conceptual basis which translates into shared understanding of "what eco-innovation is and why and how it should be supported by policy interventions, businesses and consumers". Thus, through a sophisticated monitoring, telling country reports and dedicated thematic reports, the EIO has a 'formative' function.

After the initial grant period, the EOI has been contracted for the web development and content generation.

B.4. ESPON: SDG Tool

ESPON, the European Spatial Planning Observatory Network has included SDG libraries in its Observatory. There are three libraries with Initiatives, Policies, and Tool. With initiatives, a user can select an SDG, a country or a region and search with or without keywords for relevant initiatives. Initiatives are fed from open sources. The least user-friendly library is the one of the 'Policies'. Here, policies of any kind are listed alphabetically. Below each policy, a link to their homepage is provided, but no further functionality is available.

The following focuses on the third library, the SDG benchmarking tool. This is in particular interesting for the geographic visualisation within an indicator-based dashboard. The tool asks to select an SDG, then a relevant indicator under the given SDG, then the user can choose a region and in the last step, benchmarking regions. It leads to a visualisation.
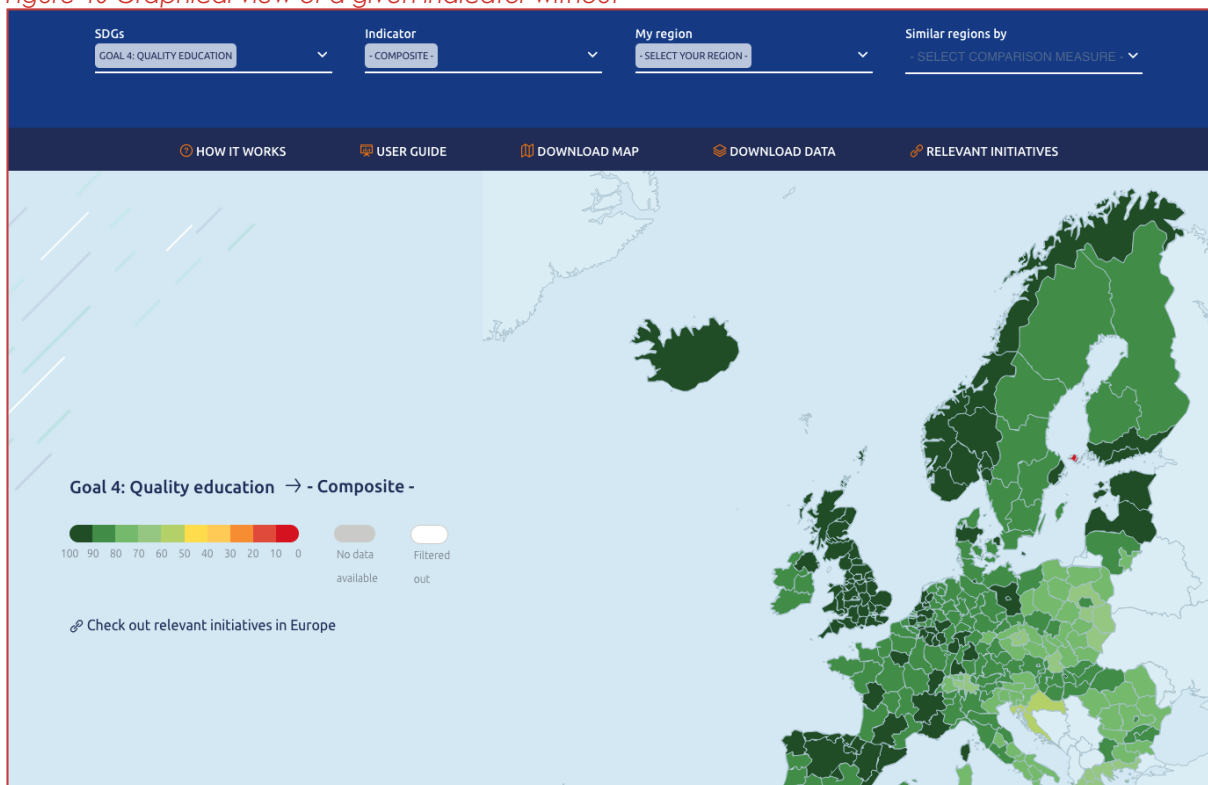
Figure 39 ESPON's SDG tool
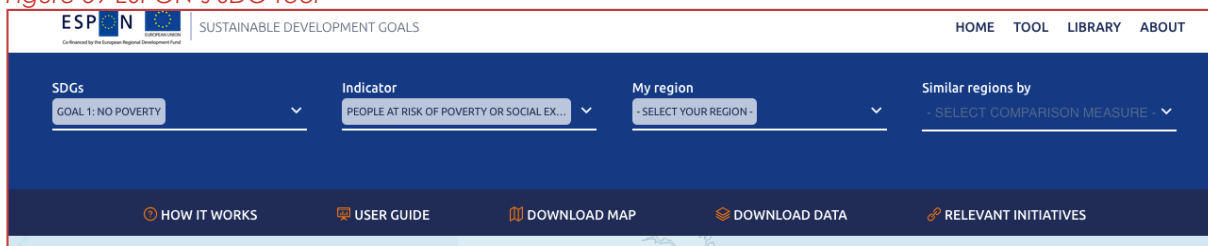
Source: ESPON

The visualisation shows how a region or country is currently performing on an individual indicator or on a composite indicator basis. There is no absolute data displayed, instead, the graphics are based on relative performance measures.

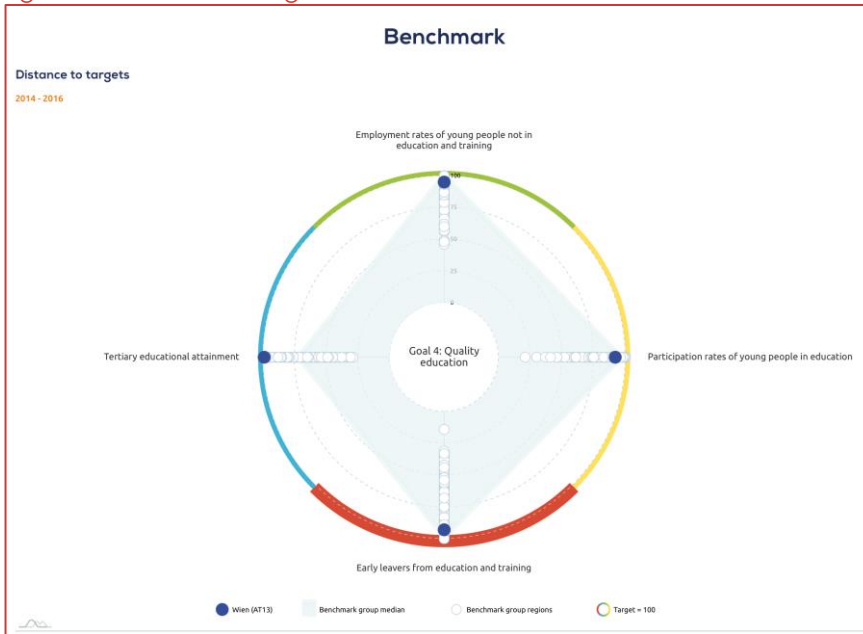*Figure 40 Graphical view of a given indicator without*

Source: ESPON

There is an option to use benchmarks. For the choice of the benchmark, one cannot choose specific regions, but indicators such as population density, rural-urban which compares like with like. Further benchmark information is provided in terms of SDG and the key indicators in an SDG as well as developments over time.
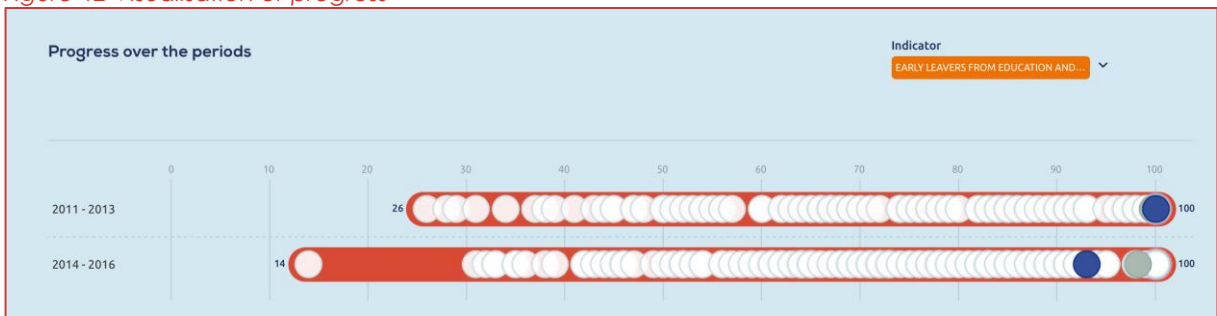
With the visualisation of 'Distance to target', a user interested in the regional perspective can see where it stands compared to a measurable goal. The figure below indicates where a selected region stands in terms of four education indicators, while shows the progress over two periods and the position of the region vis a vis the average of the selected peer group.

Study Providing Methodological Support for the European Higher Education Sector Observatory

Figure 41 Distance to target visualisation

Source: ESPON

Figure 42 Visualisation of progress

Source: ESPON

The SDG tool is a procured service. The tool was developed by a commercial provider and also the content was collected by a service provider.

B.5.   ERAWATCH

ERAWATCH was a large policy monitoring exercise funded by DG JRC between 2006-2012/13. It was designed to monitor the STI developments of the ERA and as such included all EU-MS, associated countries and several 'international' countries. From the ERAWATCH legacy, only the country reports survived, and they were moved to the JRC's RIO website, which ceased to exist as such in 2021. The bulk content – detailed information on STI policies - is lost. The collection has however started again with the STIP Compass, described above. The ERAWATCH example is chosen since content development followed a different model than the ones explained above.

Information collection approach

Given that ERAWATCH covered from the beginning more than 35 countries, the EC (RTD and JRC) initiated the monitoring as a public procured service. Different contracts were awarded, including:

- Technical development of the website and content management system (CMS)
- The development of a structure and the collection of the content
- Extensions (technical/content)

For the collection of the content, a network of individual country experts was established (the ERAWATCH Network asbl). Key advantages of using paid country experts included control over what had to be collected; language capacity enabling qualitative methods (e.g. interviews with different stakeholders in the country), and the collection of relevant materials in the national languages.

The project management, together with the EC services developed template structures. They were then tested in a prototyping phase by 2-3 experts and for selected countries only. Following their finalisation and the development of reporting guidelines, the country experts were asked to collect relevant information. The monitoring included:

- A country report with the basic elements of the research system including key indicators such as population, GDP, GERD/GOVERD, number of scientific publications. The country reports informed in a structured manner about the various developments of specific ERA policy areas, concluded with a SWOT analysis.
- Support measures – public policy (funding) programmes on research and innovation, but also on education and skills
- Organisations to cover all major institutional policy actors and intermediaries, for example funding bodies, research councils
- Policy documents, e.g., strategy documents, laws

All country experts had a specific quantitative target, which was developed according to the size of the country. A small country such as Cyprus has fewer organisations and policy measures than for example the Netherlands. The experts were encouraged to provide content through the CMS whenever there was a new policy measure to report. In the first years, there were planned updates twice a year, but it turned out that this updating schedule was too ambitious and not much new could be reported every six months. Given that constant monitoring was not realistic, and new policies and programmes are developed sporadically, it was decided to have a dedicated annual updating cycle. Updating included the inclusion of new measures, as well as the update of existing ones with new elements, as needed. All deliverables went through a double QA process:

- First, at the level of the service provider, the detailed country fiches were quality controlled by a small set of external senior policy advisors. They reviewed the content based on pre-agreed quality criteria. In addition, a set of consultants checked the rest of the information collected mainly for language, completeness of the information, and internal coherence
- Second, once the content was transmitted to the JRC through the CMS, the JRC added another round of checks often by colleagues with knowledge about a country

This two-step quality control proved to be not without caveats. While the quality was ensured, it hampered speedy publication on the web and information was often published with quite some delays. Yet, given rigorous quality control, the ERAWATCH website was a highly trusted

source of information. At that time, JRC did not implement website statistics, therefore, the overall use was not measured systematically.

Why is the ERAWATCH experience relevant?

Much of the information collected under ERAWATCH was qualitative. A measure – such as a funding programme or a policy document on a new strategy – included qualitative information on the content. ERAWATCH was thus able to provide a holistic picture that enabled policy makers and other user groups such as researchers to obtain not only factual information, but also the background that explains developments and the measurable KPIs.

The ERAWATCH 'system' evolved over several years. This concerns the content collected, the countries covered, the update cycles and quality review processes. The tool proved to be a real intelligence system: once information was collected for a couple of years, it was possible to analyse the data more sophisticly and identify patterns and trends.

There are several lessons learned from the ERAWATCH example:

- Using an observatory as an intelligence tool requires investment to set it up and to maintain
- A long-term vision – funding and maintenance - will enable the development of long-term datasets and potentially identification of correlations. There is a need to consider the changes from an MFF to another
- Technical development started with the backend, the CMS, and the frontend. The initial technical development lasted for about 8-9 months. It required frequent exchange with the content/methodological development experts
- Typically, a technical contract was awarded for 12-18 months. The series of technical contracts required for hosting the website, as well as new developments or improvements of existing ones

B.6. EOSC Observatory

It is currently under development funded by a Horizon2020 grant. The EOSC Observatory was primarily envisaged as a policy portal – collection of information on what type of measures different countries have on open science/open data - but it is equally developing into a monitoring tool. This EOCS Observatory is being developed for three target groups:

- DG RTD – to monitor the overall developments of open science/open data
- The EOSC Partnership - to provide a number of monitoring indicators
- EU MSs – to access comparable information for benchmarking

The data is collected through individual surveys to (various) members. The surveys are an integrated function of the EOSC Observatory. There are various roles and processes defined in the CMS linked to registered user profiles. Within the dedicated space in the EOCS Observatory, registered users can provide information and have access to a dashboard.

In case of the survey of the Member States, the EC has 'super rights' as they can also access the individual survey responses submitted by the MSs. There is no dedicated quality review of the content provided. It is assumed that the MS/organisations know the situation best and ensure coordination prior to submitting the information. By submitting, the mandated organisation indicates that the submitted information is valid. Currently, only this internal facing monitoring sphere is available, access by the broader public and visualisation of the information for the users will be developed in the next phase.

The question of sustainability arises with an observatory that is being developed through a grant. Very often, created structures cease to exist once the project funding ends. Who will take over? How will continuity be ensured?

Why is the EOSC Observatory a relevant example?

The monitoring tool of the EOSC Observatory is an example of a restricted area developed for specific user groups to access and/or collect data with different permissions and roles assigned. If for example monitoring data from the European University Initiatives is collected and integrated, there may be a decision that these universities have access to the collected data, the public, however, has more restricted options for the display.

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