INSPIRE

D3.1 GEP Prevalence Monitoring Indicator Framework v1

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Executive Summary

A reliable method for systematically monitoring Gender Equality Plans (GEPs) at a supra-institutional level is unavailable. This is the reason why this report summarises the development of a methodology to monitor GEP across Europe in two different ways to figure out which could be the most appropriate in the future or how to combine both methods. The first methodology is *non-reactive* (web scraping and automated text analysis), and the second methodology is a European-wide online *survey* (reactive method). At the end of the report, we compare both methodologies in terms of their advantages and disadvantages for the European-wide monitoring of GEP.

In order to develop the methodologies, a pilot study has been conducted to test the methods on a smaller scale. The pilot study sample encompasses 83 organisations selected from Germany, Greece, Ireland, and Estonia.

Firstly, the report outlines the theoretical basis of the INSPIRE indicators and their development process for monitoring purposes. The INSPIRE indicators were created based on the T.2.1 Data Monitoring Report, and feedback was received from four different focus groups, which were conducted with a total of 28 participants from all over Europe. The INSPIRE indicators encompass the four areas regarding the prevalence, characteristics, implementation, and impact. While developing INSPIRE indicators, we also consider intersectional and inclusive perspectives.

Second, the nonreactive methods and the survey methodology for data collection will be explained. On the one hand, we have combined various non-reactive methods. The web scraping tool SerpAPI was used for data collection and specified Google's crawled database to build a specific INSPIRE scraper. The INSPIRE web scraper detects more than the targeted GEPs and downloads also unspecified PDFs. Therefore, an intermediary classification process is required to clean up the data corpus using Large Language Models (LLM). On the other hand, a more conventional online survey was sent to Research Performing Organisations (RPOs) via the online survey platform UNIPARK for data collection.

Both approaches demonstrate advantages over one another. Online surveys offer the advantage of obtaining high-quality targeted data, enabling many observations and facilitating efficient data collection. However, online surveys face a low response rate and difficulties in acquiring participants' email addresses. Indeed, the pilot study results show that the INSPIRE pilot survey has a low completion rate and is hampered by issues such as reaching private RPOs. Nevertheless, it provides high-quality, targeted information. To improve the survey methodology for monitoring GEP, having more knowledge or evene a database about contact persons would be worthwhile. In contrast, web scraping offers excellent potential for collecting massive amounts of data without needing much contact details. However, collecting data via web scraping faces challenges such as selecting appropriate tools for scraping and developing the algorithm to collect the data. Web scraping offers extensive data collection capabilities, but sorting and selecting the data poses considerable challenges.

First pilot study results show that the INSPIRE's scraper has more success in capturing the prevalence of GEP in comparison to the online survey. However, capturing information

regarding the characteristics, implementation, and impact of GEP requires more sophisticated approaches, which the online survey can deliver. The biggest challenges for non-reactive methods are to deal with translation issues for data collectiona and analysis, inconsistencies in metadata, the need for high computational capacity and the absence of standardised terminology for file descriptions.

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List of Acronyms

AB	Advisory Board
BART	Bidirectional and Auto-Regressive Transformers
BERT	Bidirectional Encoder Representations from Transformers
BuildERS	Building European Communities Resilience and Social Capital project
D	Deliverable
DoA	Description of Action
GEP	Gender Equality Plan
GPU	Graphical Processing Unit
GPT	Generative Pre-trained Transformer
LLM	Large Language Model
RFO	Research-Funding Organisation
RPO	Research Performing Organisation
WP	Work Package

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1 Introduction

The European Commission calls for cultural and institutional change to foster gender equality in science and research. For this purpose, it is encouraged that research-performing (RPOs) and funding organisations (RFOs) implement gender equality plans (Council of the European Union 2015; European Research Area and Innovation Committee 2015; Cheveigné et al. 2017; European Commission 2020). In the last years, the European Commission has expanded the concept of gender equality "by opening policy to intersections with other social categories" (European Commission 2020, 16) and calls for approaches to inclusive gender equality and inclusive gender action plans (European Commission 2022). Recently, having a gender equality plan (GEP) became an eligibility criterion for getting funding in Horizon Europe (European Commission 2021a).

Considering the relevance of GEPs, monitoring their prevalence among research-performing and funding organisations, implementation and impact becomes crucial in assessing changes towards gender equality in European research. The ongoing review and monitoring of GEPs enables adjustments and improvements (European Commission 2021a). An efficient monitoring approach includes – but is not limited to – the accessibility and availability of data and the incorporation of appropriate indicators (Löther, Karataş, and Weber 2023).

Thus, INSPIRE's research programme seeks to develop a robust and efficient methodology to monitor inclusive GEPs across Europe. This includes developing relevant indicators for monitoring inclusive GEP, establishing monitoring instruments through reactive and non-reactive methods and comparing the advantages and challenges of both approaches.

This paper presents the first version of the indicators on the one hand and the methodologies and results of the pilot study on the other hand. The pilot study consists first of an online pilot survey for the reactive methods and, secondly, a combination of web-scraping and text analysis for non-reactive methods.

After explaining the research design (1), we explain the indicator development and the indicators (3). Afterwards, we display how we implemented the indicators for non-reactive (4) and reactive methods (5) and present in detail the developed instruments. Finally, we discuss the preliminary results of comparing the two methods.

2 Research Design

Figure 1 presents the study's research design. We conducted a pilot study for both methodologies. The sample for the pilot study – research-performing organisations in Germany, Greece, Ireland, and Estonia – was the same for the web scraping and survey. The pilot study aimed to check and design the web scraping tools and the questionnaire and to test the field access.

Figure 1   Research design
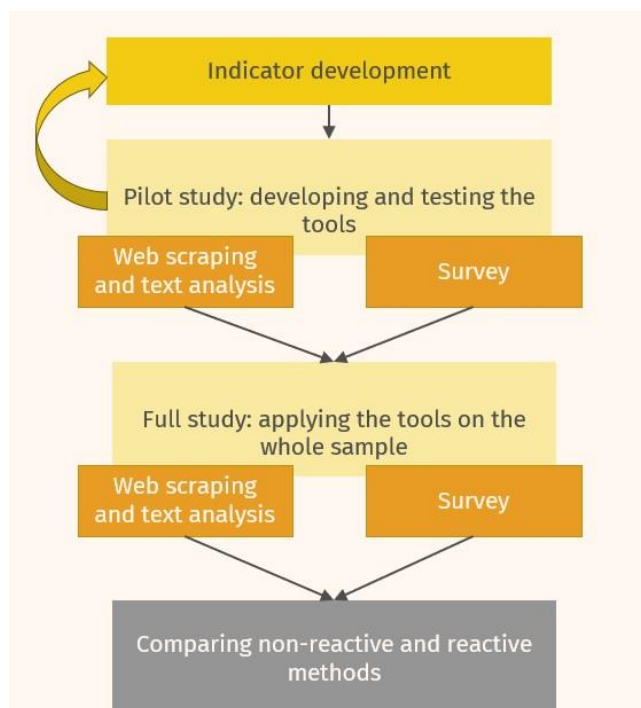
The present paper covers the indicator development and the pilot study. Deliverables 3.2 and 3.3 will present the full study's results and methodology.

2.1 Objectives, Sampling and Implementation of the Pilot Study

The pilot study aims to develop and test the tools for web scraping, text analysis, and the survey questionnaire. Applying the web scraping and the text analysis on a small sample and comparing the results with a manually controlled corpus allows us to calculate quality indicators. Furthermore, the pilot sample serves as a preliminary test to assess the questionnaire for the full sample.

We constructed the sample for the pilot studies stepwise. In the first step, we selected four countries: Germany, Greece, Estonia, and Ireland. One selection criterion was differences and peculiarities in the linguistic context and grammatical rules. We aimed to assess linguistic challenges by choosing different countries with diverse language backgrounds. For this reason, we chose Germany and Ireland because we are familiar with these languages, whereas we do not know the language of the two other countries. This enabled us to discover when we need cultural expertise to construct instruments. Another criterion was the expected prevalence level of GEPs, ranging from high rates in Germany to lower rates in Estonia.

In the second step, we selected higher education institutions (HEIs) and research-performing organisations (RPOs) from the mentioned countries. We selected institutions by conducting web searches and using the CORDIS[1] database containing EU research initiatives under the Horizon 2020 (2014–2020) programme. During the selection process, we prioritised institutions with GEPs and those with URLs in the CORDIS database. We also aimed to have an even

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[1] CORDIS - EU research projects under Horizon 2020 (2014-2020) - Data Europa EU.

distribution in the sample concerning the type of organisation in each country. A piloting dataset with web domains has been crafted, featuring four countries (Greece, Ireland, Germany, and Estonia) and approximately 20 organisations per country, spanning academia, research institutions, and private companies. Figure 2 presents the pilot sample of the 83 organisations categorised by country and type of organisation.

Figure 2   Organisation type by country
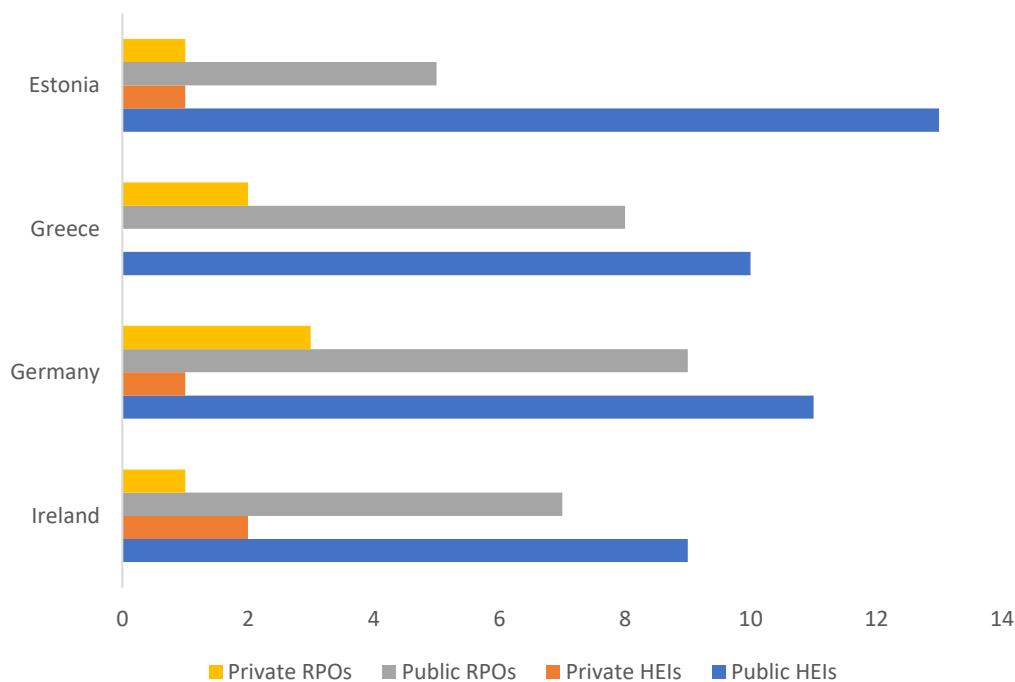
Table 1 gives an overview of the pilot study's implementation.

Table 1   Implementation of the pilot study

Tasks	Period
Developing the web scraper	08/2023 – 01/2024
Developing tools to download and classify GEPs as pdf-file	01/2024 – ongoing
Developing the algorithm/tool for the text analysis	12/2023 – 03/2024
Developing the survey questionnaire	10/23 – 2/24
Pretest of the survey	28.2. – 27.3.2024

2.2 Sampling (Full Study)

To apply and test the indicators for both methodological approaches, we use the same sample of research-performing and research-funding organisations in the European Union member states and six states associated with the European Research Area. Initially, these states comprised Israel, Montenegro, North Macedonia, Norway, Switzerland and the UK. The

consortium meeting decided to integrate Bosnia-Herzegowina and Serbia instead of Montenegro and North Macedonia because of INSPIRE case studies (WP 3, Task 3.3.) in these countries.

2.2.1 Sample of Research-Performing Organisations

After checking some other sources for research-performing organisations – especially the European Tertiary Education Register (ETER)[2] – we decided to use the CORDIS database on projects funded in Horizon 2020[3] for the following reasons:

- Includes higher education institutions, publicly financed research institutions and private companies, thus a unique source for all organisation types,
- High number of organisations (41,406 for all countries and 37,866 for the countries of the sample)
- Closed program (no further changes in the sample)
- A GEP was not an eligible criterion in Horizon 2020. Thus, there are more differences between having and not having a GEP.

After reducing the project list to a list of organisations, we cleaned the list by:

- Eliminating duplicates
- Eliminating departments of universities

Furthermore, we reduced the list to higher education institutions, research organisations and private companies, eliminating organisations of the categories "public bodies" and "other". After cleaning, the list includes 30,545 research-performing organisations from the selected countries (see Table 2).

Table 2   Sample and selection process by type of organisation

	Total number of organisations in CORDIS		Organisations in CORDIS with URL		Sample	
	N	%	N	% of total	N	%
Higher education	1,486	4.9%	1,023	68.8%	1,486	21.5%
Private company	26,268	86.0%	4,245	16.2%	2,627	38.0%
Research organisation	2,791	9.1%	1.462	52.4%	2,791	40.4%
Sum	30,545	100%	6,730	22,0%	6,904	100%

The numbers include only INSPIRE countries.

The web scraping and the survey (search for email addresses) need the website addresses. The CORDIS database includes a column "organisationURL", but the database provides the

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[2] https://www.eter-project.com/
[3] CORDIS - EU research projects under Horizon 2020 (2014-2020), URL: http://data.europa.eu/88u/dataset/cordisH2020projects, DOI: 10.2906/112117098108/12. Date of data extraction: 6.7.2023.

URL of only 22% of the organisations (see Table 2). In particular, many entries from private companies lack a website address.

Due to financial restrictions (extracting the email addresses), including all organisations (N=30,545) in the sample was impossible. Furthermore, the organisations are unevenly distributed among the organisation types, with a high proportion of private companies. We decided to reduce the sample size but keep all higher education institutions and all research organisations in the sample. A proportional reduction of all organisation types would result in a deficient number of these organisation types. Assuming a response rate of 20-30% would make a valuable analysis impossible. Furthermore, we expect a lower rate of gender equality plans among private companies and, thus, less material for the text analysis.

We decided to include 10% of the private companies in the sample according to the following selection criteria:

- The CORDIS list displays the organisation's website address for practical reasons and to reduce the number of URLs searched.
- Total sum of all Horizon 2020 projects of the organisation as a proxy for the size, significance and level of the company's research investments.

The sample consists of 6,904 research-performing organisations. Table 2 shows the distribution among the organisation types. Table 3 displays the sample by country and organisation type.

Table 3   Sample by country and type of organisation

	Higher education	Private company	Research organisation	Total	% of sample
AT	42	82	123	247	3,6%
BA	9	0	10	19	0,3%
BE	28	115	133	276	4,0%
BG	35	5	62	102	1,5%
CH	26	84	58	168	2,4%
CY	10	16	16	42	0,6%
CZ	24	25	82	131	1,9%
DE	212	433	358	1.003	14,5%
DK	15	54	30	99	1,4%
EE	7	8	9	24	0,3%
EL	36	83	63	182	2,6%
ES	88	282	355	725	10,5%
FI	37	64	30	131	1,9%
FR	205	312	195	712	10,3%
HR	16	5	42	63	0,9%
HU	32	30	46	108	1,6%
IE	24	41	24	89	1,3%
IL	24	25	16	65	0,9%
IT	110	269	299	678	9,8%
LT	10	7	19	36	0,5%
LU	1	6	8	15	0,2%
LV	16	3	17	36	0,5%
MT	3	0	5	8	0,1%
NL	49	206	113	368	5,3%
NO	24	41	66	131	1,9%
PL	88	23	115	226	3,3%
PT	44	57	88	189	2,7%
RO	42	17	81	140	2,0%
RS	9	4	31	44	0,6%
SE	37	85	52	174	2,5%
SI	13	26	51	90	1,3%
SK	22	7	31	60	0,9%
UK	148	212	163	523	7,6%
Sum	1,486	2,627	2,791	6,904	100%

2.2.2 Sample of Research Funding Organisations

After checking different sources to create the list of research funding organisations (f.eg. GENDER-NET plus, https://gender-net-plus.eu/; EU-Project: Grant allocation disparities (GRANteD), https://www.granted-project.eu/; Global Research Council,

https://globalresearchcouncil.org/), we decided to use Science Europe[4] and She Figures 2021 (European Commission 2021b). Science Europe represents major public organisations that fund or perform research in Europe. 37 of the 40 members of 29 European countries are research funding organisations, two of which are both research funding and performing organisations. To complete the sample, we extracted research funding organisations from countries not represented in Science Europe through lists in She Figures (European Commission 2021b, 328–37). The final sample consists of 43 research funding organisations from all INSPIRE countries.

3 Indicator Development

3.1 Political Relevance and Theoretical Framework

To foster cultural and institutional change in research and innovation towards gender equality through GEPs, quality assurance of their implementation and impact is necessary. Monitoring and evaluation aim to assure the quality of the implementation and realisation of GEPs and gender equality policies. Whereas monitoring "is the ongoing process of systematically collecting data on an outcome" and "is a means for measuring progress", evaluation refers "to the systematic assessment of an initiative, its design, implementation and results" and asks for effectiveness and efficiency (Aldercotte 2018, 4). INSPIRE focuses on monitoring and seeks to develop a solid set of indicators that allow monitoring of GEPs, primarily in RPOs, but also in RFOs.

INSPIRE seeks to monitor the GEPs of many RPOs on a European-wide level (27 member states + Bosnia-Herzegowina, Norway, Israel, Switzerland, Serbia and the UK), instead of the effect of a GEP on gender inequalities in a single institution. The analysis will consider national contexts but do not seek to compare countries. Thus, the INSPIRE indicators facilitate GEP monitoring on a supra-organisational, not on an institutional level.

GEPs aim at transformational change toward gender equality in an organisation, and monitoring GEPs aims to check if transformational change occurs. To monitor change in a structured way, the programme management cycle (Wroblewski 2023, 30; European Commission 2021a, 12; Lipinsky and Schäfer 2016) and the logic chart analysis (Palmén et al. 2019b; Wyatt Knowlton and Phillips 2009) and build the framework to structure the monitoring process and the indicators. The programme management or policy cycle describes the implementation of gender equality policies, which includes needs assessment (or gender analysis), planning and decision of the actions, implementation, monitoring and evaluation and adaptions of the measures, by which the cycle starts again. Thus, monitoring is an integral part of gender equality policies. The logic chart analysis provides a framework for evaluating input, output, outcome and impact. Following this distinction, the INSPIRE indicators focus on four areas to monitor the transformational potential of GEPs:

1. Prevalence (as input): Is there a GEP (or equivalent) in the organisation?

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[4] https://scienceeurope.org/about-us/members/, Date of data extraction: 21.11.2023.

2. Characteristics (as output): What are the characteristics of the GEP regarding stakeholders, formal features, areas of activity or inequalities mentioned?
3. Implementation (as outcome and processes): Which measures have been implemented? Are there financial and personal resources for the implementation? Which processes have been introduced?
4. Impact: What can we know about long-term effects?

Even if monitoring primarily measures output, outcome, and processes, we aspire to gain some knowledge about the effects and impact of GEPs (or other equality policies). For a deeper understanding of the impact, evaluations are needed, which regularly rely on sophisticated quantitative and qualitative data and thus are applied on a smaller scale of case numbers. Conventionally, evaluations try to attribute observed effects to the intervention by measuring the counterfactual and searching for causal links (Aldercotte 2018; Gates and Dyson 2017; Kalpazidou Schmidt et al. 2017).

Despite the differences between monitoring and evaluation, evaluation approaches are valuable in conceptualising impact monitoring. We rely on "theories of change" and the "impact driver model" because both approaches established a way to get information on impact, not by directly measuring impact but by assessing factors contributing to change. Based on *theories of change*, impact evaluation investigates how "the implementation of the interventions 'contributed' to the outcomes and impact of the intervention in combination with a complex array of contextual influential factors" (Palmén and Kalpazidou Schmidt 2019, 7). Using a similar approach, Mergaert, Cacace, and Linková (2022) set up indicators for impact drivers that monitor preconditions for effective change toward gender equality. Their impact driver model combines two approaches: *the institutional capacity model* and *the actor mobilisation model*.

The *institutional capacity model* focuses on an institution's potential and implementation process. Impact drivers for gender mainstreaming are:

- effective leadership
- adequate financial and human resources
- availability of appropriate procedures and processes
- appropriate organisational incentives and accountability structures (Mergaert, Cacace, and Linková 2022, 4–6).

The *actor mobilisation model*, on the other hand, focuses on agency and the activation of internal processes, namely

- transformational agent(s)
- agency dynamics like mobilising stakeholders
- structural features like internal functioning, norms and regulation
- dimensions and areas of sustainable outcomes (Mergaert, Cacace, and Linková 2022, 6–7)

In the combination of both models, the so-called *impact driver model* consists of twelve impact drivers with several indicators each and six stages of institutionalisation. The model envisages monitoring progress in the organisation by self or external assessment. The indicators are not directly applicable to our supra-organisational GEP monitoring, but the focus on drivers and enablers for transformational change guides our development and selection of indicators. This

approach aligns with the criteria for GEPs set for Horizon Europe, which also focus on several preconditions for change (publication and official endorsement, dedicated resources, data collection and monitoring, training and recommended thematic blocks) (European Commission 2021a).

3.2 Methodological Approach of Indicator Development: Process and Quality Check

The indicators aim to monitor the prevalence, characteristics, implementation and impact of GEPs European-wide on a supra-institutional level. The indicators represent a conceptual level. They are not associated with a distinct method (survey or non-reactive methods). In another step, we will operationalise the indicators for each instrument (see chapter 3.4). We describe how to apply the indicators for non-reactive methods (web scraping and automated text analysis) in chapter 4 and for reactive methods in a European-wide survey in chapter 5, using the same sample of higher education institutions, research institutions, private research-intensive organisations, and research funding organisations for both methodological approaches (see chapter 1 on the sample). In this way, the project INSPIRE intends to compare the advantages and disadvantages of each method for monitoring GEPs.

The quality criteria for the development and selection of indicators emerge from the following:

- The subject matter (GEPs): referring to GEPs, not gender inequalities
- The level of analysis: feasible for monitoring a large number of RPOs and RFOs on a European-wide level
- The focus on facilitating factors for impact: providing information on drivers and enablers for transformational change.

A scoping literature review that investigates the state of the art on monitoring gender equality and especially GEPs in research-performing and funding organisations guided the development of the indicators (Löther, Karataş, and Weber 2023). Building on this review, we mapped indicators used or proposed in the literature. By applying the mentioned criteria, we developed a first draft of indicators.

For a quality check and to get feedback, experts on gender equality and monitoring discussed the draft indicators in four online focus groups. Participants of the focus groups came from four geographical areas in Europe (Northern and Western Europe, Eastern Europe, German-speaking countries and Southern Europe). The selection criteria for the participants were expertise in gender equality in science and research, as a researcher or practitioner, and especially in gender monitoring. Furthermore, the participants came from different institutional backgrounds (private research-intensive organisations, higher education institutions, and public research organisations).

The focus groups took place from 26.5.2023 to 14.6.2023, with 28 participants[5] in total. The goal has been to have 40 participants. For this purpose, we invited more than 60 people. However, due to internet connectivity issues and time conflicts, especially in Eastern and Southern Europe, some persons who confirmed their participation had to cancel at short

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[5] Northern and Western Europe: 10; Eastern Europe: 5; German-speaking countries: 8; Southern Europe: 5.

notice. We moderated the discussion with a guideline to facilitate comparable results. We recorded and transcribed the discussion for documentation and extracted the main results. The expert's comments improved the understanding of the indicators' objectives and the impact indicators' comprehensiveness and specified the distinction between the "prevalence" and "characteristics" indicators.

We also benefited from the remarks made by consortium members at the second project meeting (June 20–21, 2023). The revised draft of the indicators integrated the feedback of the focus groups and the consortium partners.

In the next step, we operationalised the draft indicators for the pilot study: on the one hand, for web scraping and automated text analysis, and on the other hand, for the survey. In a feedback loop, findings from the operationalising procedure, developing the algorithm for the web scraping and the text analysis and results from the questionnaire development flow into the final version of indicators presented in this deliverable.

3.3 Developed Indicators

A detailed list of indicators can be found in the appendix (p. 94).

3.3.1 Prevalence

Prevalence indicators measure whether a GEP is in place in research-performing or funding organisations and inform about the organisational context of these plans.

Indicator 1.1 ***A gender equality plan or a written and formal institutional strategy that fosters gender equality) exists in a research-performing or research-funding organisation.***

Different definitions of GEP exist that may hinder the comparability of our study. The European Institute for Gender Equality (2016) defines a GEP as a set of actions aimed at identifying gender inequalities and bias, designing and implementing measures to correct these, and setting targets and monitoring progress via indicators. In a broader definition, it refers to a planned institutional change approach.

Our study follows the definition given in Horizon Europe, defining a GEP as "a set of commitments and actions that aim to promote gender equality in an organisation through a process of structural change" (European Commission 2021a, 11). The minimum requirements are a public document, dedicated resources, data collection, monitoring, and awareness raising/training on gender equality (European Commission 2021a, 9). Due to practicability, non-reactive methods might have to use a less strict definition. Depending on the country and the organisational context, some organisations might not have a GEP focusing on gender inequalities but a broader equality or diversity plan. Table 4**¡Error! No se encuentra el origen de la referencia.** informs about publications that provide or use indicators on the prevalence of GEPs:

Table 4   Publications: Indicators on the prevalence of GEPs

Publication	Indicator	Used or recommended application
Bührer and Wroblewski (2019, 5)	The existence of an institutional strategy, inter alia, a gender equality plan	Used for a survey of EU-funded researchers (2016)
Research Council of Norway (2016, 16)	Gender equality plans: Do these exist?	Recommendations for transnational indicators
European Commission - DG Research (2016, 110–11)	The Proportion of research-performing organisations (RPOs) that adopted gender equality plans	Used for an ERA RPOs Survey (2014)
Wroblewski et al. (2015, 64–65)	Share of RPOs with gender equality plans	Used for an ERA RPOs Survey (2013)

The She Figures 2018 and 2021 had to change the indicator on GEPs because of the lack of European-wide surveys asking for GEPs. Using web-scraping, the indicator displays the proportion of RPOs that have taken measures and actions to promote gender equality (European Commission 2021c, 106), thus focusing on measures instead of an institutionalised and formalised strategy. Guyan and Douglas Oloyede (2020) and Higher Education Authority (2018) also ask for interventions and initiatives instead of GEPs.

Indicator 1.2 The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of:
  - ***Participation in EU structural change projects, e.g., Horizon 2020, Horizon Europe***
  - ***Received funding other than EU projects, e.g., from national RFOs***
  - ***Received non-monetary support***
  - ***Legal requirements or requirements linked to getting research funding.***

In this indicator, we investigate the link between the prevalence of a GEP and any legal requirements or national factors. Eleven countries require a GEP to be in place, mainly for higher education and research institutions (Wroblewski 2023, 21–22; Standing Working Group on Gender in Research and Innovation 2021). National initiatives like the Athena SWAN Charter (Barnard 2017) or the German Women's Professorship Program (Biela et al. 2022; Löther 2019) encourage higher education institutions and research organisations to approve a GEP. On a European level, besides the eligibility criterion in Horizon Europe, the European Commission has supported the implementation of GEPs in thirty structural change projects with over 200 research performing and funding organisations (European Commission 2021b, 168). As context for the prevalence of GEPs, we need to get information about links to national and European initiatives and third-party funding.

All focus groups highlighted external reasons and motivations for setting up a GEP, such as national legal frameworks, Horizon Europe funding criteria and the receipt of funding. To date, the literature does not describe a comparable indicator.

3.3.2 Characteristics

Indicators of the GEP's characteristics refer to their procedural and formal features, including leadership commitment, activities, and relation to other inequalities.

Indicator 2.1 Ownership and hierarchical level of the organisation that adopted the GEP: ownership of the GEP

Leadership commitment is crucial for effective change (Mergaert, Cacace, and Linková 2022; Palmén and Kalpazidou Schmidt 2019). Analysing the ownership of the GEP – who approved and signed it – may serve as a first indication of the commitment. The focus groups emphasised ownership and acceptance of the GEP as crucial. Two publications mention an indicator of leadership commitment:

Table 5   Publications: Indicators of leadership commitment and ownership

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "Leadership actively committed to gender equality/gender mainstreaming" with the indicator "There is an explicit and visible commitment of leaders to GM."	Proposed for assessment
Research Council of Norway (2016, 16)	Gender equality plans: Approved at what level in the organisation?	Recommendations for transnational indicators

Indicator 2.2 Publication of the GEP: accessible to people outside the organisation, internal publication (accessible to all members of the organisation), or internal document (accessible only to the management).

The publication of the GEP is mandatory in the definition of GEPs given by Horizon Europe. It provides transparency and is also an indication of the commitment of the leadership and the organisation. The literature doesn't provide indicators of the GEP's publication.

Indicator 2.3 Date of the first and current plan's adoption and time frame of the current plan

The date of the first GEP indicates how long the organisation is engaged in gender equality. The time frame informs if the GEP is regularly revised and adopted. Furthermore, the date of the first plan and the time frame of the current plan contextualise information about activities and their implementation and impact. We would assume more progress in organisations engaged in gender equality for longer. According to the focus groups, the time frame is a context factor but not a quality criterion.

The literature doesn't provide indicators on this issue.

Indicator 2.4 ***Areas of activity (grouped according to the specification for Horizon Europe) and target groups addressed in the GEP***
- ***Prevalence: Are there measures in each area of activity***
- ***Quantity: How many measures in each area of activity***

Gender equality policy involves measures in different areas. The European Commission (European Commission 2021a, 6) suggests including activities in the following fields: a) actions of awareness-raising and training, b) work-life balance and organisational culture, c) gender balance in leadership and decision-making, d) gender equality in recruitment and career progression, e) measures against gender-based violence, including sexual harassment, and f) integration of the gender dimension into research and teaching content. Feedback from selected experts on the questionnaire recommended further specifying the target groups for the area of activities.

Many publications provide indicators which ask for measures in different areas, typically for monitoring the implementation of measures, not for monitoring the GEP:

Table 6   Publications: Indicators of measures in different areas

Publication	Indicator	Used or recommended application
Doneva, Gaftandzhieva, and Boykova (2022, 3388)	Area of intervention	Proposed GEP implementation reports for individual organisations
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "Coverage of the different dimensions/areas of GE institutional change" with the indicators "comprehensiveness of the GEP/GM work in terms of areas addressed."	Proposed for assessment
Subdirección General para el Emprendimiento, la Igualdad en la Empresa y la Negociación Colectiva de Mujeres (2021)	Areas for the initial diagnostics: recruitment and selection processes, professional roles, training opportunities, career progression, working conditions, work-life balance, gender-based violence, inclusive language, workplace safety	Proposed indicators for audit and initial diagnostic
Heidler and Reichwein (2018, 7)	Implemented measures by dimensions (staff/early career researchers, work/life balance, research/academic culture, organisational development, gender in research & training, quality assurance)	Used for the analysis of submitted reports
Higher Education Authority (2018, 61–62)	Frequency of recruitment and promotion initiatives (differentiated by type of initiative)	Used for the analysis of Athena SWAN applications and self-audited Irish institutions

Indicator 2.5   The GEP integrates inclusive approaches like:
- **Gender diversity**
- **Intra-categorial differences inside the gender groups (e.g. women with migration background, Black women, etc.)**
- **Intersectionality (on a more conceptual level, not necessarily as a term)**
- **Diversity (inequalities addressed beside each other/"celebrating the differences" approach)**

Recently, the European Commission has expanded the understanding of gender equality "by opening policy to intersections with other social categories" (European Commission 2020, 16) and calls for *inclusive gender equality* approaches and inclusive gender action plans (European Commission 2022). This indicator provides information on whether concepts of intersectionality, inclusion and diversity are included in GEPs. Furthermore, inclusive GEPs also refer to non-binary gender concepts. Thus, the indicators also ask about gender diversity.

Even if several publications on monitoring gender equality interventions discuss intersectional approaches (Guyan and Douglas Oloyede 2020; Mour 2022), we couldn't find indicators of intersectionality and gender diversity which refer to monitoring GEPs.

Indicator 2.6   The GEP addresses different inequalities (race, class/social background, age, etc.).

If the GEPs include an inclusive approach (see Indicator 2.5), this indicator assesses the inequalities addressed in the GEP. As for indicator 2.5, several publications on monitoring gender equality interventions discuss different inequalities (Guyan and Douglas Oloyede 2020; Mour 2022), but we couldn't find indicators which refer to monitoring GEPs.

3.3.3 Implementation

Following the *programme management cycle* (Lipinsky and Schäfer 2016, 2–3), implementation monitoring concerns the realisation or execution of the GEP and, therefore, the outcomes (Douglas 2014). The indicators envisage monitoring the implementation and the prerequisites for a successful implementation, such as financial and personal resources, the involvement of stakeholders, and quality assurance. Implementation indicators monitor, on the one hand, whether the RPOs fulfil the requirements regarding dedicated resources and data collection and monitoring. On the other hand, implementation indicators like financial and personal resources, regulations including gender equality requirements, and stakeholder involvement refer to impact drivers.

Indicator 3.1   Assessment of planned and implemented gender equality measures (by areas of activity):
- *Level of realisation: planned – started – implemented*
- *Institutional coverage: implemented across the institution, implemented in some departments, not implemented anywhere.*

Primarily, the indicators on implementation try to get information on whether the organisations realise the measures envisioned in the GEP. The criteria for implementation are the level of realisation on the one hand and institutional coverage on the other hand. Monitoring the implementation in an individual organisation would assess the realisation of each measure mentioned in the GEP. A supra-organisational monitoring can't reach this complexity, but the indicator groups the assessment of implementation by areas of activity (see indicator 2.4). Table 7 displays publications that provide or use indicators for monitoring the realisation of GEPs:

Table 7   Publications: Indicators for monitoring the realisation of GEPs

Publication	Indicator	Used or recommended application
Doneva, Gaftandzhieva, and Boykova (2022, 3388)	Planned indicators; quantitative achievements by measure; qualitative achievement by measure; relevance of the action	Recommended for GEP implementation reports of individual organisations
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "Coverage of the different dimensions/areas of GE institutional change" with the indicator "comprehensiveness and sophistication of the work within addressed areas."	Proposed for assessment
Heidler and Reichwein (2018, 6–7)	Number of measures per institution by the level of realisation (planned, implemented and established); growth in the implementation of measures by action area	Used for university reports and the analysis of individual reports
Higher Education Authority (2018, 61–62)	Frequency of recruitment and promotion initiatives (differentiated by type of initiative)	Used for the analysis of Athena SWAN applications and self-audited Irish institutions

Indicator 3.2 Financial resources are dedicated to gender equality measures/implementation of GEP.

The implementation of a GEP depends on financial resources. For example, the European Commission states in the eligibility criteria for Horizon Europe that "the GEP has dedicated resources and expertise in gender equality to implement the plan." The financial volume "should be appropriate to the size and needs of the organisation and its GEP." (European Commission 2021a, 20). Still, assessing whether the financial resources are sufficient and comparing organisations is challenging.

Despite the importance of resources, only a few publications explicitly mention indicators of financial resources:

Table 8   Publications: Indicators of financial resources

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "availability of resources" with the indicator "There are funds dedicated to GE"	Proposed for assessment
Nimo (2021, 445)	Rate of variation of the organisation (specific university) budget allocated to the Equality Office; Rate of change in the number of people who have had access to resources on equality	Used for the monitoring of a specific university

Indicator 3.3 *A gender equality unit, gender equality committee and/or dedicated staff are in place.*

Closely linked to financial resources is dedicated staff. The European Commission proposes "a dedicated gender equality function" as one kind of human resource for implementing a GEP (European Commission 2021a, 20). Dedicated staff ensures expertise in setting up and implementing gender equality policies. Mergaert, Cacace, and Linková (2022, 10) describe two aspects of staff engaged in gender equality as impact drivers: a core team of change agents and the availability of resources, including knowledge and expertise.

The structure of the personal resources – (gender) equality officer or unit, employee representation or part of the management dedicated to gender equality or multiple inequalities – may differ according to legal requirements and the organisation type. Thus, the indicator should grasp the existence of dedicated staff and the organisational varieties. Despite the importance of dedicated staff and expertise, few publications propose indicators for gender equality staff (see Table 9**¡Error! No se encuentra el origen de la referencia.**).

Table 9   Publications: Indicators of dedicated staff

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "core team of change agents" with four indicators (core team of change agents exists; core team comprises motivated people; core team has a formal mandate and ownership; core team has access to an extended group of change agents); impact driver "availability of resources" with the indicator "internal gender knowledge and expertise are available and used".	Proposed for assessment
Heidler and Reichwein (2018, 1)	Equal opportunity structures	Used for university reports and the analysis of individual reports

Indicator 3.4 Gender equality is integrated into institutional/internal regulations (appointment regulation, basic rules of the institution, etc.).

Structural and organisational change also involves changes in regulations, which are not primarily concerned with gender equality, like recruitment procedures. Thus, knowledge about regulations, which include gender equality requirements, informs the implementation of organisational change.

A draft of the indicators included an indicator asking whether the GEP was embedded in a broader institutional plan or strategy. In adapting the indicator for the web scraping and survey, we found it difficult to distinguish this indicator from integrating gender equality into institutional and international regulations. We have, therefore, omitted the draft indicator on mainstreaming.

Only one publication proposes indicators of organisational change.

Table 10   Publication: Indicators of organisational change

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 11)	Impact driver "organisational governance" with the indicators "gender-sensitive routines exist" and "Gender-specific routines exist".	Proposed for assessment

Indicator 3.5 Internal and external stakeholders are involved in the GEP implementation.

The involvement of internal and external stakeholders, besides the change agents with expertise in gender equality, is essential in gaining support and allies for the GEP (Mergaert, Cacace, and Linková 2022, 6). Among the internal stakeholders, leadership commitment is crucial, as already stated (Research Council of Norway 2016, 10). Thus, the indicator assesses if internal and external stakeholders are involved in implementing the GEP.

Only one publication proposes indicators of stakeholders.

Table 11   Publications: Indicators of stakeholder involvement

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "involvement of internal stakeholders" with five indicators (leadership engagement with the core team of change agents and GE work; variety of internal stakeholders; number of people/size of groups that engage with GE efforts; degree of adherence to GE goals; internal stakeholders start initiatives themselves) and impact driver "involvement of external stakeholders and experts" with four indicators (NGOs/CSOs are involved in the institutional GE work; gender dimension addressed in events; external partnerships with relevant institutions for GE work; external gender expertise available and used)	Proposed for assessment

Indicator 3.6 A policy for monitoring/controlling gender equality measures and the GEP implementation is in place.

In the programme management cycle, monitoring is a critical element in implementing and developing policy initiatives. Monitoring as a part of quality assurance is a prerequisite for a data-driven implementation and further development of the GEP. The European Commission declares data collection and monitoring mandatory for a GEP to comply with the Horizon Europe eligibility criterion (European Commission 2021a, 5).

The first quality assurance indicator generally asks if a monitoring and/or controlling system on gender equality is in place. A monitoring and controlling system goes beyond data collection because it links data to the objectives of the GEP and measures progress. Systems for quality assurance might also include other approaches like evaluation.

Many publications propose the collection and publication of sex-/gender-disaggregated data, but only a few deal with indicators of a monitoring policy.

Table 12   Publication: Indicators for the policy of monitoring and/or controlling gender equality measures and GEPs

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "Transparency and accountability" with "GE is included in unit reports and assessment for internal monitoring" and "GE reporting is done publicly available"; Impact driver "organisational governance" with the indicators "Gender analysis is considered in internal monitoring" and "Gender analysis is considered in internal audits and institutional assessments."	Proposed for assessment
Research Council of Norway (2016, 16)	What is the system of implementation and monitoring?	Recommendations for transnational indicators

Indicator 3.7   Sex-disaggregated data are collected and published.

Data collection is mandatory for Horizon Europe's eligibility criteria. "To be eligible for Horizon Europe, organisations must collect and publish disaggregated data on the sex and/or gender of personnel (and students, where relevant) and carry out annual reporting based on indicators" (European Commission 2021a, 23). Although Horizon Europe talks about "sex and/or gender", statistical data usually refer to sex (as "biological and physiological characteristics")[6], not to gender (as "social attributes and opportunities associated with being female and male and to the relationships between women and men and girls and boys, as well as to the relations between women and those between men"). Thus, the indicator focuses on sex-disaggregated data. The indicator doesn't ask for specific data but, more generally, if sex-disaggregated data are collected and published.

The literature proposes many quantitative data which rely on collecting sex-disaggregated data (Wroblewski and Eckstein 2018; Nimo 2021), but rarely do the publications propose a more general indicator about collecting and publishing data.

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[6] EIGE Glossary & Thesaurus, Sex: https://eige.europa.eu/publications-resources/thesaurus/terms/1048, gender: https://eige.europa.eu/publications-resources/thesaurus/terms/1046.

Table 13   Publication: Indicator about data collection and publication

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "Data collection and statistical analysis" with the indicators "institutional gender-disaggregated data are collected" and "institutional gender-disaggregated data and statistics are collected public and accessible"	Proposed for assessment
Higher Education Authority (2018, 46)	A comprehensive gender-disaggregated data collection system will be in place in every HEI.	Recommendations

Indicator 3.8   Gender diversity and intersectional perspectives are integrated into the monitoring or data collection:

- ***Inclusion of a broader and non-binary understanding of gender diversity***
- ***Inclusion of other inequalities in conjunction with gender***

The expanded approach to open gender equality "to intersections with other social categories" (European Commission 2020, 16) and to inclusive gender action plans (European Commission 2022) (see indicators 2.5 and 2.6) also concerns monitoring and data collection as part of inclusive GEPs. Feminist theory and gender research, on the one hand, and legal changes in some European countries, which recognise genders other than men and women, on the other hand, call attention to the fact that gender-disaggregated data must go beyond a binary concept. Thus, the indicator informs if and how monitoring and data collection integrate a non-binary understanding of gender (Hadler et al. 2022; Lindqvist, Gustafsson Sendén, and Renström 2020).

In addition, integrating intersectional perspectives into monitoring and data collection refers to collecting data on inequalities other than gender, like race, class, and age, and combining different axes of inequalities, e.g., race and gender. The situation of collecting inequality data is very diverse in the European countries: Whereas the Athena SWAN initiative has a strong emphasis and increasing attention to the intersectionality perspectives and data on ethnicity are part of the national statistics in the UK and Ireland, other countries like Spain, France and Germany refrain from collecting such data (Löther, Karataş, and Weber 2023, 37; Claeys-Kulik, Jørgensen, and Stöber 2019; Ovseiko et al. 2019).

We didn't find any indicator of monitoring the integration of a non-binary gender understanding, and only one proposed an indicator of intersectional approaches in data collection and monitoring.

Table 14   Publications: Indicators on gender diversity and intersectional perspectives in monitoring and data collection

Publication	Indicator	Used or recommended application
Mergaert, Cacace, and Linková (2022, 10)	Impact driver "Data collection and statistical analysis" with the indicator "Intersectional gender-disaggregated data are collected and published"	Proposed for assessment

3.3.4 Impact

Impact relies on the long-term effects of measures and interventions like GEPs. The evaluation of GEPs and gender equality policies is needed to measure and assess these impacts fully. (Technische Universität Wien 2021; Bührer et al. 2020; Palmén et al. 2019a; Aldercotte 2018; Wroblewski, Kelle, and Reith 2016). The focus groups also confirmed that it is impossible to analyse the impact from the outside but rather internally. Using qualitative approaches to capture impact is preferable, as it relies on institutional reflection.

Despite this limitation, the INSPIRE indicators aim to monitor impact mainly by assessing factors that enable change towards gender equality. Indicators which assess these factors are included in the chapters "Characteristics" and "Implementation".

Following the allusion to institutional reflection, the impact indicators monitor the understanding of the impact and the methods and data used in the RPOs and refer to self-assessment. To obtain quantitative data, the indicators ask for changes in the gender distribution in leadership positions.

Indicator 4.1   The GEP includes a reflection or description of the GEP impact. The organisation reflects its understanding of the GEP impact.

Asking about the impact understanding and methods/data used refers to accountability, transparency, and quality assurance as impact drivers. This indicator informs whether the organisation reflects on the impacts of the GEP.

Douglas Oloyede (2014) doesn't provide indicators of the understanding of impact but integrates the reflection on impact in developing qualitative indicators for measuring progress on equality.

Table 15   Publications: Indicators on the understanding of impact

Publication	Indicator	Used or recommended application
Douglas Oloyede (2014, 10)	What change in factors (experience, attitudes, confidence, behaviour) do you want to see? What would success look like, and how should it be measured?	Questions for developing qualitative indicators

Indicator 4.2 The GEP designates data and methods (e.g. evaluations, surveys or qualitative data) to assess the GEP impact.

The indicator is linked to the previous indicator and refers to accountability, transparency and quality assurance. Indicators 3.6 and 3.7 inform about monitoring systems and data collection, while this indicator provides more precise information on impact assessment methods. We found one publication with such indicators.

Table 16   Publications: Indicators of data and methods to assess the impact

Publication	Indicator	Used or recommended application
Claeys-Kulik, Jørgensen, and Stöber (2019, 36)	How do you measure the impact of your activities on diversity, equality and inclusion? Options: number of students/staff/ graduation rate – from underrepresented/disadvantaged backgrounds; success stories	Used in a survey among HEIs

Indicator 4.2 Changes in the participation of women within a fixed period (5-10 years) and comparing RPOs with/without GEP (or gender equality measures) in leading positions

Most gender equality impact indicators presented in the literature rely on data on the representation of women at different career stages. Calculating changes in time and using the difference-in-differences approach (comparing institutions with/without GEPs) are possibilities to causally attribute observed effects to the intervention (implementation of a GEP).

The focus groups proposed integrating several career stages and positions, such as leadership positions, newly recruited women in leadership positions, non-academic positions and administrative staff, senior managerial positions, and decision-making boards. Because the indicators aim to monitor GEPs on a supra-institutional and European-wide level, we decided to restrict the indicator to leadership positions, namely grade A according to the She Figures

(European Commission 2021c, 110) and leading researcher (R4) according to the European Framework for Research Careers (European Commission 2011, 2).

Table 17   Publications: Indicators on the representation of women

Publication	Indicator	Used or recommended application
Nimo (2021, 445)	Number of predoctoral contracts, percentage of women graduates, percentage of women in decision-making bodies	Used for monitoring of a specific university
Stadler and Wroblewski (2021)	Composition of students, graduates and different groups of employees, gender pay gap among professors, glass ceiling index, presence of women in appointment procedures	Used in gender equality reports of Austrian universities
O'Connor and Irvine (2020)	Gender pay gap, gender profile of the professorate, gender profile of senior management	Used in the evaluation of several gender equality initiatives in Ireland
Löther (2019, 7)	Evaluation of the proportion of women professors at HEIs participating or non-participating in a German gender equality program	Used in the evaluation of the German women professors programme
Gregory-Smith (2018, 479)	Female employment and female part-time professors; comparison of schools who have applied for Athena SWAN and schools which have not	Used to evaluation the effectiveness of Athena SWAN
Stepan-Norris and Kerrissey (2016, 226)	Percentages of women among faculty, new faculty hires and separations	Used for the evaluation of the ADVANCE Program in one university

Wroblewski and Leitner (2013)	Gender pay gap, gender in recruitment procedures	Used for the analysis of gender equality reports in Austrian universities.
Timmers, Willemsen, and Tijdens (2010)	Changes in the share of women among academic staff, professors, PhD students and students; changes in the glass ceiling index	Used for the evaluation of gender equality policies in Dutch universities

Indicator 4.3 ***Rating of the changes in the areas of activity (gender balance, awareness, knowledge about gender (and other) inequalities, promotion and recruitment procedures, work-life-balance) and relevance of GEPs for the achieved changes***

Impact monitoring on the level of individual organisations uses surveys among staff and students, but this approach is not feasible for comparing institutions on a supra-organisational level. Besides expert and qualitative assessments (Mergaert, Cacace, and Linková 2022; Douglas Oloyede 2014), which are not possible for the international monitoring of a large sample, self-assessment of the organisations is another approach, although suffering from biased rating as mentioned in the focus groups.

A GEP and measures, as well as other circumstances inside and outside the organisation, can affect changes in gender equality. Thus, the indicator should also inform about the relevance of the GEP for the achieved changes, which should also be measured through self-assessment.

The "six stages of institutional capacity development" of the impact driver model, labelled as "Starting point, Project, Inception, Growth, Integration, and Institutionalisation" (Mergaert, Cacace, and Linková 2022, 9), could serve as a scale for the self-assessment.

Two publications mention indicators of self-assessment and estimating the relevance of gender equality actions:

Table 18   Publications: Indicators on impact self-assessment

Publication	Indicator	Used or recommended application
Doneva, Gaftandzhieva, and Boykova (2022)	Estimated the relevance of gender equality actions for the achievement of the observed outcome (quantitative and qualitative achievements)	Proposed for GEP implementation reports for individual organisations
Douglas Oloyede (2014)	Qualitative questions at institutional, departmental and functional levels: How far is equality mainstreamed or embedded? Whether attitudes towards equality have become more positive? A belief that equality is taken into account at the senior strategic level.	Questions for developing qualitative indicators

3.4 Adapting the Indicators for Reactive and Non-Reactive Methods

Based on the conception of indicators for GEP monitoring, we examined how the indicators apply to non-reactive methods (namely web scraping, automated text analysis, and public available administrative data) and reactive methods (the survey).

Table 19   Operationalising the indicators for reactive and non-reactive methods

Indicator	Non-reactive methods	Reactive methods	Challenges
Indicator 1.1 A gender equality plan or a written and formal institutional strategy that fosters gender equality) exists in a research-performing or research-funding organisation.	web scraping	survey	Definition of GEP; common and comparable understand of GEP; different focus on gender equality, equity and/or diversity with differences according to countries and organisation types; unit of the GEP (whole organisation, not departments)
Indicator 1.2 The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of: participation in EU funded structural change projects	search in CORDIS database	not necessary when using a list of participating organisations	
Indicator 1.2 The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of: Received funding other than EU projects, e.g., from national RFOs	not possible	survey	Clear distinction between funding for gender equality measures or setting up a GEP
Indicator 1.2 The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of: Received non-monetary support	not possible	survey	Clear distinction between funding for gender equality measures or setting up a GEP
Indicator 1.2 The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of: Requirements linked to getting European research funding	web scraping or text analysis	survey	Survey: answering truthfully
Indicator 1.2 The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of: Requirements for research funding (national)	not possible; using EU reports	survey	Survey: answering truthfully
Indicator 2.1 Ownership and hierarchical level of the organisation that adopted the GEP: ownership of the GEP	text analysis	survey	Comparability of boards; defining the highest board

Indicator 2.2 Publication of the GEP: publication accessible to people outside the organisation, internal publication (accessible to all members of the organisation), internal document (accessible only to the management)	not possible	survey	Publication is one of four criteria for a GEP according to Horizon Europe.
Indicator 2.3 Date of the first and current plan's adoption	not possible	survey	Respondents might not know the first GEP; changes in GEP concepts over time
Indicator 2.3 Time frame of the current plan	text analysis	survey	
Indicator 2.4 Areas of activity (grouped according to the specification for Horizon Europe) addressed in the GEP: Prevalence: Are there measures in each area of activity	text analysis	survey	Clear description of the areas
Indicator 2.4 Areas of activity (grouped according to the specification for Horizon Europe) addressed in the GEP: Quantity: How many measures in each area of activity	not possible	survey	Difficult to count the measures; difficult comparison and assessment
Indicator 2.5 The GEP integrates inclusive approaches.	text analysis	survey	Aspects: gender diversity, intra-categorial differences, intersectionality as concept, diversity as concept. Different understanding of the concepts in different countries (gender diversity: references to non-binary gender identities and to gender-mixed teams)
Indicator 2.6 The GEP addresses different inequalities (race, class/social background, age, etc.).	text analysis	survey	List of inequalities
Indicator 3.1 Assessment of planned and implemented gender equality measures (by areas of activity)	not possible	survey	Common understanding and comparability of the scale "planned", "started", "implemented"; status of the implementation depends on the time frame of the GEP
Indicator 3.2 Financial resources are dedicated to gender equality measures/implementation of GEP.	not possible	survey	Dedicated resources = one of four criteria for a GEP according to Horizon Europe; amount difficult to determine (no fixed budget, resources in different parts of the organisation)
Indicator 3.3 A gender equality unit, gender equality committee and/or dedicated staff are in place.	web scraping or text analysis	survey	Differentiation between staff and internal stakeholders/change agents (voluntary

			activities); provide exact definitions or list of functions
Indicator 3.4 Gender equality is integrated into institutional/internal regulations (appointment regulation, basic rules of the institution, etc.).	difficult: web scraping and text analysis of vision, strategy or mission statement	survey	Provide a list of core regulations
Indicator 3.5 Internal and external stakeholders are involved in the implementation of GEP.	not possible	survey	Differentiation between the adoption and implementation of the GEP
Indicator 3.6 A policy for monitoring/controlling gender equality measures and the GEP implementation is in place.	text analysis	survey	Focus on mentoring or quality assurance (including evaluation)
Indicator 3.7 Sex-disaggregated data are collected and published: collection	text analysis	survey	Data collection = one of four criteria for a GEP according to Horizon Europe
Indicator 3.7 Sex-disaggregated data are collected and published: publication	text analysis	survey	
Indicator 3.8 Gender diversity and intersectional perspectives are integrated into the monitoring or data collection.	not possible	survey	Comparable understanding of gender diversity and intersectional perspectives; clear definition and explanation necessary
Indicator 4.1 The GEP includes a reflection or description of the GEP impact. The organisation reflects its understanding of the GEP impact.	text analysis	survey	Analysis of qualitative data
Indicator 4.2 The GEP designates data and methods (e.g. evaluations, surveys or qualitative data) to assess the GEP impact.	text analysis	survey	Provide a list of possible methods
Indicator 4.2 Changes in the participation of women within a set period (5-10 years) and comparing RPOs with/without GEP (or gender equality measures) in leading positions	HEI: ETER data base; GOV, BES and RFO: not possible	survey	Exact definition of career stages; comparability of the career stages; availability of data; willingness to indicate the data in a survey

Indicator 4.3 Rating of the changes in the areas of activity (gender balance, awareness, knowledge about gender (and other) inequalities, promotion and recruitment procedures, work-life-balance) and relevance of GEPs for the achieved changes: assessment	not possible	survey	Self-assessment is influence by the position of the respondent (management, gender equality staff);understanding of the scale; comparability; lack of a baseline
Indicator 4.3 Rating of the changes in the areas of activity (gender balance, awareness, knowledge about gender (and other) inequalities, promotion and recruitment procedures, work-life-balance) and relevance of GEPs for the achieved changes: relevance	not possible	survey	Self-assessment is influence by the position of the respondent (management, gender equality staff);

4 Non-Reactive Methods

This chapter will display how we operationalised and applied the developed indicators for GEP monitoring (see chapter 2) to non-reactive methods (namely web scraping and automated text analysis). INSPIRE will develop and pilot a "non-reactive" instrument designed to operate autonomously, navigating through the vast landscape of the internet and extracting pertinent information directly from websites. This innovative approach involves creating and testing a sophisticated automated web-crawling system. It allows for real-time and continuous data gathering, providing a dynamic and up-to-date perspective on the prevalence of GEPs. The web crawler becomes a proactive tool, proactively seeking and extracting relevant data, eliminating the lag associated with reactive survey instruments.

The non-reactive method is an umbrella term which refers to techniques where data is collected without subjects being aware that they are monitored (R. M. Lee 2019; Webb et al. 1999; Janetzko and Kennke 2004). Hence, these methods are also known as *unobtrusive, indirect, hidden, naturalistic, noninvasive, or non-disruptive*. From an epistemological standpoint, if the researcher does not interact with the subjects during the study, it can be considered non-reactive, i.e., a simple observatory or archive document (Janetzko 2016). The main objective of this strategy is to reduce the influence of observation on the reactions of the individuals or cases who participate in the research. Given that people tend to change their behaviour when they know they are under study, non-reactive approaches allow the capture of more unbiased data (Webb et al. 1966, pr. [1976]). Early literature addresses three non-reactive methods: simple observations, physical traces, and non-reactively gathered archive documents (Webb et al. 1966, pr. [1976]).

For over a decade, novel non-reactive methods such as data gathering from the internet have prevailed, e.g., big data. The tremendous growth of the internet over the last decades has created new possibilities for researchers for non-reactive data collection. This possibility includes using datasets from which information can be gleaned, e.g., via data mining, web scraping, etc. (Leskovec, Rajaraman, and Ullman 2020). Big data represents the new kinds of digital data available and the tools and technologies required to access these data. Big data was claimed to be a paradigm shift in how we comprehend the world (Eynon 2013; Lazer and Radford 2017). Many scholars, including social scientists, are utilising massive quantities of information produced by and about people, things, and their interactions to extend knowledge and respond to research questions. To that end, new technologies (e.g. APIs for web crawling) allow the collection of enormous data (Olmedilla, Martínez-Torres, and Toral 2016; Eynon 2013).

Recent developments in information technologies have enabled data capture, storage, and handling to be quicker and more effective than traditional methods. Automation is rapidly growing, significantly influencing research (Yarkoni et al. 2021). In that regard, Big Data creates an opportunity in social science from the quantitative side, which can facilitate traditional social science methods where collecting data has always been challenging, time and resource-intensive (Olmedilla, Martínez-Torres, and Toral 2016; Macanovic 2022).

In big data, web scraping and web crawling technologies automate obtaining massive amounts of data from the Internet (Nigam and Biswas 2021). Web scraping and web crawling are related

and essential methods for collecting data from the internet, each serving a distinct role within the broader context of information retrieval (Kulyk 2023).

Before exploring the INSPIRE approach to monitor GEPs via non-reactive methods, some basic information about data extraction from the internet is essential for understanding.

4.1 Web Crawling versus Web Scraping

Although web crawling and web scraping share commonalities in their use of HTTP requests and parsing of HTML, their objectives differ fundamentally. Web crawling focuses on systematic exploration and indexing, forming the foundation for search engines (Sheinbaum 2023). Web scraping is centred around targeted data extraction for specific analysis and application purposes (Barton 2023). Together, these techniques complement each other, offering a comprehensive approach to understanding and utilizing the vast resources available on the web.

Understanding the two processes of web scraping and web crawling and how they interact or are used in our INSPIRE project is indeed crucial, especially for tasks involving data collection, analysis, and application.

4.1.1 Web Crawling

Web crawling, often called web indexing, is a robust technique employed to systematically navigate the extensive terrain of the internet and catalogue information from websites. This methodical approach is a foundational process for search engines, facilitating the creation of comprehensive indexes that enable efficient information retrieval (Sharma, Shrivastava, and Singh 2021).

Web crawling involves a crawler, also known as a spider or bot, systematically traversing through web pages by following hyperlinks from one page to another. Unlike web scraping, which focuses on extracting specific data, web crawling is more concerned with indexing and mapping the web structure. The primary objective is to collect metadata and identify relationships between web pages.

The initiation of web crawling starts with a crawler sending HTTP or HTTPS requests to a list of seed URLs. These URLs act as starting points for the crawler to navigate the web. When the crawler visits a webpage, it collects information about the page, including its content, URL, metadata, and any hyperlinks present. The collected data is then processed, stored, and organised, to create a comprehensive map of interconnected web pages.

One key distinction lies in the breadth of coverage. Web crawling aims to explore many pages, and index their content for efficient search functionality. The process involves traversing domains, sub-domains, and various pages within a website, ensuring a thorough examination of the entire web landscape (Sharma, Shrivastava, and Singh 2021).

Web crawlers often prioritize pages based on relevance, popularity, or recency to enhance efficiency. This prioritization ensures that the crawler focuses on indexing the most valuable and up-to-date content. Commonly employed algorithms, such as Breadth-First Search (BFS) or Depth-First Search (DFS), guide the crawler in navigating the web's complex structure.

4.1.2 Web scraping

"Web-scraping" refers to the automated process of extracting data from webpages, typically using a software program (Luscombe, Dick, and Walby 2022; Noortje and Esther 2012). It is commonly used to gather information from various websites for analysis or research purposes. Using computational methods, web scraping allows data collection activities to be automated with established package examples (McDonnell 2020). Web scraping is also known as web harvesting or web data extraction. It is a systematic approach to gathering valuable data from the web, transforming it from an unstructured format into an organized structure suitable for analysis and application. Web scraping finds extensive use in various domains, including data analysis, research, and competitive intelligence, making it an indispensable tool for companies, researchers, and analysts.

At its core, web scraping involves systematically navigating through the underlying HTML structure of websites to locate and extract specific data. To initiate web scraping, tools send HTTP or HTTPS requests to the targeted website's server, replicating the behaviour of a web browser requesting a webpage and systematically navigating through the underlying HTML structure of websites to locate and extract specific data. Once the HTML content is received, the web scraper parses it. This process involves breaking down the HTML into a tree-like structure, leveraging distinctive HTML tags such as **<div>**, **<p>**, and **<span>**, which organize and present content on the webpage. This parsing process transforms raw HTML into a structured format, facilitating more straightforward navigation and identifying specific elements within the HTML.

The efficacy of web scraping lies in its ability to navigate the structured HTML and pinpoint desired data accurately. XPath and CSS selectors play pivotal roles in this navigation. With its path-like syntax, XPath provides a systematic roadmap for the scraper. Conversely, CSS selectors use patterns for selection, offering flexibility in identifying and isolating elements on a webpage.

These tools act as virtual compasses, guiding the web scraper to specific elements on a webpage for extraction. Be it text, images, links, or other content, the scraper identifies and extracts targeted data using established paths and patterns. This meticulous process ensures precision in data extraction, allowing the scraper to selectively gather information relevant to its intended purpose.

Post-identification and extraction, the next step involves storing the information in a structured format. This structured storage facilitates subsequent analysis, making the extracted data valuable for informed decision-making. Typical formats for storage include CSV files,

databases, or JSON formats, each chosen based on the specific requirements of the intended analysis.

Websites often include a file called "robots.txt" that provides guidelines for web crawlers and scrapers. This file outlines which sections of the site can be accessed or scraped and which should be avoided. Adhering to these guidelines and respecting a website's terms of service and privacy policies is imperative for ethical and responsible web scraping practices.

Moreover, the dynamic nature of the web demands adaptability from web scrapers. Websites frequently undergo structural changes, and a scraper must be designed to handle these alterations gracefully. Failure to do so can result in broken scraping scripts, underscoring the importance of continuous monitoring and adaptation.

4.2 Detecting The GEPs: The INSPIRE's Web Scraper

INSPIRE aims to address the existing gap in monitoring the prevalence of GEPs across European countries and sectors. The objective of INSPIRE's web scraper derives from the Prevalence indicator (see chapter 3.3.1), which aims to measure whether a GEP is in place in research-performing or funding organisations and inform about the context of these plans. To this end, INSPIRE aims to establish a robust, efficient, and scalable methodology for monitoring the prevalence of GEPs across various industries and regions in Europe, particularly from the challenging-to-reach private sector, that can be reused for future research.

Recent research from the 2018 edition of *She Figures* makes usage of web scraping. *She Figures* measured the proportions of organisations that hold gender equality measures, implementing the web-scraping tool (European Commission 2021b). Their web scraping tool reached an 86% accuracy rate in the trial phase. Nevertheless, this accuracy rate decreased when GEPs' PDFs associated with the webpage were also included in the analysis (European Commission 2021b; European Commission - DG Research 2021).

Currently, a reliable tool is lacking to track GEPs systematically. INSPIRE's web scraper aims to fill a critical gap in gender equality assessment across diverse sectors in Europe. The INSPIRE web scraper is an extended version of a traditional web scraper. We build upon web crawling that serves as a means of systematic exploration and indexing, ensuring a comprehensive understanding of the web landscape. We use SerpAPI[7] and specify Google's crawled database to build INSPIRE's scraper. Google regularly crawl the webpages and index them based on their content. This enables INSPIRE to utilize SearpAPI for enhanced web scraping, effectively leveraging data from search engine-crawled sources. We use SearpAPI to enhance our INSPIRE web scraping efforts by incorporating data that search engines have already collected. This approach capitalizes on the thorough and continuous web crawling carried out by search engines, enabling us to streamline the extraction of targeted and pertinent information. The web scraper is specifically designed to search for predetermined terms related to GEPs on the identified web domains. By analysing the content of web pages

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[7] SerpApi: Google Search API

for these specific terms, the web scraper will retrieve relevant search results indicating the prevalence of GEPs within a particular webpage in the domain.

Using SearpAPI for web scraping leverages the autonomy and versatility of existing search engine web crawling, along with focused accuracy, to ensure a complete and detailed understanding of GEP prevalence across various websites and domains. Nonetheless, referring to our methodology as a 'scraper' aligns more accurately with the practices of web scraping. The following chapters will explain the development of INSPIRE's scraper steps in depth.

Figure 3   Web Scraping Process

- •4.2.1 Tool selection for Web-scraping
- •4.2.2 Defining Search terms
- •4.2.3 Methodology to reveal the indicator "prevalence"
- •4.2.4 Methodology to downlaod GEPs
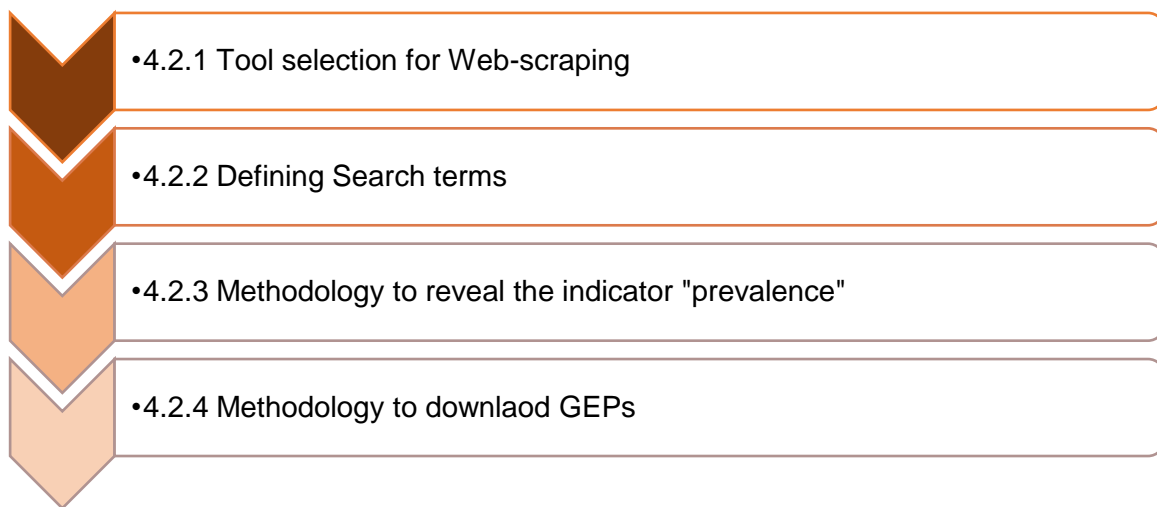
4.2.1 Tool Selection For Web-Scraping

Numerous libraries, including open-source ones, exist for web scraping and crawling in various programming languages (Glez-Peña et al. 2013). For the INSPIRE project, among many others, we examined three possible tools for constructing the scraper: Scrapy[8], a Python scraping toolkit; OpenSearchServer[9], a Java-based search engine software; and SerpAPI, a real-time API for accessing Google search results. We thoroughly compared these three tools, focusing on critical factors such as performance, features, and ease of use.

Although Scrapy and OpenSearchServer are open-source tools for web scraping while using, we noticed that their scaping rate is slow, making it very difficult to scrape 6,904 URLs for the full sample (see chapter 2.2). In addition, these tools have a notable risk of the server IP being blocked or receiving abuse reports, necessitating proxy services to mitigate this risk. In contrast, SerpAPI poses no threat of IP blocking and delivers fast, instant outcomes by utilising Google's extensive dataset. Eventually, we chose SerpAPI to develop INSPIRE's scraper since it is easy to use, allowing us fast query results with minimal response time.

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[8] https://scrapy.org/
[9] https://www.opensearchserver.com/

Scrapy

Scrapy is a robust open-source web crawling framework for Python that provides comprehensive web scraping and data extraction functionalities. In the realm of continuous text processing, Scrapy offers a range of features that make it a versatile tool for navigating websites, retrieving textual content, and organizing data seamlessly.

Scrapy allows users to define and customize spiders, which are scripts that specify how to navigate a website, follow links, and extract information. This flexibility enables users to tailor their web crawling strategies to the specific structure and requirements of the target websites. Scrapy's support for XPath and CSS selectors makes it efficient in extracting continuous text from HTML pages, ensuring accurate textual content retrieval.

The framework's ability to handle asynchronous requests and responses enhances its efficiency in dealing with dynamic content, such as JavaScript-generated pages. This ability ensures that Scrapy can effectively crawl and extract information from modern, interactive websites.

Scrapy supports various storage backends, allowing users to store and organize the scraped data in different formats and databases. Additionally, the framework provides mechanisms for handling common challenges in web crawling, such as handling cookies, redirects, and managing user-agent headers.

Pros:

- **Open Source and Free:** Scrapy is an open-source framework, making it freely accessible to developers and organisations. This affordability factor is particularly advantageous for those operating on tight budgets or looking for cost-effective solutions.
- **Concurrency:** Scrapy supports asynchronous requests and can handle multiple requests concurrently, enhancing performance during web scraping.
- **Compliance with Robots.txt and Noindex Rules:** Scrapy respects the rules outlined in the robots.txt file and adheres to no index directives. This ensures that the scraping activities align with ethical standards and legal guidelines, promoting responsible web scraping practices.

Cons:

- **Slow Scraping:** A notable drawback of Scrapy is its slow scraping speed. This slow processing can hinder the efficiency of data retrieval and impact the overall performance of scraping tasks.
- **Risk of IP Blocking and Abuse Reports:** A notable concern with Scrapy is the associated risk of server IP blocking and the potential receipt of abuse reports. This risk is particularly significant during extensive and prolonged scraping operations, and using proxy services is a must to overcome this issue.

Significant challenges surfaced when we implemented the INSPIRE web scraper while using Scrapy. Performance issues, such as slow scraping and frequent crashes, became apparent early in the implementation phase. For instance, the tool crashed after approximately 20 hours while crawling Greece's URL list without yielding any output. Moreover, a similar scenario occurred while exploring Ireland's URL list, with the tool crashing after around 26 hours and retrieving only a limited set of results. These issues persisted across the testing of multiple countries, URLs, and specific search terms, preventing Scrapy from completing the required scraping tasks. It became evident that these limitations hindered our ability to achieve the desired functionality and reliability needed for INSPIRE's objectives.

OpenSearchServer

OpenSearchServer is an open-source search engine software that offers robust functionalities in the context of web crawling. It allows users to efficiently index and search through large volumes of data on the web. With its web crawling capabilities, OpenSearchServer can systematically navigate websites, retrieve information, and organize them for effective search operations. The software supports continuous text processing, enabling seamless analysis and indexing of textual content.

OpenSearchServer's web crawling functionality includes trailing websites, following links, and extracting textual data from HTML pages. It can handle dynamic content by executing JavaScript, ensuring it captures information from modern, interactive websites. The software supports customizable configurations for crawling, allowing users to tailor the crawling process to their specific needs.

The continuous text processing aspect of OpenSearchServer involves extracting and analysing textual content from web pages. The software can handle various text formats, ensuring that it can effectively index and search through diverse types of content. It also supports extracting metadata and other relevant information to enhance the search experience.

Pros:

- **Index Creation:** The software creates and utilizes its indexes, forming a crawled site database. This database organizes the indexed information in a structured format, optimizing search performance and retrieval.
- **Indexing Speed:** OpenSearch Server is designed to handle large-scale data and provides good indexing speed for structured and unstructured data.
- **Customization Options:** Users can customize stored values, indexes, scoring mechanisms, and other aspects, tailoring the search engine to specific needs.
- **Parser Capabilities:** The parsers can extract full-text data from various formats, including web pages, PDF files, office documents, and images, enhancing the search engine's versatility.

- **Administrative UI:** The Administrative UI provides a user-friendly interface for managing and configuring the search engine, including the export functionality for query results.
- **API Integration:** The ability to integrate OpenSearchServer through a RESTful API allows for seamless collaboration with other applications and systems.
- **Free to use:** Being open source, OpenSearchServer is accessible to a wide range of users, including developers, businesses, and organisations, without incurring licensing costs.
- **Compliance with Robots.txt and Noindex Rules:** OpenSearchServer respects the rules outlined in the robots.txt file and adheres to no index directives. This ensures that the scraping activities align with ethical standards and legal guidelines, promoting responsible web scraping practices.

Cons:

- **Slow Scraping:** The software may have limitations in terms of scraping speed, potentially resulting in slower data retrieval and indexing processes.
- **Risk of IP Blocking:** There is a notable risk of the server IP being blocked or receiving abuse reports, necessitating proxy services to mitigate this risk.
- **Storage Resource Requirements:** OpenSearchServer may require substantial storage resources, with examples indicating that initial indexes for multiple domains can take up significant disk space, leading to potential cost implications.

SerpApi

SerpApi is a third-party API service that extracts Search Engine Results Pages (SERPs) data. It simplifies obtaining information from search engines like Google, Bing, and Yahoo. While SerpApi is not a web crawling framework like Scrapy, it focuses on providing an easy-to-use interface for developers to access search engine results in a structured manner.

With SerpApi, developers can request HTTP API requests, specifying the search query and parameters. The API then returns structured JSON data containing search results, including titles, snippets, URLs, and other relevant information. This approach eliminates the need for complex web scraping and parsing code, as SerpApi handles the intricacies of interacting with search engines.

In terms of continuous text processing, SerpApi allows users to extract and process textual content from search results efficiently. The API response includes the text-based information in the SERPs, enabling users to analyse and utilise the extracted text for their specific needs.

SerpApi abstracts away the complexities of handling various search engine quirks, including changes in HTML structures and anti-scraping measures. It provides a straightforward solution for obtaining search engine data without maintaining and updating complex scraping scripts.

Pros:

- **Uses Google's Database:** SerpApi leverages Google's extensive database for search results, providing users with access to a wealth of data directly from Google's search engine. This ensures the reliability and comprehensiveness of the search results.
- **Instant Query Results:** One of the significant advantages of SerpApi is its capability to deliver instant query results. These results are paginated, allowing users a maximum of ten results per page, and are ordered based on Google's relevance score. This feature ensures quick and efficient access to up-to-date and relevant information.
- **No Blocking Issues:** Unlike some other scraping solutions, SerpApi boasts a no-blocking characteristic, meaning users are less likely to encounter issues related to IP blocking or restrictions during their scraping activities. This enhances the reliability and continuity of the scraping process.
- **API Integration:** SerpApi supports seamless integration through its API. This allows developers to incorporate SerpApi's functionalities directly into their applications or systems, providing a flexible and efficient solution for various use cases.
- **Response Time**: SerpApi aims to provide fast and reliable responses for search engine results. The API is designed to minimize latency and deliver data quickly.
- **Concurrency**: SerpApi allows for concurrent requests, enabling users to fetch multiple search engine results simultaneously enhancing performance for large-scale data extraction.
- **Caching**: The API may use caching mechanisms to improve response times further for frequently requested queries.
- **Compliance with Robots.txt and Noindex Rules:** SerpApi respects the rules outlined in the robots.txt file and adheres to no index directives. This ensures that the scraping activities align with ethical standards and legal guidelines, promoting responsible web scraping practices.

Cons:

- **Limited Intervention in Index Schema:** One limitation of SerpApi is the lack of extensive control over the index schema. Users have limited opportunities to intervene and customize the index schema according to their specific requirements. This may be a constraint for those with advanced customization needs.
- **Returns Only Allowed-to-Index Results:** SerpApi returns only results that are allowed to be indexed according to Google's policies. While this aligns with ethical practices, it may limit the types of data available for scraping, especially if the goal is to retrieve results that are not typically indexed.
- **Monthly Subscription Requirement:** To access SerpApi's services, users must subscribe to a monthly plan starting from approximately €50 per month. While this subscription model provides consistent access to the service, it introduces a recurring cost, which may be a consideration for budget-conscious users or those with sporadic scraping needs.

Comparison

Table 20 consolidates the findings of the above analysis and highlights crucial aspects that inform our decision-making process for selecting the most suitable web crawling mechanism for the INSPIRE project.

Table 20   Comparison table of OpenSearchServer, Scrapy, and SerpApi

Feature / Characteristic	OpenSearchServer	Scrapy	SerpAPI
Type	Search Engine Server	Web Crawling Framework	Search Engine API
Open Source	Yes	Yes	No
Language	Java	Python	REST API (various languages)
Scalability	Scalable	Scalable	Highly scalable
Performance	Good	Depends on configuration and hardware	Fast and reliable
Customization	Extensive	Modest	Limited
Web Crawling	Yes	Yes	No (Search API)
Data Source	Full-text search, structured data	Web scraping	Search engine results
Full-Text Extraction	Yes	Yes	Yes
Instant Query Results	No	No	Yes (Paginated)
Risk of IP Blocking	Possible	Possible	No
API Integration	Yes	Yes	Yes

Robots.txt Compliance	Yes	Dependent on Implementation	Yes
Pricing	Free and open-source	Free and open-source	A freemium model with pricing tiers
Intervention in Index Schema	Yes	Limited	Limited
Ease of Use	Moderate	Moderate to Advanced	Easy
Documentation	Comprehensive	Well-documented	Comprehensive

In addition, we have conducted benchmark tests with all tools to assess the prevalence of GEPs in a subset of the piloting dataset. This subset was manually verified to confirm the true GEP prevalence, ensuring a reliable basis for assessing the performance of the tools. This manual verification process refers to assessing whether the institutions in the pilot study (see chapter 1) have a GEP by checking their web pages manually. The manual verification process enabled us to perform a more comprehensive comparison of the three tools, specifically tailored to meet the requirements of the INSPIRE project.

Table 21   GEP prevalence with OpenServer vs SerpApi (October 2023)

	Organisations with GEPs	Detected with OpenServer	Detected with SerpApi
Ireland	12	3	9
Greece	17	4	7
Germany	20	5	7
Estonia	6	3	4

Table 21 illustrates the results of the two web scraping tools, OpenServer and SerpAPI, that use the same search terms. SerpAPI overperforms OpenServer in detecting GEPs in selected institutions for the pilot study. Therefore, after carefully analysing the available features, performance metrics, and ease of integration, we have chosen SerpApi as the optimal solution for our study. The decision was made with a focus on scalability, ease of implementation, and the reliable extraction of data, ensuring that our web crawling mechanism aligns perfectly with the objectives of INSPIRE.

4.2.2 Defining Search Terms

We started developing our web scraping approach by defining appropriate search terms that would yield the presence of a GEP in a given domain. The **search terms** refer to the words searched in web domains. Selecting search terms plays a crucial role in web-scraping because these search terms are explored by the scraper not only on the web page's content but also in the metadata[10] of the webpage, i.e., keywords, description, and title.

We launched our first web scraper approach by doing trials with *She figures'* search terms (European Commission 2021b)[11]. This method yielded many hits due to the fact that it aims to detect Gender Equality measures. We then modified the search terms by selecting those that are either in proximity to the term "**gender equality plan**" or may indicate the existence of a gender equality plan. During this process of manual assessment, we noticed that in the English-speaking context, the terms "**gender action plan**", "**gender equality charter**", and "**gender equality action plan**" are also commonly used interchangeably. Therefore, the mentioned terms are included in the **search terms** list. Moreover, we consider country-specific terms in our scraping strategy while considering the country's cultural context. For example, the term "**Athena SWAN**" is included in the **search terms** for Ireland as this is one of the country's relevant charters.

Defining final search terms is composed of several steps:

  i.   Defining initial search terms in English.
  ii. Translating search terms into pilot study languages: Greek, Estonian and German.
  iii. Expert verification of search terms in the country context.
  iv. Including/excluding search terms based on experts' suggestions.
  v.   Defining the final search terms.

The complete search terms for the pilot countries can be found in the annexe (see chapter 8.2).

4.2.3 Methodology to Reveal the Indicator "Prevalence"

The methodology employed to ascertain the prevalence of GEPs within specific domains in the pilot dataset involved a systematic, multi-step approach utilizing the INSPIRE web scraper. The methodology is grounded in the premise that identifying terms related to the "gender equality plan" on an organisation's website indicates the presence of a GEP within that organisation. Therefore, in the initial phase, the selection of language-specific search terms (Greek, German, English, and Estonian) was underpinned by considering various aspects of gender equality within each linguistic and cultural context. This process ensured a comprehensive list of search terms that captured the diverse nuances of the topic.

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[10]Metadata on a webpage refers to information about the page's content that is not presented immediately to users while browsing the page.

[11] We are grateful to Quantos SA Statistics and Information Systems, who is responsible for web-scraping of She figures, for collaborating by providing us with their search terms for 29 countries.

Following the definition of search terms, the INSPIRE web scraper was deployed, initially focusing on querying each domain using language-specific terms in their corresponding countries (e.g., Greek search terms in Greek organisations). Ten results were targeted for each search, but the search did not yield the anticipated results regarding GEP prevalence. A strategic refinement of the methodology was undertaken in response to these outcomes. The subsequent step involved extending the web scraper's scope by incorporating language-specific search terms and introducing English search terms across all countries, fostering a comprehensive cross-linguistic analysis. This expanded methodology proved pivotal in unveiling the previously undetected GEPs, enhancing the comprehensiveness and effectiveness of our data collection process.

The 4-step approach

The evolution of our methodology led to the development of a refined and detailed 4-step approach, aiming to enhance precision in the search process:

1. **Initial Search with English Key Term:** Conduct an initial search using a single key term, specifically "gender equality plan" in English. If the search yields no results or fewer than 10, proceed to the next step.

2. **Local Language Search with Key Term Translation:** If the initial English search is unproductive, search using the translated equivalent of the key term in the local language. For example, if the project is focused on a Greek organisation, the search would utilize the translated term "gender equality plan" in Greek. If the results are insufficient (less than 10), proceed to the next step.

3. **Extended Search with Additional English Terms:** Expand the search by incorporating multiple terms in English to ensure a more comprehensive exploration. This step is an alternative in cases where the initial strict search did not reveal adequate results or none. If the outcome is still unsatisfactory (less than ten results), move on to the final step.

4. **Extended Search with Additional Local Language Terms:** Similar to step 3, extend the search by introducing various terms in the local language. We designed this step to capture nuanced aspects of gender equality plans that the earlier searches may not adequately represent. If the script does not retrieve any result in all four steps, the organiation is assumed not to have a GEP.

This systematic 4-step approach was implemented to refine the search process, ensuring that targeted and alternative methods are employed to reveal the prevalence of GEPs within specific domains.

While we experimented with executing the 4-step approach in the order 1-3-2-4, we observed worse performance in identifying GEP prevalence, leading us to decide to abandon this particular sequence. Our commitment to an iterative approach allows us to adapt and refine our methods for optimal outcomes. This adaptability, demonstrated in our methodology,

underscores its applicability beyond the pilot dataset, enabling us to navigate the complexities of identifying GEP prevalence across diverse linguistic and organisational landscapes.

Results of the 4-step approach

Hereby, we present a comprehensive analysis of the GEP prevalence using the three distinct approaches: language-specific searches, language-specific combined with English searches, and the refined 4-step approach (see Figure 4). We examine the effectiveness of these methodologies in extracting relevant information in the piloting dataset of the four European countries: Ireland, Greece, Germany, and Estonia. For each country, we manually detected:

i.   The number of language-specific search results
ii.   Results from language-specific combined with English searches
iii. Results obtained through a refined 4-step approach revealed the existence of a GEP within an organisation.

Figure 4   GEP prevalence from the incremental steps of the INSPIRE methodology (October – November 2023).
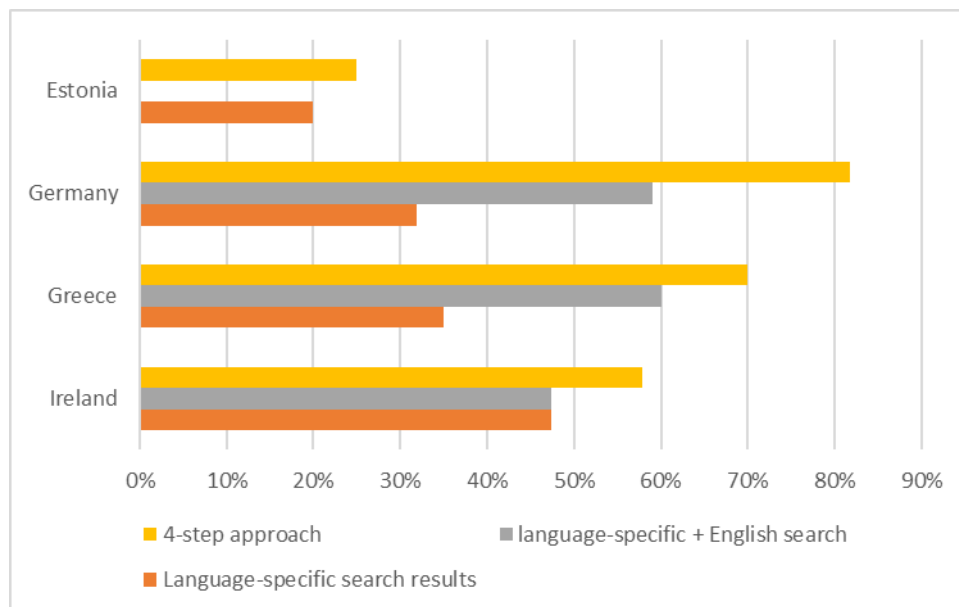
The percentage values represent the proportion of relevant results among the total number of organisations.

Key Findings:

● **Language-Specific Searches**: The 4-step approach consistently outperforms traditional language-specific searches in all countries.

● **Language-Specific + English Searches**: Greece significantly improves information retrieval when combining language-specific and English searches, emphasizing the importance of multilingual queries.

- **4-Step Approach**: The 4-step approach yields the highest percentage of relevant results across all countries, showcasing its effectiveness in extracting targeted information.

This comparative analysis underscores the importance of a tailored approach to language-specific information retrieval. The 4-step methodology is a robust strategy, while the combination of language-specific and English searches shows promise, particularly in multilingual contexts. As information retrieval methods evolve, understanding these nuances becomes crucial for optimizing search outcomes in diverse linguistic landscapes.

Quality assessment of the INSPIRE scraper for the Indicator "Prevalence"

We assessed the quality of INSPIRE's web scraper in gathering data on the "prevalence" indicator in four pilot European countries: Ireland, Greece, Germany, and Estonia. The quality assessment involved comparing manually detected GEPs with those obtained through automated scraping to gain insights into auto-scraping efficiency for this indicator. We first aimed to manually determine whether 83 organisations in our pilot sample (see chapter 2.1) had a GEP. Then, we performed 4-step web scraping on the same 83 organisations. Finally, we obtained results from both approaches to compare their results and assess the success of INSPIRE's web scraper. Manual detection revealed that 55 out of 83 organisations have a GEP, accounting for 66%. We assessed the success of INSPIRE's scraper using four measures from the evaluation metric: *accuracy*, *sensitivity*, *specificity*, and *precision*. These measures are widely used in information retrieval, machine learning, data mining, and medical diagnostics (Das et al. 2019; Hossin and Sulaiman 2015; Powers 2020; Wang 2022). Based on the evaluation metrics used, we determined the success of INSPIRE's scraper.

Table 22   A comparison: web scraper vs manual detection

		Truth (as assessed by us manually)	
		Positive	Negative
Scraping result	Positive	$N_{tp} = 55$	$N_{fp}=7$
	Negative	$N_{fn}=0$	$N_{tn}=21$

- N_{tp} refers to the number of true positives.
- N_{fp} refers to the number of false positives.
- N_{tn} refers to the number of true negatives.
- N_{fn} refers to the number of false negatives.

i.   The first measure of evaluation metrics is *accuracy, which* quantifies the overall accuracy of a model or test, computed as the ratio of correct results (including true positives and true negatives) to all cases assessed. Accuracy is a straightforward and easy-to-understand performance measure, giving a rapid overview of how well a model performs for both positive and negative categories.

$$\text{Accuracy} = \frac{N_{tp} + N_{tn}}{N_{tp} + N_{tn} + N_{fp} + N_{fn}}$$

ii. The second measure of evaluation metrics is *sensitivity*, which determines the likelihood that the organisation has a GEP and how effectively the scraper can detect this.

$$\text{Sensitivity} = \frac{N_{tp}}{N_{tp} + N_{fn}}$$

iii. The third measure of evaluation metrics is *specificity*, which assesses the likelihood of the scraper detecting an absence of a GEP if the organisation does not have one.

$$\text{Specificity} = \frac{N_{tn}}{N_{tn} + N_{fp}}$$

iv. The fourth measure of evaluation metrics is *precision*, which indicates the proportion of correctly identified positive cases out of all those flagged as positive by the scraping process.

$$\text{Precision} = \frac{N_{tp}}{N_{tp} + N_{fp}}$$

Table 23   Performance metrics of INSPIRE's scraper for prevalence of GEPs

Measurement	Accuracy	Sensitivity	Specificity	Precision
Statistics	92%	100%	75%	89%

As Table 23 shows, INSPIRE's scraper exhibits high accuracy with an overall accuracy rating of 0.93. This figure shows a high level of correctness in the scraper's operations. With a precision rate of 0.90, the scraper is quite effective at correctly pinpointing 90% of GEPs, reflecting its capability to sift through large volumes of online data to find relevant documents. The specificity score is measured at 0.79, showing that the scraper effectively filters out 79% of non-GEP content, thus eliminating significant irrelevant data. Notably, INSPIRE's scraper achieved a sensitivity (or recall) rate of 1.00, meaning it successfully identified all actual GEPs

in the dataset without missing any relevant documents. These metrics collectively illustrate the robustness and effectiveness of the scraper in identifying GEPs, highlighting its value as an essential tool for researchers and policymakers focusing on gender equality initiatives.

4.2.4 Methodology to Download the GEPs

The initial phase of our methodology involved the utilisation of a script designed to measure the prevalence of GEPs from websites within the piloting dataset. To analyse the GEP structure and content, we recognised the need to enhance our approach by incorporating a more intricate layer – retrieving associated documents containing detailed GEP information. Given that the text analysis tool to be used can analyse PDFs, we targeted our refinement process to PDF only, leaving aside the rest of the types of files that could also include detailed GEP information, i.e. HTML or .doc files.

This advanced script goes beyond web content extraction and is now able to download PDF documents that match identified GEPs. This innovative script harnesses the power of Google search, using the 'filetype:pdf' filter and GEP-related terms to accurately target and download relevant PDF documents.

The script initiates the process by conducting targeted *Google* searches employing the specified file type filter, narrowing the search results to PDF documents. Simultaneously, the script integrates the GEP-related terms similarly to the prevalence script to ensure a refined focus on documents pertinent to GEPs. This strategic combination streamlines the search process and enhances the accuracy of identifying and retrieving GEP-related PDFs.

The iterative nature of the script ensures a meticulous verification of GEP presence on websites before proceeding to the PDF download phase. This two-step process enhances the reliability of the data collected, as it confirms the alignment between the identified GEP terms on websites and the contents of the downloaded PDFs.

By harnessing the capabilities of Google searches with tailored filters, our script enhances the efficiency and precision of data extraction, aligning with the evolving landscape of web-based information retrieval. This refined approach signifies a technological leap in our methodology and underscores our commitment to capturing a comprehensive and nuanced understanding of GEPs within the INSPIRE project's scope.

As part of our ongoing optimisation efforts, we fine-tuned the 4-step approach by strategically altering the order of search terms in steps 3 and 4. Recognising the dynamic nature of web searches, this adjustment aimed to enhance the precision and effectiveness of the INSPIRE web scraper. By experimenting with different arrangements of search terms, we sought to uncover patterns that could potentially yield more accurate and relevant results. Indeed, the modification in the order of German search terms yielded a noteworthy enhancement in the success rate for German scraping, resulting in a substantial improvement of 20%. This iterative process reflects our commitment to continually improving the methodology's adaptability to diverse linguistic and organisational landscapes.

Another significant fine-tuning involved broadening the search scope by incorporating Google suggestions without using quotation marks. By omitting quotation marks, we aimed to increase the flexibility of the search process, enabling the scraper to adapt to variations in language usage and capture a more comprehensive set of relevant results. This fine-tuning proved particularly effective in countries with more complex grammar and syntax in their native language, ultimately improving performance. This refinement aligns with our commitment to staying responsive to evolving search dynamics and maximising data extraction accuracy in the INSPIRE project.

We established a username on the GitHub platform, an open-access code-sharing platform, in order to publish the developed scripts. The created username is "InspireQualityeu" (https://github.com/InspireQualityeu). The two developed scripts, one for prevalence and the other for downloading GEPs, have been made available on the open-access platform GitHub. The repository is named "gep-scraper" and can be accessed at the following URL: https://github.com/InspireQualityeu/gep-scraper.

Result of the 4-step approach for downloading GEPs

We conducted a comprehensive evaluation of the performance of each step within the 4-step approach. The detailed breakdown in Table 24 offers a nuanced understanding of the number of identified GEPs at each stage of the data extraction process for every country in our analysis.

Table 24   PDFs extracted by each step of the 4-step approach.

	Step 1	Step 2	Step 3	Step 4
Ireland	5	N/A	6	N/A
Greece	6	6	1	1
Germany	11	3	0	5
Estonia	2	0	0	1
Contribution	44%	17%	13%	13%

Table 24 shows the contribution of each step to the 4-step approach, i.e., how many PDFs have been extracted from each step.

Key findings:

- **Variability in results:** There is notable variability in the performance of each step across countries.

- **Local Language Search Impact (steps 2 and 4):** The local language search (simple and extended) demonstrates a significant impact on results, particularly in Greece (via step 2) and Germany (via step 4), where there is a notable increase in the GEP pdf inclusion.
- **Dependency on Language and Cultural Context:** The results underscore the importance of tailoring the methodology to each country's linguistic and cultural contexts, as observed in the impact of local language searches.

These findings demonstrate that the effectiveness of the four-step information retrieval process varies across the examined European countries. All four steps are required depending on the case, emphasizing the need for a tailored and adaptable approach when extracting data related to GEPs across diverse linguistic and organisational landscapes.

Quality check for downloading the GEPs

We comprehensively analyse the PDF retrieval success rates across the four piloting European countries: Ireland, Greece, Germany, and Estonia. The data includes manually detected PDFs of GEPs and those obtained through automated scraping, providing insights into the efficiency of auto-scrapingg in capturing relevant documents. The success rate is defined by whether auto-crawled PDFs contain real GEPs.

Key Findings:

- **High Success Rates:** Ireland and Greece showcase high success rates of 92% and 94%, respectively, indicating the effectiveness of automated scraping in capturing the majority of relevant PDFs. Germany demonstrates an 86% success rate, suggesting that while auto-scraping is effective, additional factors may influence document availability.
- **Challenges in Estonia:** Estonia experiences a lower success rate of 60%, highlighting potential challenges in automated scraping. This is attributed to the non-indexing of PDFs in Google, revealing a specific hurdle in retrieving relevant information through automated means.

This analysis provides valuable insights into the success rates of automated scraping in capturing relevant PDFs across different European countries. While Ireland and Greece demonstrate robust performance, Germany presents a slightly lower success rate, and Estonia faces challenges, indicating the importance of considering regional variations in information retrieval methodologies.

To check the quality of results and assess the performance of the algorithm, we use the same four measures from the evaluation metric Table 25: accuracy, sensitivity, specificity, and precision.

Table 25   PDF extraction results (January 2024)

Measurement	Accuracy	Sensitivity	Specificity	Precision
Statistics	17%	59%	10%	10%

4.3 Monitoring Characteristics, Implementation and Impact of GEPs: Classifying PDFs and Text Analysis

INSPIRE's prevalence indicator is discussed and analysed in the previous chapter (See chapter 4.2). Our objective is to investigate beyond the prevalence indicator (see chapter 3.3) via text analysis techniques. Thus, we developed a methodology for extracting information regarding the characteristics, implementation and impact of the GEPs.

Our analysis aims to retrieve information for the INSPIRE indicators in the extracted GEPs via web scraping. For this purpose, we want to use text analysis and clean the unstructured data corpus (see chapter 4.3.1). Web scraping conducted in the pilot study created a considerable data corpus with some inappropriate files. Table 25 demonstrates that the accuracy of the extracted PDFs is relatively low. Many false positives make identifying the true GEP for each institution challenging. Using web scraping alone does not suffice to obtain one accurate PDF per institution.

However, an automatic text analysis algorithm and classification method have been developed to get one PDF (i.e., GEP) per institution. We manually analysed and classified the documents instead of using an automated classification method. The chapter 4.3.2 explains the classification issue in more detail. This enables the calculation of the quality of the classification method and quality check for INSPIREs' indicators extracted from GEPs. Hence, the classification of these documents appears necessary to distinguish the target GEP document.

4.3.1 Text Analysis as a Methodological Approach

Recent sociological approaches have already used well-established methodological practices for text analysis, such as quantitative text analysis (e.g., dictionary-based procedures) and qualitative content analysis (Macanovic 2022; Spörlein and Schlueter 2021). The field of Natural Language Processing and machine learning have brought up new opportunities to automate text analysis methods in social sciences due to proven efficiency concerning time and cost.

Computational text analysis methods (CTAM) are an umbrella term for many approaches to analysing digital data. These methods differ in the way they involve techniques for extracting specific information using keywords or formatting guidelines and advanced software solutions such as BERT, GPT, and other large language models (Baden et al. 2022; Mazel 2023). Indeed, some of these techniques, such as information retrieval (IR), have already been used

in computer science. The information retrieval process entails retrieving unstructured content, usually, text-based documents, that matches the information needs from extensive collections often kept on computers (Manning, Raghavan, and Schütze 2012). Unstructured text mainly presents challenges for researchers to analyse. It is defined by the absence of a predictable framework or order, the use of natural language, which may be imprecise and complex, and variances in context, style, and syntax (Inmon and Nesavich 2007; Manning, Raghavan, and Schütze 2012). Recently developed tools now allow for content extraction from PDFs with significantly reduced data loss (Meuschke et al. 2023).

4.3.2 Classification of PDFs

As previously stated in chapter 4.2.4, 838 documents were downloaded from 83 institutions' domains for this pilot study between January and February 2024. However, each institution may have only one GEP; so our text analysis script (see chapter 4.3.3) is designed to analyse only one GEP per institution. However, the abundance of documents was caused by retrieving GEPs and other non-targeted gender-related documents containing our search terms. The challenge of retrieving one target GEP document from an institution's webpage is caused by the structure of these websites, which are not the same. The Metadata is not informative enough, and the presence of various languages causes problems in classification because the data was not standardised available. We will find out the true GEPs per institution via various text analysis techniques. Notably, we tested two approaches to classify the documents: a) Zero-shot classification and b) Metadata analysis.

Zero-shot Classification with BART and GPT

Text classification can be done through different approaches, such as supervised machine learning and large Language Models (LLMs). A recent study showed that LLMs outperformed traditional machine-learning models for text classification tasks (Chae and Davidson 2023). Advanced LLMs have a high amount of representational richness and the ability to generalise, allowing them to effectively complete new tasks without additional training. This capacity is usually known as zero-shot learning. (Brown et al. 2020; Chae and Davidson 2023; Socher et al. 2013). Zero-shot learning is advantageous over supervised machine learning models, which do not require training data. Developing a training dataset and testing a classifier can be costly and time-consuming. Yet, advanced LLMs can be modified with a few lines of code to achieve good performance with a few high-quality instances. (Do, Ollion, and Shen 2022; Chae and Davidson 2023). Among many others, some of the models have proven a great success for zero-shot classification, namely, Generative Pretrained Transformer (GPT) (Brown et al. 2020; Ouyang et al. 2022), Bidirectional Encoder Representations from Transformers (BERT) (Devlin et al. 2018) and Bidirectional and Auto-Regressive Transformers (BART) (Lewis et al. 2019).

We performed some predictions with these models' variations; namely, we used GPT-3.5 turbo instruct and the BART facebook/bart-large-mnli model[12]. Although GPT-4 is more capable than

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[12] See [facebook/bart-large-mnli · Hugging Face](#)

the GPT-3.5 turbo instruct model, it has a chat endpoint, which means GPT-4 can not provide predicted probabilities for categories. Predicted probabilities linked to the labels enable adjustment of thresholds for predicted labels and facilitate selection among the predicted labels for each organisation. We compared the two large language models (candidate models), which is displayed in Table 26.

Table 26   Comparison of LLMs

	GPT - 3.5 turbo instruct	BART – facebook/bart-large-mnli
Resources	Uses OpenAI server. No need for additional computational sources.	Source intensive. Needs powerful computational sources.
Cost	Cost for API 0,003 Euro per 1K token for GPT 3.5 Turbo instruct model	Using BART is free because It is an open-source project.
Time	Since its server is used, it has been pretty fast. Also, GPT turbo models are optimised for their speed. It takes 3-4 minutes to classify ~700 rows (first 200 words of PDFs).	The model is cumbersome. Although Google Colab is used, it took ~120 minutes to classify ~700 rows (first 200 words of PDFs).
Language/s	It is trained in many languages. It is capacity in English is much better. It is strong in understanding other widely spoken languages such as Spanish, French, and German. However, it has an understanding of many European languages. There is no published list for this.	Only trained in English; therefore, the text should be translated into English for other languages. This requires using other LLMs, which are source-intensive as well.
Prompting	It is highly flexible for prompting. It is designed for prompting requests. The result of classification can be improved via efficient prompting.	It is not naturally designed for prompting. However, prompting can be adopted.
Understanding context	GPT is designed for chat interaction and prediction of the next words. However, it has an excellent understanding of the context.	BART is naturally designed to understand the content of the text.
Limit	The GPT 3.5 Turbo instruct model currently has a 4096 token limit per request. Which means we cannot send longer texts to make predictions. 4096 tokens are equivalent to ~3000 words.	512 tokens per request. Equivalent to 450 words.

The GPT 3,5 turbo instruct model is preferable due to its speed and less need of computational capacity. However, this model can only be used by purchasing tokens from Open AI.

We evaluated the performance of the BART and GPT 3.5 models. For both models, processing the entire document for analysis requires high computational and time resources considering the final study, which aims to contain 6,904 institutions. Therefore, we concentrated on processing only some portion of each retrieved document to decrease the required computational resources. Our first approach was to process each PDF's first 1-2 pages. Usually, each document has a complete title referring to "gender equality plans". However, this approach did not provide the target information as some documents contain an opening page or an initial page, which is not a text and is not entitled as "gender equality plan". We then changed our approach into retrieving the first 100 words of each PDF. This strategy produced more robust results, indicating that the information collected for each PDF is more consistent across the sample.

For each model, an intermediate step, preprocessing the text data, was necessary and carried out differently due to the models' different natures. Zero-shot classification using the BART model is performed in Google Colab[13]. For the **BART** model, the following preprocessing steps were performed:

i.   Reading each PDF and extracting the first 100 words.

ii.   The text is preprocessed, and duplicate rows are eliminated.

iii. The first 100 words were translated into English via LLMs.

iv.   We created defined candidate labels based on existing PDFs.

v.   We asked the machine to classify the PDFs based on the content of the 100 words of each PDF using the BART model.

vi.   The model produces an estimated label and its associated probability.

vii. Decisions are made based on predicted labels and probabilities.

Where we define candidate labels as follows for the BART model:

- Gender Equality Initiatives

- Educational Program Details

- University Administrative Records

- Research and Development

- Academic Publications and Materials

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[13]Google Colaboratory, is a free cloud-based platform provided by Google.

- Strategic Development Plans

- Legal and Policy Documents

- Student and Faculty Resources

- Public Health and Nutrition Studies

- International Relations and Agreements

For the GPT model, the preprocessing steps were slightly different. The main difference was that we did not translate the text into English since GPT is able to understand German, Greek, and Estonian. The preprocessing steps for the **GPT** model are defined as follows:

i. Reading each PDF and extracting the first 100 words.

ii. The text is preprocessed, and duplicate rows are eliminated.

iii. We asked the machine to classify based on the content of the 100 words of each PDF using the GPT 3.5 Instruct model.

iv. The classification task is carried out via the prompt.

v. The model produces an estimated binary (Yes/No) category and its associated probability.

vi. Decisions are made based on predicted labels and probabilities.

The prompt is defined as follows:

"Is the following text part of a Gender Equality (Action) Plan or not? A Gender Equality Plan (GEP) is a set of commitments and actions that aim to promote gender equality in an organisation through a process of structural change, particularly in workplaces, educational institutions, and public bodies. Provide "Yes" or "No" as an answer."

Table 27 displays a comparison of the BART and GPT models' performance.

Table 27   Evaluation metrics of the BART and the GPT 3.5

Country	Model	Precision	Sensitivity	Accuracy	Specificity
Ireland	BART	75%	67%	64%	60%
Ireland	GPT 3.5	38%	100%	47%	20%
Greece	BART	100%	60%	60%	N/A
Greece	GPT 3.5	100%	33%	33%	N/A
Germany	BART	100%	82%	82%	N/A
Germany	GPT 3.5	71%	100%	72%	17%
Estonia	BART	100%	40%	77%	100%
Estonia	GPT 3.5	100%	29%	62%	100%
Total	**BART**	**94%**	**62%**	**71%**	**80%**
Total	**GPT 3.5**	**77%**	**65%**	**53%**	**46%**

As Table 27 shows, BART and GPT models work well to distinguish gender equality plans/initiatives from other documents, such as educational programs, administrative records, research and development papers, and academic publications and materials. However, the model cannot predict the targeted GEPs correctly because there are many documents that are similar to GEPs.

One of the assumptions made while evaluating the quality of LLMs is that the presence of departmental GEP is considered as a true positive for the organization. Distinguishing between different types of GEPs is still highly challenging for the model. One of our objectives is to optimize the predictions for finding true GEPs per institution in the classification step. Based on our result presented above, the BART model overperforms the GPT 3.5 model in our specific setting. However, the BART model needs high computational capacity. Changing the prompt of the GPT 3.5 turbo instruct model, defining better candidate labels for the BART model or improving the hardware/software equipment (server capacity) could make the process better.

The optimal approach to be employed should be determined at the latter stage, as the number of documents and hardware capacity present obstacles. Currently, we are engaged in reducing

the number of documents via meta-analysis, after which we will apply zero-shot learning models to enhance precision.

Metadata analysis

As a second method, our classification strategy relies on analysing the metadata of the retrieved PDFs. Several steps were employed to achieve this objective:

1. **Focus on English PDFs:** By narrowing our focus to English documents, we streamline the subsequent stages, optimizing efficiency and resource utilization.
2. **Filtering PDF filenames based on specific terms:** To curate a more focused dataset, we implemented a filtering mechanism based on specific terms within the filenames of downloaded PDFs. This approach involved scrutinizing filenames for keywords directly related to GEPs, such as Gender Equality Plan, GEP, Action Plan, Gender Equality Action Plan, and GEAP (in English only, as well as a combination of English and various local languages). Files lacking these crucial terms were excluded, allowing us to eliminate non-relevant documents and concentrate on those more likely to contain substantive GEP content.
3. **Keyword search in the first page of PDFs:** Another integral step of our classification process involved a detailed examination of the first page of each downloaded PDF. By employing keyword searches specific to Gender Equality Plans, similar to the terms mentioned above, we can verify the content's relevance and legitimacy. This step is essential for discerning whether the downloaded files genuinely pertained to GEPs, contributing to a higher degree of accuracy in our dataset.
4. **Filtering based on the metadata of the PDFs:** Another step towards classification involves scrutinizing the metadata of each downloaded PDF, such as document title, author information, creation date, and keywords, to identify and retain documents with relevant GEP information. However, this approach was not fruitful as most of the PDFs did not include pertinent metadata.

If more than one PDF is detected as a GEP per institution, then the first GEP is assumed to be the real GEP.

Table 28   Search terms for the classification task

	English	**Greek**	**German**
Search Terms	gender equality plan	ΣΧΕΔΙΟ ΙΣΟΤΗΤΑΣ	Gleichstellungs
	GEP	ΣΧΕΔΙΟ ΔΡΑΣΗΣ	Rahmenplan
	Action Plan		
	Gender Equality Action Plan		
	GEAP		

Table 29   Performance metrics of the English-only approach

	Precision	**Sensitivity**	**Accuracy**	**Specificity**
Ireland	60%	75%	68%	64%
Greece	73%	62%	58%	50%
Germany	75%	50%	52%	57%
Estonia	100%	60%	87%	100%
Total	77%	64%	67%	67%

Table 30   Performance metrics of English plus local languages approach

	Precision	**Sensitivity**	**Accuracy**	**Specificity**
Ireland[14]	60%	75%	68%	64%
Greece	79%	79%	70%	50%
Germany	61%	73%	58%	36%
Estonia	100%	60%	87%	100%
Total	75%	71.75%	70.75%	62.5%

The classification task was carried out using exclusively English search terms and a mix of English and local language search terms. The superior outcomes were achieved with the combined approach, and Table 30 displays its performance metrics.

4.3.3 Developing the Algorithm for the Text Analysis

The pilot study aims to explore a text analysis method that proves to be the best-automated approach to retrieve information for INSPIRE indicators in a small sample. As we worked parallelly on classifying the retrieved documents and extracting targeted GEPs, we manually downloaded GEPs to proceed with the text analysis. Automated text analysis is performed by combining different tools, which are explained in detail in the next section. Our text analysis comprises several steps, as demonstrated in Figure 5.

Figure 5   Text Analysis Process
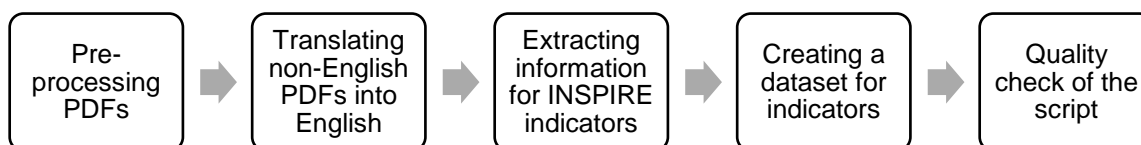
Preprocessing PDFs

Processing text for analysis using the Portable Document Format (PDF) is not straightforward. Tables in PDFs can be challenging to work with due to the embedded tabular structure (Rastan, Paik, and Shepherd 2019), text alignment, and formatting details. Moreover, PDF

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[14] For Ireland, only English search terms used.

files can also contain images, footnotes, and figures, which makes it difficult for software or other assistive technologies to process information. Given that downloaded GEPs in PDF form do not share a uniform structure, extracting the texts for analysing purposes poses challenges. To overcome this challenge, we use a **Python**[15] library called "**pdfplumber**[16]" to extract the text from GEPs in PDF form. However, pdfplumber works very well with machine-generated PDFs rather than scanned PDFs. Therefore, it would not be possible to process scanned PDFs for analysis purposes. Indeed, during the pilot study, we realised that only one GEP was problematic because its last page was a scanned image merged with a machine-generated PDF. It's because the responsible party's signature appears on the last page.

The GEPs were stored in four separate folder for each country of the pilot sample: Estonia, Germany, Greece, and Ireland. The **"os**[17]" library in Python allowed us to extract GEPs by specifying their parent directory and saving information about which country each GEP belonged to.

Furthermore, the dataset we are working with is accessed via Python, demonstrating the programming language's flexibility and ease of use when dealing with multiple data formats. However, the existing format of our data poses substantial challenges to efficient operation. The lack of structure, in particular, limits our ability to apply analytical functions directly, change the information, or even execute fundamental data exploration tasks with the speed and efficiency we require. In Python, structured data formats, such as data frames, provide various benefits, including faster data access, more straightforward data cleaning and transformation processes, and the ability to apply complicated analytical algorithms with relatively simple code. Therefore, we created a data frame using Python's **"pandas**[18]" library. Reading PDF documents presents significant challenges and requires a substantial amount of time. As the final goal of text processing, we saved each PDF as a plain text file (.txt) to determine the optimal method for extracting information in the following phase because Python is substantially faster at processing basic text files.

The preprocessing steps are outlined below:

- Python receives PDF files from the specified directory.
- Extracts the text from each page for each PDF.
- Concatenates text from every page for each PDF.
- Creates a data frame containing PDF names, PDF texts and belonging country.
- Saves each PDF as a plain text file (.txt).

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[15] Python is a popular interpreted programming language that emphasizes readability, flexibility, and simplicity. It has since become prevalent in many domains, including artificial intelligence, scientific computing, data analysis, and web development.

[16] See pdfplumber · PyPI

[17] OS module provides portable operating system-dependent functionality (see os — Miscellaneous operating system interfaces — Python 3.12.1 documentation)

[18] Pandas is an effective open-source tool for data analysis and manipulation (see pandas - Python Data Analysis Library (pydata.org))

A hurdle: Translation of GEPs

Working with GEPs requires understanding their content for text analysis. Even though, our web-scraping strategy prioritises English GEPs, not all GEPs are found in English. Analysing GEPs in national languages would be challenging due to the wide-ranging sample of INSPIRE, which spans 33 countries (see chapter 2.2) and encompasses 26 different languages. Alternatively, the search terms employed in the text analysis would have had to be translated, as the text analysis method is based on searching for information using identified keywords. This method would also necessitate a translation process, which would be less extensive than translating the entire text. However, in this instance, the development of separate scripts for each language and their subsequent execution in isolation would be a highly time-consuming process. For the abovementioned reasons, it was decided that all non-English GEPs should be translated into English for analysis purposes. Although this approach is more time-consuming in the first step, it is more robust in the end.

Table 31   Distribution of GEPs by language

	Ireland	Germany	Greece	Estonia	Total
English	11	9	10	1	**31**
Non-English	0	5	5	3	**13**
Total	11	14	15	4	**44**

Altogether, 44 GEPs were designated for the pilot study, as Table 31 demonstrates. Among them, 13 GEPs are not produced in English. In order to work with the GEPs and understand their content, the next step is to translate non-English GEPs into English.

Deciding what tool to use for translation also depends on the number of documents to be translated. Therefore, the language of each GEP should be identified automatically before the translation process. For this purpose, we tested Python's **"langdetect[19]"** library to detect the GEPs' language automatically. *Langdetec* library was developed by Shuyo. The library predicted the language of the GEPs with a 100% success rate. Indeed, Langdetec Library has been proven to have a more than 99% success rate in 49 languages (Shuyo 2010).

We have investigated some options for the translation of GEPs. These options include:

  i.   Professional translation
 ii.   Machine document translation one by one (i.e., google or deeply)
iii.   Machine document translation via API[20] (i.e., google.com or deeply.com)
 iv.   Machine translation via open-source Large Language Models (LLM)

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[19]See langdetect · PyPI
[20] API refers to application programming interface.

Table 32 shows a detailed comparison of the language translation options. With a full sample of 6,904 institutions, assuming 50% of them have GEP, we could end up with around 3,452 GEPs. By using Table 31   Distribution of GEPs by languagewe can, therefore, determine the share of English GEPs in non-English speaking countries, which is 60.60% (20 out of 33). Considering RPOs in the English-speaking countries in the full sample (see chapter 2.2), the proportion of English GEPs for the full sample study was estimated at 65.14% (2,214 out of 3,452). Therefore, a professional translation is too costly. The second option, translating one by one, might not be suitable, especially when we will have many GEPs to be translated during full sample analyses. Indeed, our first approach for the pilot study was to translate PDFs one by one using Google Docs translator. Nonetheless, this approach is especially suitable for the small sample sizes of 13.

We also experimented with an open-source Large Language Model, **m2m_100_418M**[21] (A. Fan et al. 2021), to translate 13 GEPs from German, Greek, and Estonian into English. Researchers at Facebook developed this model with the capability to translate between 100 different languages using 418 million parameters. In our experiment, the translation process took approximately 15 minutes using a Graphical Processing Unit (GPU) located in Google Colab. Nevertheless, we integrated batch processing into the translation procedure, thereby markedly accelerating the translation process. This method has the potential to enable complete sample analysis when we anticipate that approximately 3,500 GEPs will be available. Subsequently, the GEPs were translated using the m2m_100_418M model, after which the next step was to extract information for INSPIRE indicators.

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[21] See facebook/m2m100_418M · Hugging Face

Table 32   Comparison of language tools

Future/ Characteristics	Professional Translation	Machine Doc Translation	Machine Doc Translation via API	LLM translation: M2M_100_428M
Time	Time consuming	Time consuming	Very fast	Fast
Open source	No	No	No	Yes
Computational Resource	No need	No need	No need	Need computational resources
Language coverage	Depends on agency	Covers variety of languages (depending on company)	Covers variety of languages (depending on company)	Covers translation between 100 languages
Pricing	Very High cost	N/A	Costly	Free
Performance	The most accurate	Accurate (depends on company)	Accurate (depends on company)	Moderate
Scalability	Not scalable	Not scalable	Highly scalable	Scalable

Extracting Information for INSPIRE Indicators

After translating all GEPs into English, we extracted information for the INSPIRE indicators (see chapter 3.3) by applying text analysis techniques. Our information extraction strategy for text analysis relies on searching for specific terms or patterns within the GEPs. **Regex**[22], a Python library, is employed for text analysis.

A regular expression (often abbreviated as regex or regexp) is a sequence of characters that defines a search pattern. It is mainly used for string matching and manipulation. Regular expressions are a powerful tool in text processing (Mitkov 2022). In our situation, we implemented regex in two distinct manners: matching strings and patterns. To do string

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[22] re — Regular expression operations — Python 3.12.2 documentation

matching, we defined specific search terms for our indicators. String matching can be approached in different ways. Standard string matching focuses on identifying a particular pattern within a larger text regardless of its context or word boundaries. On the other hand, standalone string matching requires that the pattern be recognized as an independent word and separated by word boundaries from other text elements, ensuring more contextual sensitivity in search results. For instance, consider a text saying, "Recently, age management gained popularity," simple string matching for "age" would find matches within "age" and "management", focusing only on the sequence of letters without considering context or word boundaries. Whereas standalone string matching would only match with the word "age". Both standard and standalone string matches are used to extract information for the INSPIRE indicators, depending on the case.

Afterwards, we developed a function for each indicator which follows the subsequent reasoning:

  i.   The function transforms specific words or phrases into regular expression patterns, normal or standalone string-matching.

  ii. It changes the entire text to lowercase to enable case-insensitive searching.

  iii. The lowered text is then scanned for instances of each regular expression pattern.

  iv. The identified words or phrases are collected in a set to detect any matches.

  v.   If at least one match is found, it returns 'Yes'; otherwise, it returns 'No'.

Ultimately, each function is applied to the GEPs within a pandas DataFrame in Python, leading to systematic processing of the DataFrame on a row-by-row basis. In other words, GEPs are the input for the created functions. By processing the DataFrame row by row, each function can efficiently analyse and extract information for INSPIRE indicators. The tables below demonstrate the INSPIRE indicators, the methods and tools employed, and their respective success rates. The specified search terms for each indicator are available in the annexe (see chapter 8.3).

Prevalence

Table 33   Information extraction for prevalence indicator: Horizon Europe

Indicator	Tool-method used	Success rate in %
Indicator 1.2 The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of: Requirements linked to getting European research funding (HORIZON Europe)	Regex - Normal string match	100

Characteristics

Table 34   Information extraction for characteristics indicator: Time frame

Indicator	Tool-method used	Succes rate in %
Indicator 2.3 The time frame of the current plan	Regex - Pattern match	75

Areas of Activity (grouped according to the specification for Horizon Europe) addressed in the GEP

Table 35   Information extraction for characteristics indicators: Areas of Activity

Indicator	Tool-method used	Success rate in %
Indicator 2.4 Areas of activity - Actions of awareness-raising and training addressed in the GEP	Regex -Normal string match	100
Indicator 2.4 Areas of activity - Work-life balance and organisational culture addressed in the GEP	Regex -Normal string match	100

Indicator 2.4 Areas of activity - Gender balance in leadership and decision-making addressed in the GEP	Regex -Normal string match	100
Indicator 2.4 Areas of activity - Gender equality in recruitment and career progression addressed in the GEP	Regex -Normal string match	100
Indicator 2.4 Areas of activity - Measures against gender-based violence, including sexual harassment, addressed in the GEP	Regex –Normal string match	100
Indicator 2.4 Areas of activity - Integration of the gender dimension into research and teaching content addressed in the GEP	Regex -Normal string match	93

*T*he GEP integrates inclusive approaches

Table 36   Information extraction for characteristics indicators: inclusive GEPs

Indicator	Tool-method used	Success rate in %
Indicator 2.5 The GEP integrates intersectionality	Regex -Normal string match	100
Indicator 2.5 The GEP integrates diversity	Regex -Standalone string match	100
Indicator 2.5 The GEP integrates gender diversity	Regex -Standalone string match	100

The GEP addresses different inequalities

Table 37   Information extraction for characteristics indicator: different inequalities

Indicator	Tool-method used	Success rate in %
Indicator 2.6 The GEP addresses race	Regex - Standalone string match	98
Indicator 2.6 The GEP addresses nationality	Regex - Standalone string match	100
Indicator 2.6 The GEP addresses religion	Regex - Normal string match	98
Indicator 2.6 The GEP addresses class/social background	Regex - Standalone string match	93
Indicator 2.6 The GEP addresses age	Regex - Standalone string match	95
Indicator 2.6 The GEP addresses sexual orientation	Regex - Standalone string match	93
Indicator 2.6 The GEP addresses disability	Regex - Normal string match	98

Implementation

Financial and personal resources, commitment

Table 38   Information extraction for implementation indicator: dedicated staff

Indicator	Tool-method used	Success rate in %
Indicator 3.3 A gender equality unit, gender equality committee and/or dedicated staff are in place	Regex- Normal string match	95

Quality Assurance

Table 39   Information extraction for implementation indicators: Quality Assurance

Indicator	Tool-method used	Success rate in %
Indicator 3.6 A policy for monitoring/controlling gender equality measures and the GEP implementation is in place	Regex - Standalone string match	91
Indicator 3.7 Sex-disaggregated data are collected and published: collection	Regex - Normal string Match	86
Indicator 3.7 Sex-disaggregated data are collected and published: publication	Regex - Normal string match	89

Impact

Table 40   Information extraction for impact indicator: description of the impact

Indicator	Tool-method used	Success rate in %
Indicator 4.1 The GEP includes a reflection or description of the GEP impact. The organisation reflects its understanding of the GEP impact.	Regex - Standalone string match	66

A pandas DataFrame containing the relevant indicator and its corresponding output is generated upon executing the Python script. The success of the information retrieval script was subsequently evaluated by comparing it to the manually assessed GEPs. Overall, the performance of the information retrieval script is generally high, with the lowest success rate belonging to the impact indicator at 66%. Although regex is typically effective, we have outlined possible factors that may contribute to its lower success rate. These include:

- **Contextual issues:** The text contains search terms that are used in a different context than intended. In other words, the search term appears but does not refer to the indicator. We observed that the search term can be found in a footnote or reference section with no relevance to the indicator in certain instances.
- **Textual issues:** Some words could be corrupted during the text extraction process, or there might be hyphens within a word that the script may not be able to identify.
- **Translation issues:** We manually evaluated the GEPs from Germany in their original language and then translated them into English for text analysis before running the script. As a result, there could be potential translation discrepancies.

Using regular expressions (regex) for information retrieval has numerous benefits. Regex offers a versatile and potent approach to searching, matching, and modifying text, enabling accurate pattern matching and extracting specific data from extensive textual collections. While regex can process large amounts of text data as anticipated in the full sample of INSPIRE, it struggles with interpreting natural language variations and uncertainties. This limitation can result in incorrect identifications and omissions in information retrieval processes since regex lacks the ability to comprehend the context of the text beyond extracting predefined information.

The developed script for the information extraction has also been shared on the GitHub repository under the same username (https://github.com/InspireQualityeu) that was created for the INSPIRE project. The repository associated with the information extraction for the INSPIRE indicators is called "gep-information-retrieval" and can be reached via the following URL: https://github.com/InspireQualityeu/gep-information-retrieval.

5 Reactive Method: Pilot Survey

A survey can be proactive or reactive, seeking information directly from participants. We consider the survey reactive because we focus on determining whether RPOs have implemented a GEP and which measures it encompasses. Based on the indicators for GEP monitoring (see chapter 3.3), this chapter investigates their application to the online survey.

5.1 Questionnaire Design

After adapting the indicators to the web crawl and text analysis (see chapter 4.2 and 4.3), we developed the items for the survey. The items that had already been developed in previous publications were not deemed to be suitable for the purpose of our survey. We thus formulated

the items following the conceptual ideas of our indicators. The internal project team revised the first draft of the questionnaire.

After compiling the questionnaire in English, we translated it into German using two translation tools (an LLM, m2m_100_418M (A. Fan et al. 2021) and deepL.com[23], a paid translation service). Deepl.com provided significantly better translation quality than the *m2m* model. After the automated translation, German native speakers reviewed the German translation.

We sent the questionnaire to INSPIRE consortium members (English version) and to eight gender equality officers (German version) for external feedback on the clarity of the items. The incorporation of this feedback has led to the production of a final version of the pilot questionnaire (see p. 101 in the annexe).

We implemented the survey on the UNIPARK platform[24], which has been the chosen software for the online survey. English is the default language of the survey and sets the filter and obligatory questions. As a second language for the pilot, we inserted the German version. For the full survey study, the insertion of further further languages will be possible.

We assumed the online survey would take roughly 15-25 minutes, depending on the responses and the filter.

We enabled the "return" button so participants could go back and change the answers even though it would change their path on the survey (filter). Participants can take a break during the survey, close the browser, and return to the survey with the same URL provided to them via email until the survey's end date. Participants can also forward the survey to someone else in their organisation if they do not know how to answer the questionnaire. In that case, the provided URL works also for the forwarded recipient.

5.2 Participants and Access to the Field

Chapter 2.2 describes the sample for the full web scraping and online survey, and chapter 2.1 for the pilot of the online survey (83 institutions from Germany, Greece, Estonia, and Ireland). The target group are people responsible for gender equality in the organisations, invited by email. INNO Systems collected the email addresses through automated and manual web searches following a ranking system:

1. "Gender equality officer" at each institution

2. If information about the gender equality officer is unavailable, positions such as "rector," "president," or "CEO"

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[23] see https://www.deepl.com/translator
[24] https://www.unipark.com/en/.

3. If information about these functions is unavailable, it should be the "head of administration" or the "head of the HR department"

4. If none of these options yields results: "head of the communication department"

This way, we could detect email addresses for 81 institutions in the sample for the pilot study. We could not retrieve the email addresses of two private RPOs (Germany and Ireland).

We invited the participants to the online survey through Unipark software on 28.02.2024 (for the invitation, see p. 101 in the annexe). The Unipark system indicated that two email addresses could not be reached. We subsequently found alternative email addresses for both institutions and sent an invitation on 01.03.2024. The total number of institutions that received an invitation to pilot the online survey is 81. On 11.03.2024, we sent a reminder email to 77 institutions that have not completed the online survey (for the first reminder, see p. 120 in the annexe). Following that, we received an email from a private RPO expressing that they would not participate in the survey. Thus, we excluded that RPO from the participant administration portal in Unipark. On 21.03.2024, we sent a second reminder via e-mail to the 68 institutions that had not yet responded (for the second reminder, see p. 122 in the annexe). The online survey lasts four weeks, ending on March 27, 2024.

5.3 Results

The response rate to the pilot of the online survey was 28,4 % (N=23). The number includes those who clicked the link but dropped the survey. In comparison, the completion rate is 18,5% (N=15). Table 41 displays the survey participant statistics. As mentioned earlier, due to the unavailability of two private RPO email addresses, the sample size for the survey decreased to 81.

Table 41   Sample, response and completion of the survey

	Total Sample (Gross)	Adjusted total sample	Response[25]	Completion
N	83	81	23	15
In %	100	97,6	28,4	18,5

In the pilot of the online survey, we implemented two open-ended questions for the quality check to help us improve the survey (issues with the survey's language; feedback on the questions).

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[25] Response and completion rate were calculated based on adjusted total sample.

The analysis of the survey results informed the revision of the questionnaire according to the following aspects:

- Detecting misunderstandings through inconsistent answers.

- Detecting misunderstandings through answers in the text fields "other".

- Detecting problems in analysing and interpreting the results due to inconsistencies in the items or questions.

- Integrating items which stem from the text fields "other".

- Exploring answers to the feedback questions (survey language, feedback on the questions).

We will present the results of this analysis and the final questionnaire in the deliverable D3.3, which explores the full survey.

6 Comparison of the Two Approaches: Reactive vs. Non-Reactive Methods

Our study compares reactive and non-reactive methods to monitor GEPs on a supra-institutional and European-wide level. This chapter presents preliminary results of a comparison of both methodological approaches, building on the experiences in the pilot study. The two strategies – online survey as a reactive method and web scraping together with automated text analysis as a non-reactive method – present significant advantages and obstacles, each in particular circumstances.

Regarding **data quality**, the online survey turned out better than web scraping because of the personalised research design. The survey allows us to collect specific information and design questions that directly address our research objectives: prevalence, characteristics, implementation and impact of GEPs.

Surveys are typically known for a low compilation rate. This issue was also the case for the INSPIRE survey. The compilation rate of the survey is 18 per cent. We had difficulty reaching private RPOs and could not retrieve two private RPOs' email addresses. The online survey exhibits sample selection bias, as it predominantly includes respondents with a GEP. There is no information on institutions without a GEP in the online survey method.

As a non-reactive approach, web scraping does not involve direct engagement with or feedback from web users. It allows for gathering existing data from the web, such as text, images, and various other forms of content found on websites. Thus, web scraping can collect an enormous amount of data. INSPIRE's scraper achieved a 93% accuracy rate in determining the prevalence of GEP across all institutions in the pilot sample. However, finding target GEPs through web scraping was not straightforward. In our initial investigation involving 83 domains,

the data acquired via web scraping was inconsistent and noisy. We also retrieved documents about gender equality that cannot be categorised as GEPs.

The presence of multiple languages, irregular metadata, and the lack of standard terminology for file descriptions make it difficult to obtain high-quality data through web scraping. This lack of uniformity presents a challenge for automated text analysis as well. Furthermore, most webpages contain a file named "robot.txt," which defines accessible URLs within the webpage for the scraper. For example, if a GEP is located on a page not allowed by the "robot.txt" file, it cannot be detected via the scraper. Additionally, some files were delivered over Content Delivery Networks (CDN), especially protected by services like CloudFlare that did not allow the PDF files to be downloaded. Moreover, CAPTCHAs (computer challenge-response test that determines whether or not the user is human) also present challenges for web scraping to collect the data from the web. Despite the difficulties encountered, the quantity of data in regard of the prevalence indicator obtained through web-scraping during the piloting phase far exceeded that obtained through online survey method.

Both, designing an online survey and developing a web scraper are **time-consuming**. Designing a survey involves careful consideration to ensure the questions are unbiased and adequately measure the intended outcome. Deciding on and configuring the web scraper tool, i.e., SerpAPI, was time-consuming since it requires trials with different search terms and languages. Furthermore, our online survey procedure required significant time to retrieve participants' email addresses — of those persons who are responsible for gender equality in the organisations — whereas finding URLs of the targeted websites for the web scraper was straightforward to select since they can be detected via a simple web search. In regard of the web scraping cleaning the data is more time-consuming than for the online-survey.

The **cost** of implementation may differ based on the tools chosen for each approach. In our case, we opted to purchase a paid web scraping tool due to its ability to gather high-quality data. In addition, the expenses associated with classification and translation can be significant. The questionnaire needed to be at least proofread by native speakers or professional translators as well as for the classification and analysing process of the "big data" corpus; LLM requires special hardware equipment, i.e., GPUs. Regarding the INSPIRE survey, we utilised a licenced survey software called Unipark through GESIS. However, other options, such as free web scraping tools and open-source survey software, may be more cost-effective for specific projects.

Ethical considerations are another aspect of data collection. In the survey, participants are typically required to sign data consent forms in compliance with the General Data Protection Regulation[26] (GDPR) enforced by the EU. As of 2022, no laws or rules govern web scraping (Kryukov 2023). Each case of web scraping should be examined contextually, taking into account criteria such as the nature of the data being scraped, the source of the scraping tools and data protection, and the website's terms of service. Thus, collecting data regarding GEPs

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[26] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02016R0679-20160504

with SerpAPI should be aligned with the legal context since we are retrieving the crawled information from Google's database.

The development of new tools in Information Technologies (IT) and Natural Language Processing (NLP) enhances the capabilities of web scraping and text analysis, suggesting a potential shift towards more automated methods in the future. The full study presents several open questions that still need resolution. First, the most effective approach for accurately identifying targeted GEPs must be determined. This involves deciding whether to use zero-shot classification or meta-analysis and selecting between models like GPT or BART if zero-shot classification is chosen. Additionally, practical concerns include addressing hardware limitations when deploying large language models (LLMs) and analysing a vast quantity of PDFs. These challenges require strategic decisions to optimize the study's methodology and technical setup.

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8 Appendix

8.1 List of Indicators

Prevalence

Indicator 1.1   A gender equality plan or a written and formal institutional strategy that fosters gender equality) exists in a research-performing or research-funding organisation.

Indicator 1.2   The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of::
- Participation in EU structural change projects, e.g., Horizon 2020, Horizon Europe
- Received funding other than EU projects, e.g., from national RFOs
- Received non-monetary support
- Legal requirements or requirements linked to getting research funding

Characteristics

Indicator 2.1   Ownership and hierarchical level of the organisation that adopted the GEP: ownership of the GEP

Indicator 2.2   Publication of the GEP: publication accessible to people outside the organisation, internal publication (accessible to all members of the organisation), internal document (accessible only to the management)

Indicator 2.3   Date of the first and current plan's adoption and time frame of the current plan

Indicator 2.4   Areas of activity (grouped according to the specification for Horizon Europe) and target groups addressed in the GEP
- Prevalence: Are there measures in each area of activity
- Quantity: How many measures in each area of activity

Indicator 2.5   ***The GEP integrates inclusive approaches like::***
- Gender diversity

- Intra-categorial differences inside the gender groups (e.g. women with migration background, Black women, etc.)
- Intersectionality (on a more conceptual level, not necessarily as a term)
- Diversity (inequalities addressed beside each other/"celebrating the differences" approach)

Indicator 2.6   The GEP addresses different inequalities (race, class/social background, age, etc.).

Implementation

Indicator 3.1   Assessment of planned and implemented gender equality measures (by areas of activity)
- Level of realisation: planned – started – implemented
- Institutional coverage: implemented across the institution, implemented in some departments, not implemented anywhere

Indicator 3.2   Financial resources are dedicated to gender equality measures/implementation of GEP.

Indicator 3.3   A gender equality unit, gender equality committee and/or dedicated staff are in place.

Indicator 3.4   Gender equality is integrated into institutional/internal regulations (appointment regulation, basic rules of the institution, etc.).

Indicator 3.5   Internal and external stakeholders are involved in the GEP implementation.

Indicator 3.6   A policy for monitoring/controlling gender equality measures and the GEP implementation is in place.

Indicator 3.7   Sex-disaggregated data are collected and published.

Indicator 3.8   Gender diversity and intersectional perspectives are integrated into the monitoring or data collection:
- Inclusion of a broader and non-binary understanding of gender diversity
- Inclusion of other inequalities in conjunction with gender

Impact

Indicator 4.1   The GEP includes a reflection or description of the GEP impact. The organisation reflects its understanding of the GEP impact.

Indicator 4.2   The GEP designates data and methods (e.g. evaluations, surveys or qualitative data) to assess the GEP impact.

Indicator 4.2   Changes in the participation of women within a set period (5-10 years) and comparing RPOs with/without GEP (or gender equality measures) in leading positions

Indicator 4.3   Rating of the changes in the areas of activity (gender balance, awareness, knowledge about gender (and other) inequalities, promotion and recruitment procedures, work-life-balance) and relevance of GEPs for the achieved changes

8.2 Web Scraping: Search Terms in the Pilot Study

Table 42   Search terms used in web-scraping.

Country	Search Term 1	Search Term 2	Search Term 3	Search Term 4	Search Term 5	Search Term 6	Search Term 7	Search Term 8
Ireland	gender equality plan	Gender Action Plan	Gender Equality Action Plan	Athena SWAN	Gender equality charter			
Germany	Gleichstellungs plan	Frauenförderpl an	Chancengleich heitsplan	Aktionsplan AND Gleichstellung	Rahmenplan AND Gleichstellung	Rahmenplan AND Chancengleich heit	Gleichstellungs konzept	Gleichstellungs strategie
Greece	Σχέδιο για την ισότητα των φύλων	Σχεδίου Δράσης για την Έμφυλη Ισότητα	σχέδιο δράσης για την ισότητα των φύλων	Σχέδιο Δράσης για την Ισότητα των Φύλων	Σχέδιο Δράσης για την Έμφυλη Ισότητα			
Estonia	Soolise võrdõiguslikkus e kava	soolise võrdõiguslikkus e tegevuskava	soolise võrdõiguslikkus e plaan	võrdse kohtlemise kava	Soolise võrdõiguslikkus e põhimõtted ja tegevuskava			

8.3 Text Analysis: Search Terms

Prevalence

Indicator 1.2   The existence of a GEP in an organisation is linked to national and European initiatives or requirements or third-party funding in terms of: Requirements linked to getting European research funding (HORIZON Europe)

- Participation in EU structural change projects, e.g., Horizon 2020, Horizon Europe

Search Terms = "Horizon Europe", "Eligibility criterion", "Horizon research funding"

Characteristics

Indicator 2.3   Time frame of the current plan

Search Pattern = r'\s?\d{4}\s*? [\u002D\u058A\u05BE\u2010\u2011\u2012\u2013*

\u2014\u2015\u2E3A\u2E3B\uFE58\uFE63\uFF0D]\s?\d{4}\s*?'*

Indicator 2.4   Actions of awareness-raising and training addressed in the GEP

Search Terms = "awareness training", "raise awareness", "increase awareness", "awareness-raising", "unconscious bias", "gender stereotypes", "recruitment training", "selection training", "sensitisation", "sensitivity to gender equality", "capacity-building training", "gender equality training", "training sessions", "training of the recruitment committees", "raising awareness", "training courses", "training events", "awareness and competence development", "awareness of gender issues", "employee awareness", "gender equality awareness", "gender awareness", "unconscious gender bias", "awareness of gender equality"

Indicator 2.4   Work-life balance and organisational culture addressed in the GEP

Search Terms = "Work-life balance", "Caring responsibilities", "Care responsibilities", "Parental leave", "Family leave", "Maternity leave", "Paternity leave", "Career breaks", "Family-related break", "Returne4r", "Parents", "Carers", "Flexible working time", "Flexibility of working time", "Working time arrangements", "Remote working", "Hybrid working", "Family audit", "Childcare facilities", "Childcare", "Nursery", "Day care center", "Family support", "Dignity at work", "Inclusive language", "Gender-sensitive language", "Gendered language", "Welcoming", "Workload", "Open work environment", "Inclusive work environment", "Family life", "Child care leave"

Indicator 2.4   Gender balance in leadership and decision-making addressed in the GEP

Search Terms = "Gender balance", "Decision-making body", "Decision-making bodies", "Academic leadership", "Administrative leadership", "Representation", "Leadership position", "Gender quota", "Gender balance", "Election

procedures", "Leadership competences", "Leadership development", "Decision-making process"

Indicator 2.4   Gender equality in recruitment and career progression addressed in the GEP

Search Terms = "Recruitment procedure", "Recruitment committee", "Recruitment panel", "Selection process", "Selection procedure", "Promotion committee", "Career progression", "Career development", "Evaluation criteria", "Appraisal criteria", "Performance assessment", "Performance appraisal", "Mentoring", "Career ladder", "Career path", "Career advancement", "Recruitment process", "Gender equality in recruitment", "Recruitment transparency"

Indicator 2.4   Measures against gender-based violence, including sexual harassment, addressed in the GEP

Search Terms = "Gender-based violence", "Sexual harassment", "Harassment", "Sexual violence", "Bullying", "Gender-based discrimination", "Sexualized violence", "Sexualised violence"

Indicator 2.4   Integration of the gender dimension into research and teaching content addressed in the GEP

Search Terms = "Gender dimension", "Sex analysis", "Gender analysis", "Gender impact assessment", "Incorporating gender", "Incorporating sex", "Research funding", "Research priorities", "Teaching activities", "Educational activities", "Gender perspectives", "Gender in research", "Gender in teaching"

Indicator 2.5   The GEP integrates intersectionality

Search Terms = "Intersectional", "Intersectionality"

Indicator 2.5   The GEP integrates diversity

Search Terms = "Diversity"

Indicator 2.5   The GEP integrates gender diversity

Search Terms = "Non-binary", "Gender-diverse", "Trans", "Transgender", "Gender diversity", "Gender identity", "All genders", "Other genders"

Indicator 2.6   The GEP addresses race

Search Terms = "Race", "Ethnic background", "Ethnic minorities", "Migrant", "Immigrant", "Ethnic origin", "Ethnicity", "Black", "People of colour", "Black", " People of color", "PoC", "BIPoC", "Indigenous", "Minority ethnic",

Indicator 2.6   The GEP addresses nationality

Search Term = "Nationality"

Indicator 2.6   The GEP addresses religion

Search Terms = "Religion", "Religious", "Religions", "Religiose", "Religiosity", "Religiously", "Muslim", "Jewish"

Indicator 2.6   The GEP addresses class/social background

Search Terms = "Class", "Social background", "First generation", "Socio-economic status"

Indicator 2.6   The GEP addresses age

Search Terms = "Age"

Indicator 2.6   The GEP addresses sexual orientation

Search Terms = "Sexual orientation", "Gay", "Lesbian", "Bisexual", "Queer", "LGBTIQ", "Sexual identity", "LGBTI",

Indicator 2.6   The GEP addresses disability

Search Terms = "Disability", "Disable", "Disabled", "Disabling", "Disablism", "Disablist", "Ableism", "Physical Impairment", "Physical limitation", "Chronic disease"

Implementation

Indicator 3.3   A gender equality unit, gender equality committee and/or dedicated staff are in place.Search Terms = "Gender equality officer", " Gender equality commissioner", "Equal opportunities officer", "Equal opportunity officer", "Equal opportunity commissioner", "Gender equality unit", "Gender equality team", "Equality officer", "EDI manager", "Diversity manager", "Diversity team", "EDI committee", "EDI director", "Working group", "GEP working group", "Gender equality working group", "Equality committee", "EDI committee", "Athena SWAN steering group", "EDI joint advisory committee", "Gender equality steering group", "Senate commission for gender equality", "Senate commission for equality", "Senate commission for equal opportunities"

Indicator 3.6   A policy for monitoring/controlling gender equality measures and the GEP implementation is in place

Search Terms = "Monitoring", "Controlling", "Evaluation", "Quality assurance", "Gender equality analysis", "Gender equality audit", "Gender equality assessment", "Equality analysis", "Equality audit", "Equality assessment", "Self-assessment", "EDI surveying", "Equality impact assessment"

Indicator 3.7   Sex-disaggregated data are collected and published: collection

Search Terms = "Data collection", "Collection of data", "Sex-disaggregated data", "Gender statistics", "Gender data", "Collecting data", "Share of women", "Share of men", "Proportion of women", "Proportion of men", "Regular statistics"

Indicator 3.7   Sex-disaggregated data are collected and published: publication

Search Terms = "Reporting", "Gender data report", "Gender equality report", "Equality monitoring report", "EDI reporting", "Progress report", "Publication of data", "Gender distribution", "Distribution of positions", "Distribution of academic positions", "Annual report"

Impact

Indicator 4.1   The GEP includes a reflection or description of the GEP impact. The organisation reflects its understanding of the GEP impact.

Search Terms = "Impact", "Effect", "Outcome", "Output"

8.4 Survey: Questionnaire (English)

Survey to Monitor Gender Equality Plans

Starting page

Welcome to the survey to monitor gender equality plans.

Please select your preferred language.

1 Introduction

Thank you for participating in this survey.

The online survey aims to monitor the existence of a Gender Equality Plan or an equivalent, its characteristics, its implementation, and an assessment of its impact. The survey is provided by GESIS - Leibniz-Institute for the Social Sciences as part of the INSPIRE project, funded by the European Union. GESIS is researching how to monitor Gender Equality Plans (GEPs) of Research Performing Organisations (Higher education institutions, public research institutions, private companies) and Research Funding Organisations in the European landscape.

If you don't have any information about gender equality activities in your organisation, please transmit the survey to someone with the knowledge.

Informed consent

We, Lena Weber, Andrea Löther and Mazlum Karataş – researchers at GESIS – hereby inform of the following:

1. **Purpose of the study**

GESIS – Leibniz-Institute for the Social Sciences undertakes the survey in the context of the INSPIRE project. INSPIRE (https://inspirequality.eu) is a project funded by the European Union to build Europe's Centre of Excellence on inclusive gender equality in research and innovation. It brings together cutting-edge knowledge, ambitious policy approaches, and innovative practices to provide a gateway for scholars, equality experts, practitioners, and trainers to connect and share resources, as well as co-create new ones. INSPIRE's ambitious research programme develops new, relevant indicators for developing inclusive Gender Equality Plans (GEP). The project conducts a GEP monitoring survey across Europe to identify the necessary conditions for GEP impact. INSPIRE counts on four Knowledge & Support Hubs (KSHs) led by academics and practitioners throughout Europe to develop cutting-edge knowledge on sustaining change, widening participation, intersectionality and fostering innovation and change in the private sector**.** These KSHs will provide support to 12 communities of practice to facilitate GEP implementation and foster mutual support for the co-development of innovative practices, customised training and pan-European data collection.

The online-survey is oriented to map GEP prevalence and impact in Research Performing Organisations and Research Funding Organisations in the European Research Area. The survey will cover key process and content features of GEPs as specified in the Eligibility Criteria for Horizon Europe.

2. **Who takes part in the study**

Participants in the online survey are the organisations in question in the EU 27 as well as Bosnia-Herzegovina, Israel, Norway, Serbia and Switzerland from the associated countries and the UK.

3. **Procedure**

The survey consists of six parts and will take approximately [15-25 minutes] of your time to complete. We ask you kindly to answer as many questions as you can. Answers are saved automatically when you click "Continue" in the online survey interface. It is possible to interrupt the survey and re-visit your answers later by clicking the same link.. During the survey, you can go back and modify your answer by clicking "Back" button. If you change your mind during the survey and do not wish to participate, you can simply close the browser. Once you have reached the last page and do not wish to make further changes to your answers, we kindly ask you to click "Continue".

4. Confidentiality

When filling out the online survey, we will ask you if you want to receive more information about the INSPIRE project from the INSPIRE consortium members. If so, you will be redirected to the INSPIRE homepage to fill in your contact details.

As the online-survey is hosted by Unipark, GESIS will have access to the answers you provide in the survey. However, before sharing any data with other INSPIRE consortium members, the data file is split so that the main part of the survey is completely anonymous.

The remaining data is analysed anonymously and published only in aggregated form. Organisation names are asked so that collaboration networks can be mapped.

We found your data (name, function and mail-address) via a web search performed by INNO Systems, one of the INSPIRE Consortium members. Your personal data will be treated in accordance with the privacy policy of GESIS, which you can access from the research organisation's website (https://www.gesis.org/en/institute/data-protection), and according to the requirements of the European General Data Protection Regulation (GDPR 2016/679) and the German General Data Protection Regulation "GDPR" (2018). You can exercise your rights of accessing, modifying, opposing, and cancelling your data by contacting us (inspire@gesis.org). Your data and data of the submitted online-survey will be stored until the end of the project (30 September 2026). After this period, the data will be blocked until the applicable expiry period has elapsed. You may request to erase your data before the project ends by sending an email to (inspire@gesis.org). In this case your data will be blocked until the applicable expiry period has elapsed.

5. Dissemination of findings

The findings of this study are part of a European project. Findings can be used for conference presentations and publications in academic journals and/or book chapters. INSPIRE strives to make research data FAIR (findable, accessible, interoperable, and reusable) and available to the public and other researchers through open access repositories. All dissemination of research findings will follow the requirements of the EU legal framework for privacy, data protection and security of personal data.

6. Feedback

If you wish so, you can receive an electronic copy of any publications resulting from the research conducted in the INSPIRE project. Please send any requests via email to inspire@gesis.org.

7. Complaints

Any complaints regarding the ethical aspects of this study should be directed to the email of Datenschutz-GESIS@he-c.de at GESIS.

8. Who to contact if you have any questions

If you have any questions about this project, please get in touch with the principal investigator Rachel Palmén via email: rpalmen@uoc.edu.

9. Consent

I consent to participate in this survey.

- ☐ Yes
- ☐ No

Option No – exit

2 Information about the organisation

First, we like to get some information about your organisation.

2.1 Country

List/drop-down menu

2.2 Field of activity of your organisation

- ☐ Higher Education Institution
- ☐ Research organisation
- ☐ Private Company
- ☐ Research Funding Organisation

2.3 Size of your organisation

Please indicate the number of employees (academic, administrative and technical staff).

- ☐ Less than 50
- ☐ 51 - 250
- ☐ 251 - 500
- ☐ 501 – 1000
- ☐ 1001 – 5000
- ☐ More than 5.000

2.4 Name of your organisation

We ask the organisations' names to link the responses with other characteristics. The data is analysed anonymously and published only in aggregated form.

free text field

3. Prevalence

Our following questions concern the existence of a Gender Equality Plan and the motivations for adopting it.

3.1 Does your organisation approve a Gender Equality Plan or another institutional strategy to foster gender equality and/or diversity?

In this survey, we understand a Gender Equality Plan (GEP) as a written document that describes the institutional strategy to foster gender equality in your organisation. It could be name differenty in your organisation. The GEP regularly identifies gender inequalities, describes measures to counteract them, sets targets for gender equality, and instruments to monitor the progress. We can also speak of a GEP when it addresses gender among other dimensions of inequality (such as race, class, sexual orientation, age, etc.). In the framework of this survey, we investigate the gender equality plan of the whole organisation, not of departments or single units.

Please indicate the kind of institutional strategy. Several responses are possible.

1. Gender Equality Plan (focusing primarily on gender equality)
2. Gender equality and Diversity plan (including several inequalities but focusing on gender)
3. Diversity, equity or inclusion plan (dealing with several inequalities without highlighting one)
4. No such plan
5. Not known
6. No answer

Explanatory text for:

Filter 0 = 5 or 6

If you don't have any information about gender equality activities in your organisation, please transmit the survey to someone with the knowledge.

3.2 Does the equity or diversity plan integrate targets and measures to foster gender equality?

Filter: 0 = (3)

☐ Yes
☐ No
☐ Not known
☐ No answer

Explanatory text for

Filter: 3.1 = 1 + 2 or 3

If your organisation has adopted a diversity plan or strategy in addition to the gender equality plan, the questions in the survey deal exclusively with the gender equality plan.

3.3   In what language/s is the Gender Equality Plan available in your organisation?

Filter: 0 = 1-3

Please select from the list. Several answers are possible:

- ☐ National language
- ☐ English
- ☐ Other language

3.4   Has your organisation received funding from a European or national funding agency to set up a gender equality plan?

Filter: 0 = 1-3

Receiving funding to set up a gender equality plan means, for example, participating in a structural change project financed through the EU or externally funded staff exclusively engaged in setting up the gender equality plan. It does not include the financing of gender equality measures or research funding, which requires having a gender equality plan.

- ☐ Yes
- ☐ No
- ☐ Not known
- ☐ No answer

3.5   Has your organisation received non-monetary support to set up the current gender equality plan?

Filter: 0 = 1-3

Explanation: Support might consist of training (e.g., offered nationally), counselling, or cooperation (e.g., professional networks). Non-monetary support does not include support for gender equality measures in general or stakeholders of your organisations engaged in setting up the gender equality plan.

- ☐ Yes
- ☐ No
- ☐ Not known
- ☐ No answer

3.6   HORIZON Europe requires organisations to submit a Gender Equality Plan (GEP) if they apply for research funding. Did this requirement influence your organisation to set up a GEP?

Filter: 0 = 1-3

- ☐ Yes – Our organisation set up a GEP because of the requirement.
- ☐ Yes – Our organisation adopted an existing plan to meet the requirements of HORIZON Europe.
- ☐ No – Our organisation set up a GEP before HORIZON Europe started (2021).
- ☐ No – Our organisation set up a GEP recently but regardless of the HORIZON Europe requirement.
- ☐ Not known
- ☐ No answer

3.6 Some national laws, national funding bodies or national gender equality initiatives demand having a Gender Equality Plan (GEP). Did your organisation set up a GEP because a national authority or initiative (ministry, funding body, national gender equality plan, NGO, etc.) asked for it?

Filter: 0 = 1-3

Gender equality initiatives demanding having a Gender Equality Plan are f.ex. Athena SWAN (UK, Ireland) or the program for women professors (Germany). This also includes legal requirements and voluntary initiatives like diversity or equality audits.

- ☐ Yes
- ☐ No
- ☐ Not known
- ☐ No answer

3.8 Please specify this national initiative

Filter: 0 = yes

Free text field

3.9 What have been any further reasons for your organisation to set up a Gender Equality Plan?

Filter: 0 = 1-3

Free text field

[Free text field only in the pilot survey; items for the full survey will established by clustering the responses]

3.10 What is the most crucial reason for your organisation not having a Gender Equality Plan?

Filter: 0 = 4

Please select from the list. Several answers are possible:

☐ Time-consuming
☐ No personal resources
☐ No acceptance
☐ No necessity
☐ Other, please specify - free text field

4. Characteristics

In this section, we ask you about the characteristics of the gender equality plan, such as its duration, the involved stakeholders, and the key areas addressed.

4.1 Which bodies of your organisation approved the Gender Equality Plan?

Filter: 0 = 1-3

Please select from the list. Several answers are possible:

☐ Management board, rectorate, executive committee, directorate
☐ Decision-making body of internal members: e.g. Senate
☐ Decision-making body of (mostly) external members: e.g. university council, supervisory board
☐ Scientific council
☐ Members assembly, staff assembly
☐ Other, please specify - free text field

4.2 In which way is the Gender Equality Plan published and accessible?

Filter: 0 = 1-3

Please select from the list.

☐ The document is accessible to people outside the organisation
☐ Only internal document and accessible to all members of the organisation
☐ Only internal document and accessible only to the management

4.3 Please state the URL via which the Gender Equality Plan is publicly accessible.

Filter: 0 = 1

Free text field

4.4 When was the first Gender Equality Plan adopted by your organisation (year)?

Filter: 0 = 1-3

In the year: field in the format ####

☐ Not known

☐ No answer

4.5   What period does the current plan cover?

Filter: 0 = 1-3

Year [format #### - ####]

☐ The current plan does not have a specific time frame.
☐ Not known
☐ No answer

4.6   A Gender Equality Plan provides for interventions in different areas. Please indicate the number of interventions (activities, policies, regulations etc.) in each area.

Filter: 0 = 1-3

[Matrix]

Scale:

- no measures designed
- 1 measure
- 2-5 measures
- 6-10 measures
- more than 10 measures
- not applicable

List:

- Awareness-raising and training
  (e.g. workshops and training on gender bias, training for recruitment committees, booklets, films or posters)
- Work-life balance and organisational culture
  (e.g. child-care facilities for staff and students, dual career policy, network of fathers on the campus, respectful interaction, welcoming culture)
- Gender balance in leadership and decision-making
  (e.g. quota for decision-making bodies, gender-integrated leadership program)
- Gender equality in recruitment and career progression
  (e.g. active recruitment, gender equality in appointment procedures, coaching and mentoring programs for women researchers)
- Measures against gender-based violence, including sexual harassment,
  (e.g. complaints office, guidelines on sexual harassment)
- Integration of the gender dimension into research and teaching content
  (e.g. counselling for research funding, gender lectureship)

4.7   Which target groups does the Gender Equality Plan address?

Filter: 0 = 1-3

Please select from the list. Several answers are possible:

- ☐ Students
- ☐ PhDs
- ☐ Academic or scientific staff (or employees)
- ☐ Administrative and technical staff (or employees)
- ☐ Leading positions
- ☐ Applicants
- ☐ Reviewers
- ☐ Other, please specify

4.8 Which terms and perspectives about diversity and gender are used in the Gender Equality Plan?

Filter: 0 = 1-3

(1) It mentions differences within gender groups (e.g. Black women or persons with disabilities).
(2) It provides measures to enhance equal opportunities for disadvantaged groups (e.g. Black women, persons from disadvantaged socioeconomic backgrounds or international students).
(3) It includes the concept of "intersectionality".
(4) It includes the concept of "diversity".
(5) It mentions gender diversity (e.g. non-binary, diverse, trans, etc. persons).
(6) It uses gender-neutral or gender-sensitive language, e.g. with signs to draw attention to gender-sensitive language (like "*", "_", ":" or "/").

Coding for every item: Yes – No – Not known – No answer

4.9 Which inequalities other than gender does the Gender Equality Plan mention?

Filter: 0 = yes on one of 1-4

Please select from the list. Several answers are possible:

- ☐ Race, ethnicity, ethnic minorities, BAME [Black, Asian, Minority Ethnics], BIPOC [Black, Indigenous People of Colour]
- ☐ Nationality
- ☐ Religion
- ☐ Class, socioeconomic status, first-generation students or academics
- ☐ Age
- ☐ Sexual orientation
- ☐ Gender identity
- ☐ Disability/chronic health/mental impairment
- ☐ Care responsibilities

□   Additional inequalities not listed
[+ free text field]

5. Implementation

The following questions concern the implementation of the Gender Equality Plan, focusing on its realisation, personnel and financial resources and monitoring.

5.1 Who in your organisation is responsible for implementing gender equality (or equal opportunities, equality or diversity]?

Please select from the list. Several answers are possible:

□   Gender equality [equality and diversity, equal opportunities…] unit (staff dedicated to gender equality)

□   Gender equality officer / equal opportunity officer (member of the organisation charged with supervising gender equality in the organisation)

□   Gender equality [equality and diversity, equal opportunities…] committee

□   Gender equality officers, staff or committees in the departments

□   Member of the top management (president, vice-chancellor, CEO, head of administration, etc.) charged with gender equality [equality and diversity, equal opportunities…] responsibilities

□   Member of the department management or administration charged with gender equality [equality and diversity, equal opportunities…] responsibilities

□   Other, please specify

5.2 Does your organisation dedicate any internal financial resources to implement gender equality measures?

Financial resources include resources for staff charged with gender equality. Third-party funding is excluded.

□   Yes

□   No

□   Not known

□   No answer

5.3 Please assess the relation of the dedicated budget and the planed and implemented gender equality measures.

<u>Filter</u>: 0 = yes

□   Sufficient

□   Almost adequate

□   Hardly adequate

□   Minimal

5.4   Which stakeholders are involved in the implementation of the Gender Equality Plan?

<u>Filter</u>: 0 = 1-3

Please select from the list. Several answers are possible:

- ☐ Management board, rectorate, executive committee, directorate
- ☐ Decision-making body of internal members: Senate
- ☐ Decision-making body of external members: university council, advisory board
- ☐ Members assembly, staff assembly
- ☐ All employees
- ☐ Heads of the administration
- ☐ Heads of the departments
- ☐ Gender equality unit
- ☐ Gender equality committee
- ☐ Ministry
- ☐ Consultant, trainer. coaches
- ☐ Scientific council
- ☐ Other, please specify -free text field

5.5   Does your organisation provide training and capacity-building measures for gender equality (or diversity/equity)?

- ☐ Yes
- ☐ No
- ☐ Not known
- ☐ No answer

5.6   Does your organisation monitor gender equality and/or the implementation of the Gender Equality Plan?

- ☐ Yes
- ☐ No
- ☐ Not known
- ☐ No answer

5.7   Does your organisation regularly collect gender- or sex-disaggregated data for the following groups?

Please select from the list. Several answers are possible:

- ☐ Students
- ☐ Exams and graduates (BA, MA and equivalent)
- ☐ PhDs
- ☐ Academic or scientific staff
- ☐ Leading positions

☐ Administrative and technical staff
☐ Boards, councils and panels
☐ Success in acquiring funding
☐ Scientific publications
☐ Other, please specify -free text field
☐ No regular collection of gender- or sex-disaggregated data

5.8 Does your organisation regularly publish gender- or sex-disaggregated data for the following groups?

Please select from the list. Several answers are possible:

☐ Students
☐ Exams and graduates (BA, MA and equivalent)
☐ PhDs
☐ Academic or scientific staff
☐ Leading positions
☐ Administrative and technical staff
☐ Boards, councils and panels
☐ Success in acquiring funding
☐ Scientific publications
☐ Other, please specify -free text field
☐ No regular publication of gender- or sex-disaggregated data

5.9 Does your organisation collect gender- or sex-disaggregated data about the inequalities listed below?

Please select from the list. Several answers are possible:

☐ Race, ethnicity, ethnic minorities
☐ Nationality
☐ Religion
☐ Class, socioeconomic background status, first-generation students or academics
☐ Age
☐ Sexual orientation
☐ Gender identity
☐ Disability/chronic health/mental impairment
☐ Care responsibilities
☐ Additional inequalities not listed
  [+ free text field]
☐ No data collection of gender and other inequalities

5.10 When collecting data on gender, which items are generally used in your organisation?

Filter: 0 ≠ no

Please select from the list. Several answers are possible:

- ☐ Women, female
- ☐ Men, male
- ☐ Divers
- ☐ Non-binary
- ☐ Trans* /TIN
- ☐ The variable "No answer"
- ☐ Other, please specify -free text field

5.11 Please estimate the overall implementation status of the measures planned in the Gender Equality Plan.

Estimate the status quo regardless of the duration of the plan. We will take the duration into account when analysing the survey data.

Filter: 0 = 1-3

Please note that the sum should add up to 100%.

Fully implemented: ## % of the measures

Have started: ## % of the measures

Not started yet: ## % of the measures

5.12 Which documents/regulations/procedures of your organisation include gender equality issues?

Please select from the list. Several answers are possible:

- ☐ Mission statement
- ☐ Strategy, university development plan
- ☐ Quality assurance
- ☐ Recruitment or appointment regulations or policies
- ☐ Regulations or policies on career development, human resources development
- ☐ Internationalisation strategy or guest researcher program
- ☐ Regulations for internal research awards or grants
- ☐ Regulations for internal research support
- ☐ Regulation for internal teaching support
- ☐ Guidelines for reviewers and/or applicants
- ☐ Other, please specify -free text field

6. Impact

The last part focuses on the impact of the Gender Equality Plan and the methods used to evaluate its effects.

6.1   Does your organisation assess the impact (the long-term effects) of the Gender Equality Plan and/or gender equality measures?

<u>Filter</u>: 0 = 1-3

- ☐ Yes
- ☐ No
- ☐ Not known
- ☐ No answer

6.2   Please name keywords on how your organisation assesses the impact of the Gender Equality Plan.

Impact assessment issues can be the awareness of gender bias among staff and decision-making bodies or the gender distribution among students and staff.

<u>Filter</u>: 0 = yes

Free text field

6.3   Which approaches does your organisation use to measure the impact?

<u>Filter</u>: 0 = yes

Please select from the list. Several answers are possible:

- ☐ Self-evaluation
- ☐ External evaluation
- ☐ Other approaches, please specify -free text field

6.4   Which data and methods does your organisation use to measure the impact?

<u>Filter</u>: 0 = yes

Please select from the list. Several answers are possible:

- ☐ Survey on working conditions and/or organisation climate among students
- ☐ Survey on working conditions and/or organisation climate among staff
- ☐ Qualitative interviews or focus groups with students
- ☐ Qualitative interviews or focus groups with academic and/or administrative staff
- ☐ Data analysis of the administrative data about gender distribution among departments
- ☐ Analysis of monitoring data (e.g. mentoring, workshops or other equality measures, complaints about sexual harassment)
- ☐ Other, please specify -free text field

6.5   Please indicate the current percentage of women in your organisation's highest research position (or position with research tasks) and that five years ago.

Definition of the highest position: Leading Researcher, researchers leading their research area or field (R4 according to the European Framework for Research Careers); the single highest grade/post at which research is normally conducted (Grade A according to the She Figures), e.g. in universities the highest grades of professors

2022   ## %

2017   ## %

Please describe the position for which you provide the data (salary group, title or other characteristics)

Free text field

6.6   Please rate the extent of changes toward gender equality in the following areas in your organisation since 2017.

Score: -5 -+5, with -5: significant negative changes, 0=no changes. +5=significant positive changes

Please rate changes toward gender equality in terms of more (or less) awareness of gender bias, better (or worse) possibilities to combine private life, care responsibilities and work, organisational culture that takes diversity into account or a higher gender balance in decision-making bodies.

- Awareness of gender equality and gender bias in academia and science
- Work-life balance and organisational culture
- Gender balance in leadership and decision-making
- Gender equality in recruitment and career progression
- Gender-based violence, including sexual harassment,
- Integration of the gender dimension into research and teaching content

6.7   Please rate how far your organisation has stabilised activities for gender equality in the following areas.

Scale: 0 = starting point: nothing in place, 1 = minimal activities, 2 = inception (first isolated activities), 3 = growth (growing number of activities), 4 = integration (activities integrated into a coordinated concept), 5 = institutionalisation: gender equality policies fully integrated into the organisation

- Actions of awareness-raising and training
  (e.g. workshops and training on gender bias, training for recruitment committees, booklets, films or posters)
- Work-life balance and organisational culture
  (e.g. child-care facilities for staff and students, dual career policy, network of fathers on the campus)

- Gender balance in leadership and decision-making
(e.g. quota for decision-making bodies, gender-integrated leadership program)
- Gender equality in recruitment and career progression
(e.g. active recruitment, gender equality in appointment procedures, coaching and mentoring programs for women researchers)
- Measures against gender-based violence, including sexual harassment,
(e.g. complaints office, guidelines on sexual harassment)
- Integration of the gender dimension into research and teaching content
(e.g. counselling for research funding, gender lectureship)

6.8   Please rate the relevance of the Gender Equality Plan for the achieved positive changes.

Score: 0-5, 0 = no influence, 5 = high influence

<u>Filter</u>: 0 = 1-3

6.9   You stated that the Gender Equality Plan has low influence on the achieved changes in gender equality. Which policies or instruments had a bigger influence than the Gender Equality Plan?

<u>Filter</u>: 0 = 0-2

Free text field

7. Further Questions

Finally, we want to know how you handled the survey.

7.1   Which individuals were involved in the processing of this survey?

Please select from the list. Several answers are possible:

- ☐ Member of the top management (e.g. president, vice-chancellor, rectorate, executive committee)
- ☐ Staff linked to the leadership
- ☐ Gender equality officer
- ☐ Gender equality unit
- ☐ Administration staff (e.g. human resources department)
- ☐ Other, please specify - *free text field*

7.2   Would you be interested in joining a Community of Practice (CoP) for Research Funding Organisations (RFOs) or for companies (both aim to exchange knowledge on gender and innovation)?

Information about the INSPIRE's Communities of Practice can be found here: https://www.inspirequality.eu/support)

□ yes

□ No interest

7.3 Please contact with the following e-mail address to be part of Community of Practice : innovationKSH@inspirequality.eu

Filter: 0 = yes

7.4 Do you have any further remarks on gender equality or gender equality plans in your organisation?

Free text field

7.5 Did you had any difficulties with the language of the questionnaire?

[ony for the pilot]

□ Yes

□ Slightly

□ No

□ No answer

7.6 Do you have any remarks concerning the questions?

[ony for the pilot]

Free text field

Final Page 1 => Informed Consent= No

Thank you for taking the time to consider participating in our survey. We sincerely respect your decision to decline after reviewing the informed consent. Your comfort and informed choice are essential to us. If you have any questions or would like to address this topic, please do not hesitate to contact us.

inspire@gesis.org

Final Page 2 => Prevalance= "Not known" or "No answer"

We appreciate your interest in our survey. Apparently, you don't know if the gender equality plan exists in your organisation. If you clicked the answers "not known"/"no answer" by mistake, please contact us directly. Your feedback is valuable, and we like to assist with any clarifications or issues you may have.

inspire@gesis.org

Final Page 3 => The real final page

Thank you for taking the time to complete our survey on gender equality plans. Your contributions are highly beneficial as we strive to monitor gender equality plans and their impact. We appreciate your willingness to share your experiences, which are critical to our commitment to creating a more inclusive and equitable environment. If you have any questions or want to discuss your responses in more detail, please contact us at inspire@gesis.org.
For more information about Inspire project please click the link :
https://www.inspirequality.eu/

8.5 Survey: Invitation and Reminder to the Online Survey

8.5.1 Invitation

---- Deutsche Version am Ende der Mail ----

Dear Madam or Sir,

to whom it may concern,

We kindly invite you to participate in a survey to monitor gender equality plans.

GESIS – Leibniz-Institute for the Social Sciences undertakes this survey in the context of the INSPIRE project (https://inspirequality.eu/). INSPIRE is a project funded by the European Union to build Europe's Centre of Excellence on inclusive gender equality in research and innovation. As part of this project, GESIS is researching how to monitor gender equality plans of Research Performing and Research Funding Organisations in the European landscape via an online survey. The survey asks about the existence of a gender equality plan or an equivalent, its characteristics, its implementation, and an assessment of its impact. We found your data (name, function and mail address) via a web search by INNO Systems, one of the INSPIRE Consortium members.

Participating in the survey, which will take 15-20 minutes, will help get valuable and essential information about implementing gender equality plans in the European Research Area.

The survey is available in English and German. To participate, please click on the following link. The survey is available until 27.03.2024.

 #code_complete#

If you don't have any information about gender equality activities in your organisation, please transmit the survey to someone with the knowledge.

Best regards

Lena Weber, Andrea Löther and Mazlum Karataş

Guten Tag,

wir laden Sie herzlich ein, an einer Umfrage zum Monitoring von Gleichstellungsplänen teilzunehmen.

GESIS - Leibniz-Institut für Sozialwissenschaften führt diese Umfrage im Rahmen des EU-Projektes INSPIRE(https://inspirequality.eu/) durch. INSPIRE ist ein von der Europäischen Union finanziertes Projekt zum Aufbau eines europäischen Exzellenzzentrums für intersektionale Geschlechtergerechtigkeit in Forschung und Innovation Im Rahmen dieses Projekts erforscht GESIS wie ein Monitoring von Gleichstellungsplänen in Hochschulen, Forschungseinrichtungen und der Industrieforschung auf europäischer Ebene durchgeführt werden kann. Wir fragen in der Umfrage nach dem Vorhandensein eines Gleichstellungsplans oder eines Äquivalents, den Merkmalen, der Umsetzung und einer Einschätzung der Wirkungen. Wir haben Ihre Daten (Name, Funktion und Mailadresse) über eine Websuche von INNO Systems, einem der Mitglieder des INSPIRE-Konsortiums, gefunden.

Die Teilnahme an der Umfrage, die 15-20 Minuten in Anspruch nehmen wird, wird dazu beitragen, wichtige Informationen über die Umsetzung von Gleichstellungsplänen im Europäischen Forschungsraum zu erhalten.

Die Umfrage ist auf Englisch und Deutsch verfügbar. Um teilzunehmen, klicken Sie bitte auf den folgenden Link. Die Umfrage ist bis zum 27.03.2024 geöffnet:

 #code_complete#

Wenn Sie keine Informationen über Gleichstellungsaktivitäten in Ihrer Organisation haben, leiten Sie die Umfrage bitte an jemanden mit diesem Wissen weiter.

Mit freundlichen Grüßen

Lena Weber, Andrea Löther und Mazlum Karataş

8.5.2 The First Reminder

Subject: Friendly Reminder: Survey on Monitoring gender equality plans

---- Deutsche Version am Ende der Mail ----

Dear Madam or Sir,

to whom it may concern,

This is a friendly reminder for our survey about gender equality plans. Please help us receive more stable evidence about gender equality plans in European research performing organisations while answering our survey.

GESIS – Leibniz-Institute for the Social Sciences undertakes this survey in the context of the EU-funded INSPIRE project (https://inspirequality.eu/). INSPIRE is a project to build Europe's Centre of Excellence on inclusive gender equality in research and innovation. As part of this project, GESIS is researching how to monitor gender equality plans of Research Performing and Research Funding Organisations in the European landscape via an online survey. The survey asks about the existence of a gender equality plan or an equivalent, its characteristics, its implementation, and an assessment of its impact. We found your data (name, function and mail address) via a web search by INNO Systems, one of the INSPIRE Consortium members.

Participation in the survey will only take 15-20 minutes of your time.

The survey is available in English and German. To participate, please click on the following link. The survey is available until 27.03.2024.

 #code_complete#

If you don't have any information about gender equality activities in your organisation, please transmit the survey to someone with the knowledge.

Best regards

Lena Weber, Andrea Löther and Mazlum Karataş

Guten Tag,

Dies ist eine freundliche Erinnerung an unserer Umfrage über Gleichstellungspläne mit zumachen.

Wir laden Sie herzlich ein, an unserer Umfrage zum Monitoring von Gleichstellungsplänen teilzunehmen. Bitte helfen Sie uns durch Teilnahme an der Befragung mehr Evidenz über Gleichstellungspläne an wissenschaftlichen Organisationen in Europa zu erhalten.

GESIS - Leibniz-Institut für Sozialwissenschaften führt diese Umfrage im Rahmen des EU-Projektes INSPIRE(https://inspirequality.eu/) durch. INSPIRE ist ein von der Europäischen Union finanziertes Projekt zum Aufbau eines europäischen Exzellenzzentrums für intersektionale Geschlechtergerechtigkeit in Forschung und Innovation Im Rahmen dieses Projekts erforscht GESIS wie ein Monitoring von Gleichstellungsplänen in Hochschulen, Forschungseinrichtungen und der Industrieforschung auf europäischer Ebene durchgeführt werden kann. Wir fragen in der Umfrage nach dem Vorhandensein eines Gleichstellungsplans oder eines Äquivalents, den Merkmalen, der Umsetzung und einer Einschätzung der Wirkungen. Wir haben Ihre Daten (Name, Funktion und Mailadresse) über eine Websuche von INNO Systems, einem der Mitglieder des INSPIRE-Konsortiums, gefunden.

Die Teilnahme an der Umfrage wird lediglich 15-20 Minuten in Anspruch nehmen.

Die Umfrage ist auf Englisch und Deutsch verfügbar. Um teilzunehmen, klicken Sie bitte auf den folgenden Link. Die Umfrage ist bis zum 27.03.2024 geöffnet:

 #code_complete#

Wenn Sie keine Kenntnisse über die Gleichstellungspolitik Ihrer Organisation haben und deshalb die Umfrage nicht beantworten zu können, leiten Sie bitte diese Email an die aus ihrer Sicht passende Person weiter.

Mit freundlichen Grüßen

Lena Weber, Andrea Löther und Mazlum Karataş

8.5.3 The Second Reminder

Subject: Friendly Reminder: Only 6 Days Left to Share Your Insights on Monitoring gender equality plans

---- Deutsche Version am Ende der Mail ----

Dear Madam or Sir,

to whom it may concern,

As a friendly reminder, you have 6 days left to participate in our survey about gender equality plans. Please help us receive more stable evidence about gender equality plans in European research performing organisations while answering our survey.

GESIS – Leibniz-Institute for the Social Sciences undertakes this survey in the context of the EU-funded INSPIRE project (https://inspirequality.eu/). INSPIRE is a project to

build Europe's Centre of Excellence on inclusive gender equality in research and innovation. As part of this project, GESIS is researching how to monitor gender equality plans of Research Performing and Research Funding Organisations in the European landscape via an online survey. The survey asks about the existence of a gender equality plan or an equivalent, its characteristics, its implementation, and an assessment of its impact. We found your data (name, function and mail address) via a web search by INNO Systems, one of the INSPIRE Consortium members.

Participation in the survey will only take 15-20 minutes of your time.

The survey is available in English and German. To participate, please click on the following link. The survey is available until 27.03.2024.

 #code_complete#

If you don't have any information about gender equality activities in your organisation, please transmit the survey to someone with the knowledge.

Best regards

Lena Weber, Andrea Löther and Mazlum Karataş

Guten Tag,

Zur Erinnerung: Sie haben noch 6 Tage Zeit, um an unserer Umfrage über Gleichstellungspläne teilzunehmen. Wir laden Sie herzlich ein, an unserer Umfrage zum Monitoring von Gleichstellungsplänen teilzunehmen. Bitte helfen Sie uns durch Teilnahme an der Befragung mehr Evidenz über Gleichstellungspläne an wissenschaftlichen Organisationen in Europa zu erhalten.

GESIS - Leibniz-Institut für Sozialwissenschaften führt diese Umfrage im Rahmen des EU-Projektes INSPIRE(https://inspirequality.eu/) durch. INSPIRE ist ein von der Europäischen Union finanziertes Projekt zum Aufbau eines europäischen Exzellenzzentrums für intersektionale Geschlechtergerechtigkeit in Forschung und Innovation Im Rahmen dieses Projekts erforscht GESIS wie ein Monitoring von Gleichstellungsplänen in Hochschulen, Forschungseinrichtungen und der Industrieforschung auf europäischer Ebene durchgeführt werden kann.. Wir fragen in der Umfrage nach dem Vorhandensein eines Gleichstellungsplans oder eines Äquivalents, den Merkmalen, der Umsetzung und einer Einschätzung der Wirkungen. Wir haben Ihre Daten (Name,

Funktion und Mailadresse) über eine Websuche von INNO Systems, einem der Mitglieder des INSPIRE-Konsortiums, gefunden.

Die Teilnahme an der Umfrage wird lediglich 15-20 Minuten in Anspruch nehmen.

Die Umfrage ist auf Englisch und Deutsch verfügbar. Um teilzunehmen, klicken Sie bitte auf den folgenden Link. Die Umfrage ist bis zum 27.03.2024 geöffnet:

 #code_complete#

Wenn Sie keine Kenntnisse über die Gleichstellungspolitik Ihrer Organisation haben und deshalb die Umfrage nicht beantworten zu können, leiten Sie bitte diese Email an die aus ihrer Sicht passende Person weiter.

Mit freundlichen Grüßen

Lena Weber, Andrea Löther und Mazlum Karataş