RELEVANT, INCLUSIVE, TRUSTED AND OPEN INDICATORS
FOR RESEARCH AND INNOVATION POLICY

D4.1 Innovation Cases Report

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Executive Summary

The purpose of this deliverable is to perform the first validation exercise and to check the degree of compliance of a **subset of the outputs of the EURITO project** against the list of relevant principles of the Quality Assurance Framework (QAF) V 2.0 of the European Statistical System (ESS) (European Statistical System, 2019). In this sense, this deliverable is mainly focused in validating the principles regarding the quality of statistical output.

Quality is measured by the extent to which the statistics are: **relevant** (QAF principle 11, section 2), **accurate and reliable** (QAF principle 12, section 3), **timely and punctual** (QAF principle 13, section 4), **coherent, comparable across regions and countries** (QAF principles 14, section 5), **and readily accessible** by users and serve the needs of European institutions, governments, research institutions, business concerns and the public generally (QAF principle 15, section 6).

Only the QAF indicators that are relevant for the EURITO project are considered, presented and discussed. In the case that any QAF indicator is considered as non-applicable to the EURITO project, we explain why and justify this exclusion. We begin by presenting official indicators of quality taken directly from the official ESS-QAF documentation. Then we validate the level of accomplishment of the EURITO project for each QAF indicator or sub-principle and explain the reasons and evidence for our assessment of compliance. At the end of the section, we summarize the results of our assessment of the degree of compliance, with three possible levels: low, medium or high.

The present deliverable makes reference to various outputs of EURITO, which can be considered as **innovation case studies** that illustrate and exemplify the scope and nature of the project:

- Analyses of emerging technologies linked to the EURITO pilot 1 including papers about the geography of AI research (Klinger et al, 2021), gender diversity in AI research (Statholoupoulos and Mateos-Garcia, 2019), and the technological trajectory of AI research (Mateos-Garcia et al, 2020).
- An analysis of the level of research funding related to various Sustainable Development Goals (Richardson, forthcoming).
- Analyses of R&D activities related to Covid-19 informed by the pivot of the project towards understanding the response of European researchers and innovators to the pandemic including a study of the levels of adoption of AI technologies to the fight against Covid-19 (Mateos-Garcia et al, 2021a), and studies of Covid-19 related activities in the CORDIS dataset (Mateos-García, 2021) and open science activities related to Covid-19.

Considering the QAF-ESS principles 11-15 of statistical output, **the overall degree of compliance of the EURITO is high.**

The project stands particularly well regarding the principles of relevance, timely indicators and accessibility. In this respect the indicators and methodology from the EURITO project are able to make significant and reliable contributions to better track and understand the R&D&I activity in real time in general, and in the particular case of the scientific response to the Covid-19 crisis.

The project has a low degree of compliance only in one sub-principle, the comparability of statistics over time. In part this is understandable because the EURITO project was invited to pivot towards the study of a very significant event as it was the outbreak of the Covid-19 crisis. Efforts to improve the intertemporal comparability of indicators would therefore improve the overall statistical quality of the project.

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- **List of abbreviations**

AI - Artificial Intelligence
CoP- (European Statistics) Code of Practice
CORDIS - Community Research and Development Information Service
DG RTD - Commission's Directorate-General for Research and Innovation
ESS - European Statistical System
EC - European Commission
EU JRC - EU Science Hub - The European Commission's science and knowledge service (Joint Research Center)
GRID - Global Research Identifier
NIH - National Institutes of Health (NIH) of the United States
NSI - National Statistical Institute
OECD - Organization for Economic Co-operation and Development
ONA- Other National Authority
OpenAIRE - Open Access Infrastructure Research for Europe
QAF - Quality Assurance Framework
REA - European Research Executive Agency
SDG - Sustainable Development Goals
STI - Science, technology and innovation
SWOT - Strengths, Weaknesses, Opportunities and Threats
ToC - Theory of Change

1. Introduction

The purpose of the validation stage within the EURITO project is to make explicit the strengths and weaknesses of the indicator production process and to explore the consistency of the indicator results with external sources. This implies the assessment of:

- the statistical quality of the indicator production process,
- the relevance for the end users and society of the knowledge generated,
- the consistency of the results with external sources that track the response of science, technology and innovation (STI) activity to COVID-19.

The conceptual framework for the entire validation stage will be an adaptation from the Quality Assurance Framework V 2.0 (QAF) of the European Statistical System (ESS) (European Statistical System, 2019), based upon the European Statistics Code of Practice (CoP). Quality is a multi-faceted concept that affects all aspects of the operation of a process, covering not only the statistical outputs, but also the statistical processes that produce them and the environment in which the statistical system develops.

The European Statistics Code of Practice sets the standard for developing, producing and disseminating European statistics. In this line, statistical authorities, comprising Eurostat, the National Statistical Institutes (NSIs) and Other National Authorities (ONAs) responsible for the development, production and dissemination of European Statistics, are strongly committed to these quality principles defined within the CoP and the ESS QAF.

The Quality Assurance Framework of the European Statistical System (ESS QAF) complements and breaks further down the Code of Practice – by identifying possible methods, tools and good practices that can provide guidance and evidence for the implementation of the CoP. In this line, the ESS QAF includes 17 principles of statistical quality organized in three pillars: **institutional environment** (principles 1 - 6), **statistical processes** (principles 7 - 10) and **statistical output** (principles 11 - 15).

The aim of the ESS QAF is to provide guidance and examples for Indicators establishment and production, reflecting the most suitable level for their adoption, application and/or use, to provide high-quality statistics and data on Europe.

The purpose of this deliverable is to perform the first validation exercise and to check the degree of compliance of a **subset of the outputs of the EURITO project** against the list of those ESS QAF statistical quality principles that are most relevant for the comparison. Given our main focus here is on the **outcome** of the project, the relevant principles of ESS QAF framework that will be considered in this document are the statistician output principles, principles 11 - 15.

Our work plan is to reproduce a similar exercise focused on the statistical processes in the forthcoming Deliverable 4.4. This forthcoming deliverable will validate the principles regarding the quality of statistical processes and the overall methodology of

the project. For this reason, Deliverable 4.4 will check the degree of compliance of the EURITO methodology against the ESS QAF principles that refer to statistical processes, principles 7 -10.

The first pillar of the ESS QAF, principles 1-6, cover the “institutional and organisational factors have a significant influence on the effectiveness and credibility of a statistical authority developing, producing and disseminating European Statistics” (European Statistical System, p. 4). These principles are relevant when assessing an entire organization or statistical authority, but they are not applicable to the EURITO project because the project has not the goal to create an organization. For this reason, the first principles of the ESS QAF will not be considered in our validation exercise.

Hence, this deliverable is mainly focused on validating the **principles regarding the quality of statistical output,** so quality is measured by the extent to which the statistics are: **relevant** (QAF principle 11, section 2), **accurate and reliable** (QAF principle 12, section 3), **timely and punctual** (QAF principle 13, section 4), **coherent, comparable across regions and countries** (QAF principles 14, section 5), and readily **accessible** by users and serve the needs of European institutions, governments, research institutions, business concerns and the public generally (QAF principle 15, section 6).

For this analysis, the set of relevant QAF indicators (or sub-principles) to be checked is adapted and framed to the content of the project. Only the QAF indicators that are relevant for the EURITO project are considered, presented and discussed. In the case that some QAF indicator is considered as non-applicable to the EURITO project, we explain why and justify this exclusion. We begin by presenting official indicators of quality taken directly from the official ESS QAF documentation. Then we validate the level of accomplishment of the EURITO project for each QAF indicator or sub-principle and explain the reasons and evidence for our assessment of compliance. At the end of the section, we summarize the results of our assessment of the degree of compliance, with three possible levels: low, medium or high.

This deliverable is connected with the previous deliverable D5.3 User Research Report of the project. This report details the user research process and outputs for EURITO. The main purpose of the User Research Report is to provide the project team with the material required to better understand the audience for whom the final outputs of the project are intended. In this vein, the user research seeks to provide the necessary grounding for data scientists and others working on the project to avoid self-referential design - that is, the design of outputs that reflect one’s own preferences and goals rather than those of the target audience. Building on the deliverable D5.3, the present report incorporates the diversity of users’ vision into the assessment of the EURITO project.

The present deliverable also makes reference to various outputs of the project including:

- Analyses of emerging technologies linked to the EURITO pilot 1 including papers about the geography of AI research (Klinger et al, 2021), gender diversity in AI research (Statholoupoulos and Mateos-Garcia, 2019), and the technological trajectory of AI research (Mateos-Garcia et al, 2020).

- An analysis of the levels of research activity and funding related to various Sustainable Development Goals. This includes an analysis of SDG-related research by country and institution, as well as levels of collaboration between them. (Richardson, forthcoming).
- Analyses of R&D activities related to Covid-19 informed by the pivot of the project towards understanding the response of European researchers and innovators to the pandemic, including a study of the levels of adoption of AI technologies in the fight against Covid-19 (Mateos-Garcia et al, 2020), and studies of Covid-19 related activities in the CORDIS dataset (Mateos-García, 2021a) and open science activities related to Covid-19 (Mateos-García, 2021b).

These documents, which are early outputs of the project, can be considered as **innovation case studies** that illustrate and exemplify the scope and nature of the EURITO project.

After validating these principles, this report closes with a final section recalling all levels of compliance, drawing some conclusions (section 7).

2. Validation of Relevance

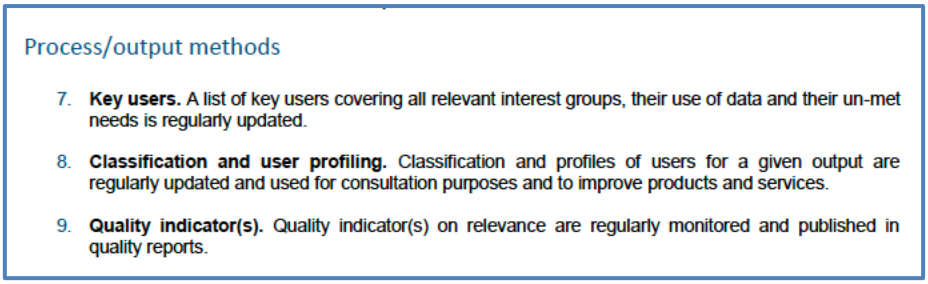
In the QAF, this "Relevance" framework is measured within the following subset of indicators:

Relevance Indicator: Statistics meet the needs of users (Indicator 11.1 QAF)

Indicator 11.1: Procedures are in place to consult users, to monitor the relevance and value of existing statistics in meeting their needs, and to consider and anticipate their emerging needs and priorities. Innovation is pursued to continuously improve statistical output.

Institutional methods

1. **Legislation on user consultation.** The statistical laws (at European and national level) include an obligation to consult users on their needs for official statistics.
2. **Aim of user consultation.** Feedback from user consultations is used to provide input for the preparation of the statistical work programme, identify emerging needs and priorities, improve the quality of statistical outputs, and monitor the value of statistics.
3. **User consultation procedures.** Procedures and activities for the consultation of users on their needs are in place. For example, they consist in setting up user committees, holding regular meetings between key users and statistical authorities, consulting key users or other relevant stakeholders, calling on the skills of experts on specific issues or processing individual user requests and responses.
4. **Analysis of the use of statistics.** Data on the use of statistics (for example, evaluation of downloads, subscribers of reports, web analytics, web scraping results) are analysed (for example, by statistical domain and by type of user) to improve statistical outputs.
5. **Relevance of statistical output.** Procedures are in place to review statistical output on its relevance for users, including its use as a source for other processes, and the impact of its possible termination.
6. **Innovation**. Innovative statistical methods and tools are developed and used to improve the relevance and value of statistical outputs.



Process/output methods

7. **Key users.** A list of key users covering all relevant interest groups, their use of data and their un-met needs is regularly updated.
8. **Classification and user profiling.** Classification and profiles of users for a given output are regularly updated and used for consultation purposes and to improve products and services.
9. **Quality indicator(s).** Quality indicator(s) on relevance are regularly monitored and published in quality reports.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 45)

Regarding indicator 11.1, the EURITO project has set in place procedures to consult key users and to monitor the relevance and value of the new set of indicators in meeting their needs. There have been multiple strands of user research and engagement that have taken place in the EURITO project.

Table 1 presents a summary of the main interactions and consultations with key users. As this table shows, there has been a continued effort to identify different profiles of users and to adapt the project to their needs, encouraging a smart adoption of the new indicators in R&I policy measurement frameworks. For this reason, the fulfilment of this indicator can be considered high.

Table 1. Summary of the main interactions and consultations with key users.

EURITO scoping phase workshop	Brussels, April 2018	Initial project workshop exploring the key challenges and opportunities for developing new R&I indicators. Attended by approximately 30 stakeholders, including representatives from the European Commission's DG RTD, the OECD and several national ministries.
EURITO new data for R&I policy workshop	Brussels, September 2018	Workshop focusing on the use of big data approaches in R&I policy, including an exploration of lessons learned and experiences in developing data pipelines and infrastructures. Attended by over 30 participants, including representatives from the EU's JRC and REA as well as national statistical agencies and other Horizon 2020 projects.
EURITO preliminary findings workshop	Madrid, June 2019	Workshop conducted to explore the emerging findings from the eight EURITO pilots. Participants were invited to speak with the research team about the details of each pilot, and to provide input on various visualization options. Attended by around 20 participants including representatives from EU institutions (JRC and REA) as well as Spanish statistical agencies, research institutions, and ministries.
BMBF & EURITO Workshop on "New Innovation Indicators – From Research to Policy Application"	Berlin, March 2020	This workshop provided an overview of the results achieved so far by the EURITO project (mapping methods of the innovation ecosystem and next generation indicators to monitor and inform R&I policies) and was followed by a discussion with representatives from the European Commission and the OECD, as well as policymakers from Germany and Norway on how to use the results of the projects for the purposes of R&I policymaking identifying needs regarding the R&I indicators.

EC Conversations for EURITO Covid-19 pivot	Conversations throughout 2020 and into 2021	Several meetings and email exchanges with EC officers have taken place in 2020 and 2021 to define and shape the EURITO pivot to the COVID-19 context, identifying EC interests, requirements and needs which have redefined the EURITO scope and focus. Detailed information about the conversation and engagement process with the commission is included in an annex to this report.
Semi-structured interviews	Phone or video calls, winter 2020	As a key input to the User Research report (D5.3), semi-structured interviews with stakeholders identified from the EURITO policymaker and expert register were conducted in winter 2020. Interviewees (n=8) worked in government, private sector, academia, multilateral institutions. Three interviewees were female, five were male. Interviewees were based in several countries, including France, Germany, Austria, the Netherlands and Spain.

Source: EURITO Deliverable 5.3 User Research Report

Relevance Indicator: Inclusion of priority needs in the work programme (Indicator 11.2 QAF)

Indicator 11.2: Priority needs are being met and reflected in the work programme.

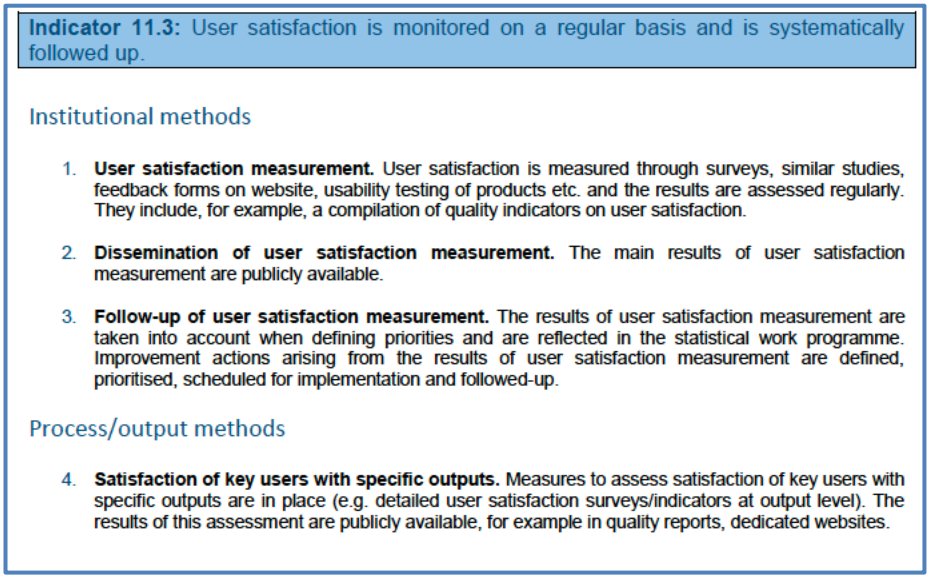
Institutional methods

1. **Statistical work programme priorities.** Procedures are implemented to prioritise different user needs in the statistical work programme.
2. **Strategic goals and programmes.** Strategic goals and programmes are elaborated and published regularly. User needs are taken into account following cost/benefit considerations.
3. **Agreements with key users.** Cooperation Agreements, Service Level Agreements or similar arrangements are established with the key users in order to define and document priority needs.
4. **Evaluation of the statistical work programme.** Periodic evaluation of the statistical work programme is carried out to identify new priorities, negative priorities and emerging needs.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 46)

Regarding indicator 11.2, the EURITO project reoriented the project towards the measurement of the R&D&I activity in response to the Covid-19 crisis following conversations with the European Commission (see Table 1 above and the Appendix of this report for further details). This flexibility to changing priorities implies a high degree of fulfilment of this principle.

Relevance Indicator: Users' satisfaction monitoring (Indicator 11.3 QAF)



Indicator 11.3: User satisfaction is monitored on a regular basis and is systematically followed up.

Institutional methods

1. **User satisfaction measurement.** User satisfaction is measured through surveys, similar studies, feedback forms on website, usability testing of products etc. and the results are assessed regularly. They include, for example, a compilation of quality indicators on user satisfaction.
2. **Dissemination of user satisfaction measurement.** The main results of user satisfaction measurement are publicly available.
3. **Follow-up of user satisfaction measurement.** The results of user satisfaction measurement are taken into account when defining priorities and are reflected in the statistical work programme. Improvement actions arising from the results of user satisfaction measurement are defined, prioritised, scheduled for implementation and followed-up.

Process/output methods

4. **Satisfaction of key users with specific outputs.** Measures to assess satisfaction of key users with specific outputs are in place (e.g. detailed user satisfaction surveys/indicators at output level). The results of this assessment are publicly available, for example in quality reports, dedicated websites.

Quality Assurance Framework of the
European Statistical System (Statistical output, p. 46)

Regarding indicator 11.3, the Users' satisfaction monitoring has been considered from the beginning of the project, as reflected in the Project Monitoring and Evaluation Plan (D6.2), aimed to defined the Theory of Change (ToC) and to provide a framework and tools for the Consortium to monitor and assess the appropriateness of the project design and implementation in achieving the specified objectives, the expected milestones and overarching process and impact, as well as programme results – both intended and unintended. With this framework, we were able to rearrange the project approach to deliver the desired results and intended outcomes identified, highlighted and selected by our end users. It provides the project a means of working together to achieve a shared understanding of the project and its aims, identifying the different views and assumptions of end users.

In this sense, EURITO during its project lifetime has promoted a participatory process for developing and shaping - with multiple stakeholders- the concepts, approaches requirements and needs that our project outcomes should accomplish to fulfil our final objectives. This process of developing the ToC in a participatory manner implemented by EURITO has qualified us -by a continuous contrasting process- to monitor and measure whether our approach and focus was the correct according to the detected users' requirements and needs. Also, it provided the framework to identify what worked and what did not, giving useful information for future projects and as an accountability measure to the Funding Authority, as well as Consortium Bodies on the value of undertaking the project.

In accordance with this, in the early stage of the project several consultations were carried out to assess the satisfaction of key users with the project (via different workshops and stakeholder interviews, table 1). In line with these consultations, Table 2 reports a SWOT analysis that emerges from this dialogue regarding the development of new R&I indicators (adapted from the scoping workshop summary report) (see Deliverable 1.3). As well, the contact with the European Commission (the main key user) has continued throughout the project. However, the satisfaction of other relevant

users was not regularly monitored, in part due to disruptions caused by the Covid-19 crisis[1] and the subsequent changes to the project plan detailed in the amendment. There is a plan to carry out a workshop with interested parties to monitor user satisfaction in a wider audience of users, also presenting project outputs to test whether they meet their needs and requirements and if they are implemented in an accessible and user-friendly way. In overall terms, therefore, the degree of compliance in these principles can be considered as medium.

The work within EURITO had also influence on the revision of the OECD Oslo Manual (OECD/Eurostat 2019) by including standards for the first time in the context as both sources and objectives for innovation and in this sense, standards have different implications for innovation processes based on the chapter on standards as innovation indicators by Blind (2019) produced within EURITO and recently updated by Blind (2021).

Table 2. SWOT analysis messages regarding the new indicator production from the initial user consultation

Weaknesses of the status quo	**Opportunities for the new system**
• The time lag between reality and measurement can be up to 2 or 2.5 years. • Inability to detect emerging innovation trends. • Indicators fail to cover the whole picture, there are blind spots (in the geographical and industry dimensions) of existing innovation activities and communities. In particular, three coverage gaps identified in: social innovation, public sector innovation and geographic granularity of data. • Non-harmonised frameworks for sources, languages or codes and coverage in databases of countries. • There is the burden of response in obtaining some data (e.g. surveys) which intensifies bias/coverage problems. • The current system is not helpful when assessing the impact of a particular project or a public call. Private companies very rarely rely on the existing indicators for impact assessment.	• Possibility of resolving problems of time lag, coverage and blind spots with novel and big data available. • If the data are open and sufficiently granular, new possibilities emerge of doing collaborative analysis of data. • The effort may go beyond setting up a new battery of indicators and contribute to a conversation on how policymakers and society think about innovation. • The new system will work better as a complement (not substitute) to the current set of indicators; this would facilitate acceptance by stakeholders and boost the potential of the project. • Build capacity for analysis (e.g. through networks and collaboration with data experts and universities)
Strengths of the status quo	**Threats of the new system**
• It has established widely accepted standards (e.g. quality). • Long time series allow for temporal and cross-section analysis; these are the typical exercises policymakers ask for. • Use of evidence in policymaking and systems development plays an important role in guiding investment decisions, improving service delivery and outcomes, even more in resource constrained settings or crisis scenarios, where informed decisions are paramount. Society is	• Lack of data quality and limited reliability/ traceability of new indicators. • Big data might produce “too much” data; it will be necessary to select and focus – this is not trivial • Peril of succumbing to “data enthusiasm”: producing rich and complex analysis, but which are difficult to interpret, generalize and replicate. • Data protection and legal issues may appear in decentralized setups of information gathering. Differences of legal standards across countries.

[1] For instance, a user research activity planned for winter 2020 (in Berlin) was cancelled due to the onset of the Covid-19 pandemic. A survey sent out in place of the activity yielded a very low response rate, so the results were not used by the EURITO team.

requiring for more transparent and evidenced based decisions. • Politicians have got used to the current "simple" data and outputs. New information and analysis should need to be "translatable" to the old metrics and mindsets, at least in the short run.	• Acceptance and use of new indicators by policymakers will come only after researchers use and adopt them; politicians are considered generally to act as "followers" rather than as "innovators" in the use of new data and analytics.

Source: EURITO Deliverable 1.3
Scoping phase report on using new data to address R&I policy needs

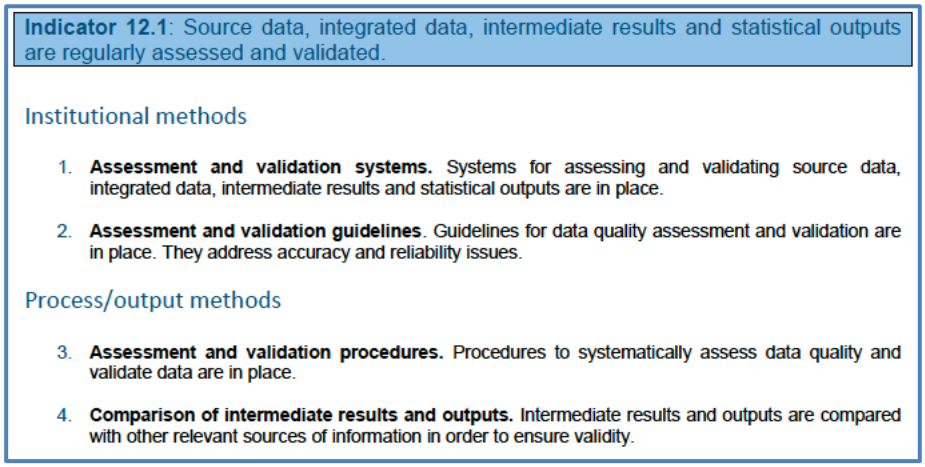
Table 3. Summary of the validation of compliance - Relevance

Indicator/principle	Degree of compliance
Indicator 11.1: Procedures are in place to consult users, to monitor the relevance and value of existing statistics in meeting their needs, and to consider and anticipate their emerging needs and priorities. Innovation is pursued to continuously improve statistical output.	High
Indicator 11.2: Priority needs are being met and reflected in the work programme.	High
Indicator 11.3: User satisfaction is monitored on a regular basis and is systematically followed up.	Medium

3. Validation of Accuracy and Reliability

In the QAF, this “Accuracy and reliability” framework is measured within the following subset of indicators:

Accuracy and Reliability Indicator: Validation and assessment of data and outputs (Indicator 12.1 QAF)



Indicator 12.1: Source data, integrated data, intermediate results and statistical outputs are regularly assessed and validated.

Institutional methods

1. **Assessment and validation systems.** Systems for assessing and validating source data, integrated data, intermediate results and statistical outputs are in place.
2. **Assessment and validation guidelines**. Guidelines for data quality assessment and validation are in place. They address accuracy and reliability issues.

Process/output methods

3. **Assessment and validation procedures.** Procedures to systematically assess data quality and validate data are in place.
4. **Comparison of intermediate results and outputs.** Intermediate results and outputs are compared with other relevant sources of information in order to ensure validity.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 47)

The EURITO project follows the standard procedures for validation from the ESS Quality Assessment Framework, as the present document shows. In this regard, the project has produced several methodological notes and follow-up papers that comply with these standards. To complete and complement the sources on which the analysis is based, the project analyses several databases (CORDIS, NIH, OpenAIRE, ArXiv) and has conducted systematic analyses of consistency of the findings that emerge from these multiple sources. For example:

- Our analyses of AI research in preprint data has been triangulated against other sources of innovative activity such as business databases, as well as traditional bibliometric databases in order to identify differences between them and gaps in coverage (Klinger et al, 2021).
- Our analysis of research activity related to Sustainable Development Goals has been triangulated against indicators in the Sustainable Development Report framework (Sachs et al. 2020), in order to understand the relationship between national specialisation in SDG related research activity and progress towards the goals.
- Our analysis of the implementation of IT security management standards based on web mining has been triangulated with data on certifications provided by the International Standardization Organization ISO (Mirtsch et al. 2021) and survey data.

It might be interesting to include comparison of new data sources to be able to match data from multiple sources for the purposes of triangulation and policy evaluation, but this is considered out of the scope of the ongoing work. This justifies setting the degree of fulfillment in this indicator as medium/high.

Indicator 12.2, "Sampling errors and non-sampling errors are measured and systematically documented according to the European standards" is considered Non-Applicable to the EURITO project because the project is not using survey data and as such there are no well-defined sample errors.

Indicator 12.3, "Revisions are regularly analysed in order to improve source data, statistical processes and outputs" is considered Non-Applicable to the EURITO project because there are no revisions planned in the project.

Table 4. Summary of the validation of compliance - Accuracy and Reliability

Indicator/principle	Degree of compliance
Indicator 12.1: Source data, integrated data, intermediate results and statistical outputs are regularly assessed and validated	Medium/high

4. Validation of Punctuality and Timeliness indicators

Punctuality and Timeliness Indicator: Timeliness (Indicator 13.1 QAF)

Indicator 13.1: Timeliness meets European and other international release standards.

Institutional methods

1. **Compliance with European and international standards.** Statistical authorities comply with European and international standards on timeliness.
2. **Publication of a release calendar.** A release calendar is published covering all statistics for which timeliness standards are established within European and international regulations and agreements.
3. **Divergences from timeliness targets.** Divergences from European and international timeliness targets are regularly monitored and an action plan is developed if these targets are not met.

Process/output methods

4. **Quality indicator(s).** Quality indicator(s) on timeliness are regularly monitored and published in quality reports.
5. **Analysis and assessment of timeliness.** Quality indicator(s) on timeliness are regularly analysed and assessed to improve the statistical process.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 49)

The EURITO project has the goal of extracting data in a timely manner from open, data sources that are regularly updated. To achieve this, the project has developed a set of pipelines to automatically collect and enrich relevant sources such as Cordis or the arXiv family of open science repositories. Several outputs of the project such as its analysis of AI research trends close to real time in Klinger et al (2020) or the analysis of Covid-19 related activities in CORDIS (Mateos-Garcia, 2021a) and open science pre-prints repositories (Mateos-Garcia 2021b) illustrates the potential of this approach for generating timely and policy-relevant analyses (OECD, 2021). Some examples include:

- Use of fuzzy matching and natural language processing to analyse the global geography of AI research and drivers of competitiveness in AI research clusters (Klinger et al, 2021)
- Use of natural language processing and complexity science to analyse the composition of AI research and the role of private sector companies in narrowing its trajectory (Klinger et al, 2020)
- Use of topic modelling and clustering to characterize the portfolio of research to tackle Covid-19 supported by the European Commission (Mateos-Garcia, 2021a)
- Use of topic modelling and Bayesian methods to characterize the impact of different streams of open research to tackle Covid-19 (Mateos-Garcia, 2021b).

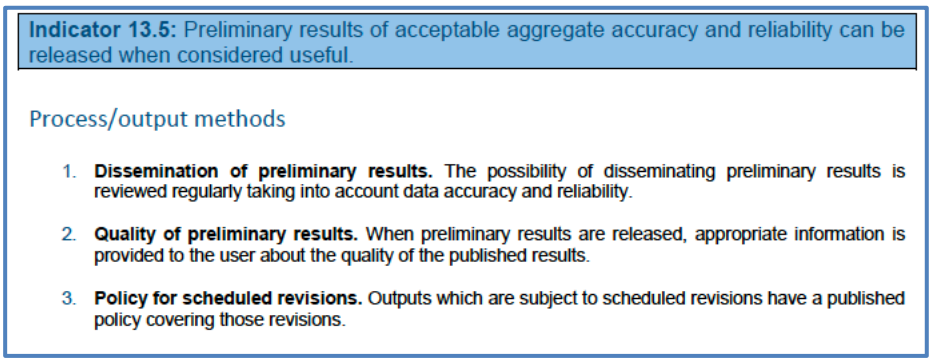
This indicator therefore is considered to be highly fulfilled.

Indicator 13.2, "A standard daily time for the release of European Statistics is made public", is considered Non-Applicable to the EURITO project because there is no expectation to establish a daily time of release.

Indicator 13.3, "The periodicity of statistics takes into account user requirements as much as possible" is considered Non-Applicable to the EURITO project because there is not a pre-defined, required periodicity of release of indicators.

Indicator 13.4, "Divergence from the dissemination time schedule is publicised in advance, explained and a new release date set.", is considered Non-Applicable to the EURITO project because there is no pre-defined schedule for release of the indicators.

Punctuality and Timeliness Indicator: Quality of preliminary results for dissemination (Indicator 13.5 QAF)



Quality Assurance Framework of the European Statistical System (Statistical output, p. 50)

The EURITO project produces data at different levels of aggregation. As mentioned above, there are no revisions of data, but the process of obtaining and processing data is transparent and well documented through pre-prints, validation with the scholarly community and open-source repositories. Some examples include:

- https://github.com/nestauk/arxiv_ai
- https://github.com/nestauk/narrowing_ai_research
- https://github.com/nestauk/sg_covid_impact

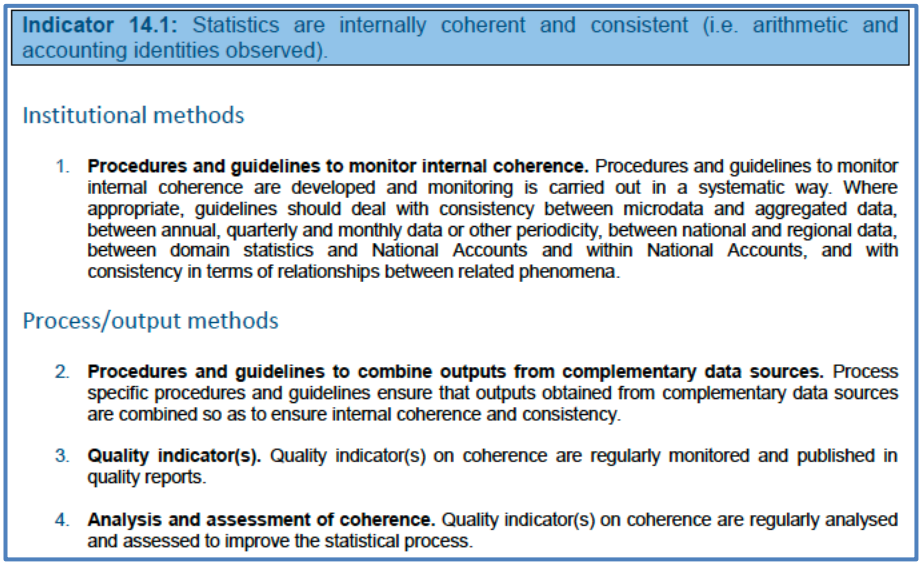
The novel nature of the indicators being developed creates some challenges for reporting ex-ante measures of data accuracy and reliability (Li, M., 2021). Using the indicators to carry out policy-oriented analysis, triangulating the data with other sources, disseminating with expert technical and policy audiences and opening up our code and data provides a process for qualitative assessment and iterative improvement to that help address, to some degree, this gap. As a consequence, the degree of fulfilment of this principle can be considered as medium/high.

Table 5. Summary of the validation of compliance - Punctuality and Timely indicators

Indicator/principle	Degree of compliance
Indicator 13.1: Timeliness meets European and other international release standards.	High
Indicator 13.5: Preliminary results of acceptable aggregate accuracy and reliability can be released when considered useful.	Medium/High

5. Validation of Coherence and comparability

Coherence and comparability Indicator: Internal coherence and consistency (Indicator 14.1 QAF)



Indicator 14.1: Statistics are internally coherent and consistent (i.e. arithmetic and accounting identities observed).

Institutional methods

1. **Procedures and guidelines to monitor internal coherence.** Procedures and guidelines to monitor internal coherence are developed and monitoring is carried out in a systematic way. Where appropriate, guidelines should deal with consistency between microdata and aggregated data, between annual, quarterly and monthly data or other periodicity, between national and regional data, between domain statistics and National Accounts and within National Accounts, and with consistency in terms of relationships between related phenomena.

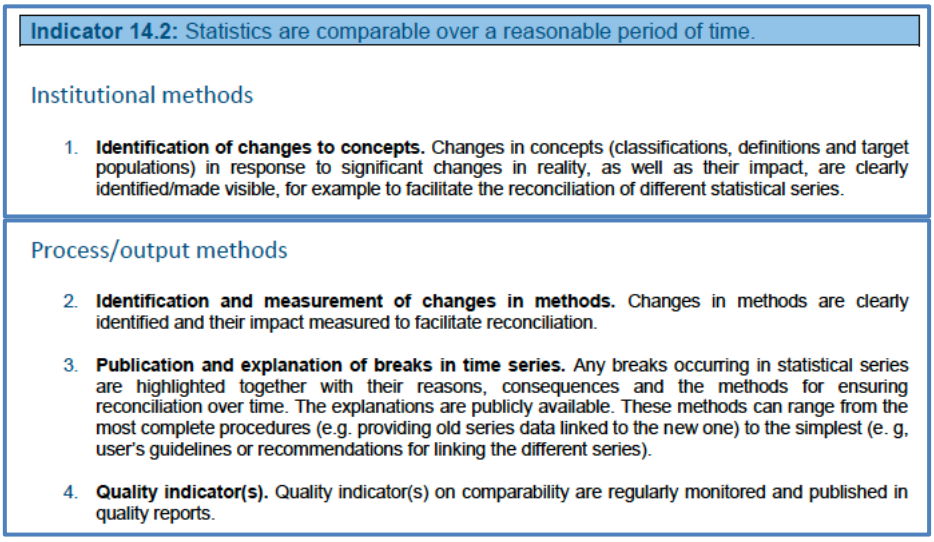
Process/output methods

2. **Procedures and guidelines to combine outputs from complementary data sources.** Process specific procedures and guidelines ensure that outputs obtained from complementary data sources are combined so as to ensure internal coherence and consistency.
3. **Quality indicator(s).** Quality indicator(s) on coherence are regularly monitored and published in quality reports.
4. **Analysis and assessment of coherence.** Quality indicator(s) on coherence are regularly analysed and assessed to improve the statistical process.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 51)

Since the EURITO project is not producing a comprehensive statistical framework of interlinked indicators but a set of experimental indicators across parallel streams, the consistence and coherence requirements are less relevant for the project. Having said this, some of our analyses have involved the incorporation of indicators from multiple sources for their common analysis, generally on a geographical basis (Klinger et al, 2021). The absence of global standards for geographical data means that we have had to rely on crowdsourced efforts such as Natural Earth boundary files when performing sub-national analyses beyond the EU. Based on this performance, the degree of fulfilment in this indicator can be considered as high.

Coherence and comparability Indicator: Comparable over periods of time (Indicator 14.2 QAF)



Indicator 14.2: Statistics are comparable over a reasonable period of time.

Institutional methods

1. **Identification of changes to concepts.** Changes in concepts (classifications, definitions and target populations) in response to significant changes in reality, as well as their impact, are clearly identified/made visible, for example to facilitate the reconciliation of different statistical series.

Process/output methods

2. **Identification and measurement of changes in methods.** Changes in methods are clearly identified and their impact measured to facilitate reconciliation.
3. **Publication and explanation of breaks in time series.** Any breaks occurring in statistical series are highlighted together with their reasons, consequences and the methods for ensuring reconciliation over time. The explanations are publicly available. These methods can range from the most complete procedures (e.g. providing old series data linked to the new one) to the simplest (e. g, user's guidelines or recommendations for linking the different series).
4. **Quality indicator(s).** Quality indicator(s) on comparability are regularly monitored and published in quality reports.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 51)

EURITO's reliance on novel data sources such as pre-prints, which have started to become increasingly adopted during the period of analysis, not least as a consequence of the Covid-19 pandemic limit the scope for long-term analyses of trends (Hook, D. W., 2021). Similarly, the temporal dimension of research funding data reflects, at least in part, changes in policy priorities as well as financial considerations as much as the nature of the research and innovation projects underlying them. For this reason, EURITO-Covid indicators can only be considered to fulfil this principle to a low degree related to these analyses. However, the methodology allows obtaining comparable future series. Furthermore, it is fulfilled in time series analyses conducted within the project based on certifications of IT security management standards (Mirtsch et al. 2020) introduced as a specific type of organisational innovation.

Coherence and comparability Indicator: Compilation on the basis of standards with respect to scope, definitions, units and classifications in surveys and data sources (Indicator 14.3 QAF)

Indicator 14.3: Statistics are compiled on the basis of common standards with respect to scope, definitions, units and classifications in the different surveys and data sources.

Institutional methods

1. **A mechanism to promote coherence and consistency.** A common repository of concepts or a mechanism to promote coherence and consistency is in place.

Process/output methods

2. **Assessment of compliance with standards.** Periodic assessments of compliance with standards on definitions, units and classifications are carried out and reflected in quality reporting.
3. **Explanation of deviations from standards.** Deviations from standards on definitions, units or classifications are made public and the reasons for the deviations are explained, particularly in reference to European and international standards.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 52)

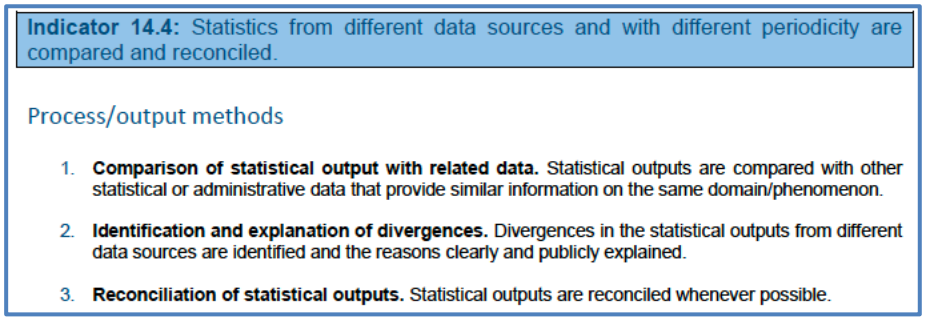
The EURITO project has adopted a hybrid approach reflecting the need to combine standard variables such as geography, time or type of institution with unstandardized, bottom-up metrics such as the topic of a research paper, or the thematic diversity of a research trajectory.

- In the case of standard variables, we draw on existing taxonomies such as the Global Research Identifier (GRID), a list of research institutions that have been classified by type of organization (educational, company, healthcare etc.) and geocoded using standard geographies,
- In the case of non-standardised concepts, we draw on relevant literatures such as economics and scientometrics during our analysis of technological diversity in AI research.
- In the stream of analysis where we label EU research projects with the Sustainable Development Goals they are related to, we rely on a keyword detection and expansion methods, which we expand to a labelled dataset through additional manual labelling following a process outlined in Richardson (forthcoming).

- Bottom-up constructs such as the topics emerging from a topic model analysis are much more difficult to standardize. In their case we adopt state-of-the-art algorithms for estimation of topic models and remove low quality using various automated and manual procedures, all of which are documented in our research papers and open code repositories.

For this reason, the degree of fulfilment of EURITO in this indicator can be considered as medium/high.

Coherence and comparability Indicator: Comparison and reconciliation of the different data sources used for statistics (Indicator 14.4 QAF)



Indicator 14.4: Statistics from different data sources and with different periodicity are compared and reconciled.

Process/output methods

1. **Comparison of statistical output with related data.** Statistical outputs are compared with other statistical or administrative data that provide similar information on the same domain/phenomenon.
2. **Identification and explanation of divergences.** Divergences in the statistical outputs from different data sources are identified and the reasons clearly and publicly explained.
3. **Reconciliation of statistical outputs.** Statistical outputs are reconciled whenever possible.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 52)

Where possible, we triangulate indicators from novel sources against traditional indicators. For example, in our analysis of AI research in arXiv we compare the results with levels of AI activity in peer-reviewed journals. We incorporate indicators within the SDG framework into our analysis of research and innovation activities related to SDGs. In the final (forthcoming) stages of the project we will combine indicators of research activity from multiple sources and validate them against each other, as well as with secondary sources. Based on this, the degree of fulfilment of the EURITO project with this criterion can be considered as high.

Indicator 14.5, "Cross-national comparability of the data is ensured within the European Statistical System through periodical exchanges between the European Statistical System and other statistical systems. Methodological studies are carried out in close co-operation between the Member States and Eurostat" is considered Non-Applicable to the EURITO project because this principle is applicable for institutional actors such as Eurostat and NSIs and not for a H2020 project. Then, this mechanism of ensuring cross-country comparability does not apply to EURITO, and instead, the project relies on targeted user research and consultation, as well as quantitative assessments of comparability. However, the conducted analyses try to rely on data being comparable across countries (e.g. Mirtsch et al. 2020).

Were these indicators, which are currently experimental - to be taken up in a more official capacity (e.g. adopted into the European Innovation Scoreboard), then appropriate procedures would need to be put in place to ensure the assessment of cross-country comparisons is 'institutionalized'.

Table 6. Summary of the validation of compliance - Coherence and comparability

Indicator/principle	Degree of compliance
Indicator 14.1: Statistics are internally coherent and consistent (i.e. arithmetic and accounting identities observed).	High
Indicator 14.2: Statistics are comparable over a reasonable period of time.	Low
Indicator 14.3: Statistics are compiled on the basis of common standards with respect to scope, definitions, units and classifications in the different surveys and data sources.	Medium/high
Indicator 14.4: Statistics from different data sources and with different periodicity are compared and reconciled.	High

6. Validation of Accessibility

Accessibility Indicator: Presentation of metadata for interpretation and comparison (Indicator 15.1 QAF)

Indicator 15.1: Statistics and the corresponding metadata are presented, and archived, in a form that facilitates proper interpretation and meaningful comparisons.

Institutional methods

1. **Dissemination policy.** A dissemination policy is in place. The policy covers relevant dissemination aspects, such as principles and subjects of dissemination, format and layout, handling of provisional and final data, metadata, and release and documented pre-release arrangements.
2. **Policy for archiving statistics and metadata.** A policy for archiving statistics and metadata is in place.
3. **Availability of policies.** The dissemination and archiving policies are publicly available.
4. **Dissemination and archiving guidelines.** Guidelines on the dissemination and archiving of statistical information are in place. They contain the procedures and standards for the preparation of statistical outputs and their dissemination and archiving.
5. **Training courses.** The statistical authorities offer training courses to staff on how to explain, communicate and publish statistical outputs and write press releases.

Process/output methods

6. **Review of practices.** Dissemination and archiving practices are reviewed periodically by a working group or similar structure
7. **User consultation on dissemination.** Users are consulted about the most appropriate forms of dissemination.
8. **Comparisons in publications.** Meaningful comparisons are clearly included in publications as appropriate.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 54)

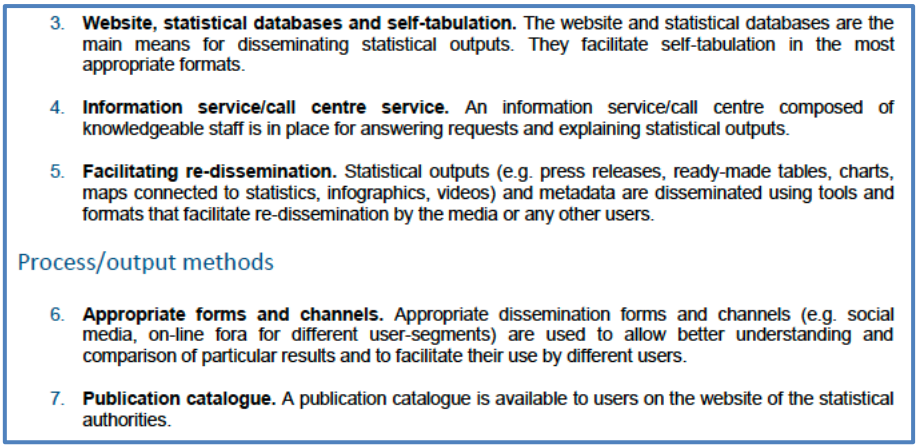
The scale and discrete nature of the project mean that we have limited resources to develop new policies and guidelines for dissemination. Given this, we have adopted standard approaches from the social sciences research and software development community, releasing all our publications as pre-prints for early feedback together with GitHub repositories, with the code used to collect and enrich our data and produce indicators, and data dictionaries describing the content of the datasets we have created. We have also piloted the use of data sheets outlining the rationale for data collection and modelling. All this means that we assign a degree of fulfilment with this criterion of “medium”.

Accessibility Indicator:Open data standards and dissemination services (Indicator 15.2 QAF)

Indicator 15.2: Dissemination services use modern information and communication technology, methods, platforms and open data standards.

Institutional methods

1. **Modern means of dissemination and communication**. Statistical authorities use modern and expedient information technology channels and are actively present on the various social media platforms. The statistical authorities' websites offer data sets according to open data standards. The information available in open data is as broad as possible. The websites are updated regularly.
2. **Conformity with universal guidelines.** The website and statistical databases conform as far as possible to universal web content accessibility guidelines (e.g. Web Content Accessibility Guidelines WCAG).



3. **Website, statistical databases and self-tabulation.** The website and statistical databases are the main means for disseminating statistical outputs. They facilitate self-tabulation in the most appropriate formats.

4. **Information service/call centre service.** An information service/call centre composed of knowledgeable staff is in place for answering requests and explaining statistical outputs.

5. **Facilitating re-dissemination.** Statistical outputs (e.g. press releases, ready-made tables, charts, maps connected to statistics, infographics, videos) and metadata are disseminated using tools and formats that facilitate re-dissemination by the media or any other users.

Process/output methods

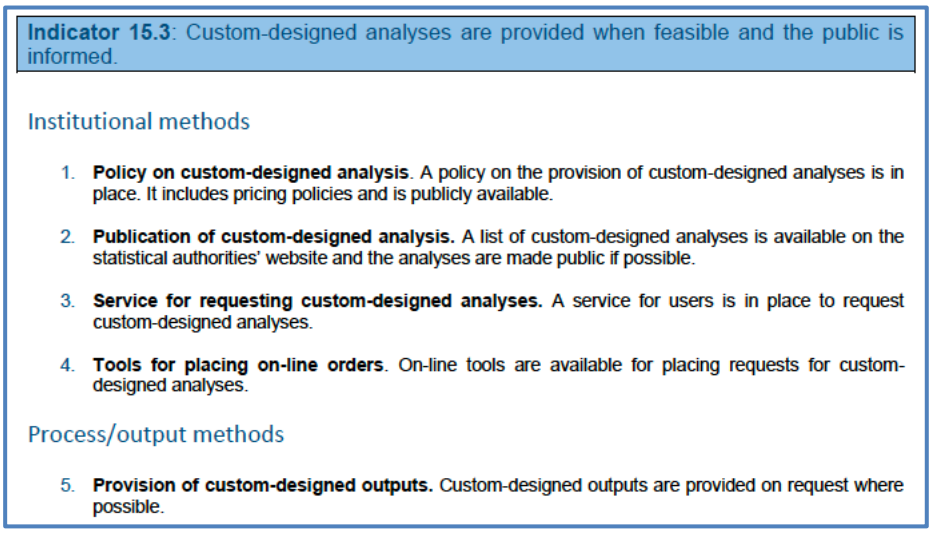
6. **Appropriate forms and channels.** Appropriate dissemination forms and channels (e.g. social media, on-line fora for different user-segments) are used to allow better understanding and comparison of particular results and to facilitate their use by different users.

7. **Publication catalogue.** A publication catalogue is available to users on the website of the statistical authorities.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 54)

A significant number of indicators developed in the project will be released through an interactive tool where users can explore them at various level of geographical and temporal resolution. The tool has been designed to uphold the highest levels of responsiveness and accessibility, including customization options for users with visual impairments. The tool includes links to CSV files with the indicators as well as YAML files that provide indicator metadata in a structured format. This implies that the degree of compliance with this criterion can be considered as high.

Accessibility Indicator: Custom-designed analyses (Indicator 15.3 QAF)



Indicator 15.3: Custom-designed analyses are provided when feasible and the public is informed.

Institutional methods

1. **Policy on custom-designed analysis**. A policy on the provision of custom-designed analyses is in place. It includes pricing policies and is publicly available.

2. **Publication of custom-designed analysis.** A list of custom-designed analyses is available on the statistical authorities' website and the analyses are made public if possible.

3. **Service for requesting custom-designed analyses.** A service for users is in place to request custom-designed analyses.

4. **Tools for placing on-line orders**. On-line tools are available for placing requests for custom-designed analyses.

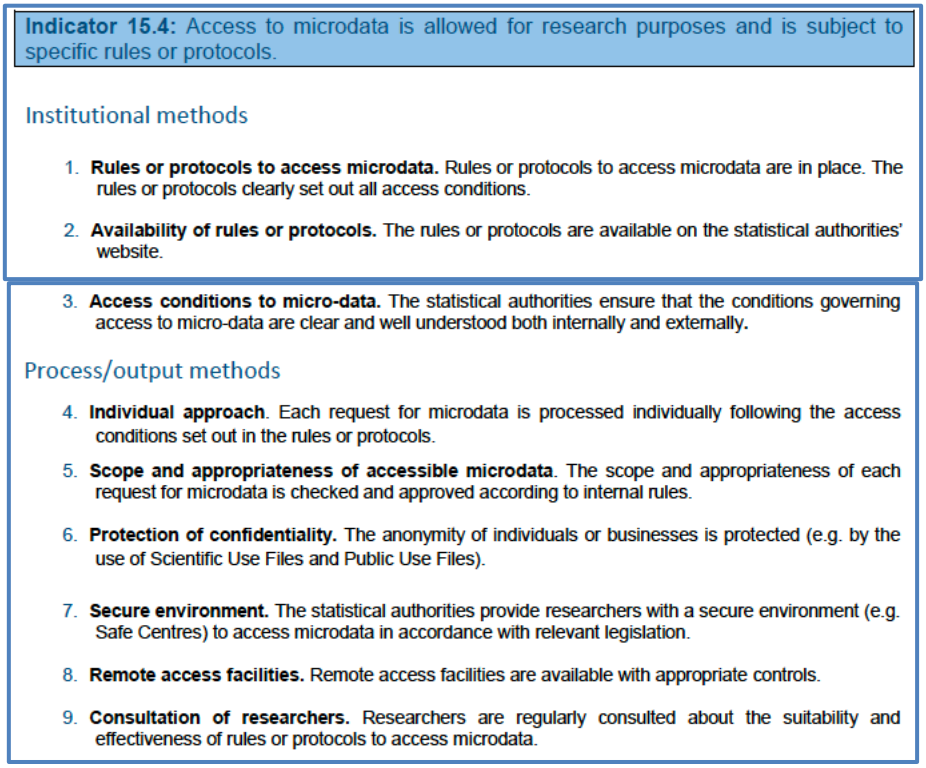
Process/output methods

5. **Provision of custom-designed outputs.** Custom-designed outputs are provided on request where possible.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 55)

We do not envisage undertaking additional analyses of the indicators after the publication of the tool and final project reports and as such this criterion is not relevant. Having said this, we note that the pivot that we have undertaken in response to Covid-19, where we initiated a new round of consultation with the European Commission and undertook new analyses to produce indicators relevant for understanding the EU response to Covid-19 is an example of a custom analysis enabled by our approach.

Accessibility Indicator: Access to microdata (Indicator 15.4 QAF)



Indicator 15.4: Access to microdata is allowed for research purposes and is subject to specific rules or protocols.

Institutional methods

1. **Rules or protocols to access microdata.** Rules or protocols to access microdata are in place. The rules or protocols clearly set out all access conditions.
2. **Availability of rules or protocols.** The rules or protocols are available on the statistical authorities' website.
3. **Access conditions to micro-data.** The statistical authorities ensure that the conditions governing access to micro-data are clear and well understood both internally and externally.

Process/output methods

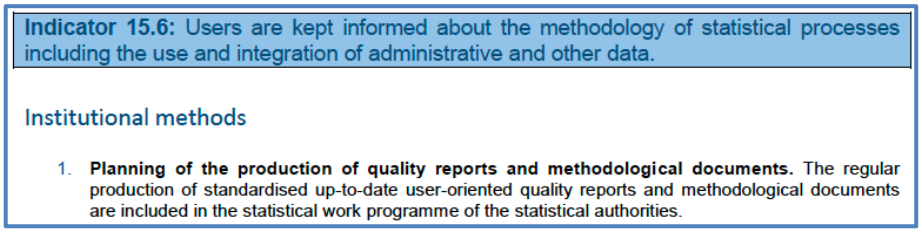
4. **Individual approach**. Each request for microdata is processed individually following the access conditions set out in the rules or protocols.
5. **Scope and appropriateness of accessible microdata**. The scope and appropriateness of each request for microdata is checked and approved according to internal rules.
6. **Protection of confidentiality.** The anonymity of individuals or businesses is protected (e.g. by the use of Scientific Use Files and Public Use Files).
7. **Secure environment.** The statistical authorities provide researchers with a secure environment (e.g. Safe Centres) to access microdata in accordance with relevant legislation.
8. **Remote access facilities.** Remote access facilities are available with appropriate controls.
9. **Consultation of researchers.** Researchers are regularly consulted about the suitability and effectiveness of rules or protocols to access microdata.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 55)

Our selection of data sources – pre-prints, open funding databases - has been partly informed by the desire to make microdata open in order to enhance reproducibility. This means that the protocols to access the data are embedded in the GitHub repositories where we distribute our code and documentation, and there is no need for users to engage us directly to access microdata, or to provide a secure environment for this purpose. For this reason, compliance with this criterion is high.

Indicator 15.5, "Metadata related to outputs are managed and disseminated by the statistical authority according to the European standards" is considered Non-Applicable to the EURITO project because there is no official statistical authority responsible for the dissemination of data associated to the project.

Accessibility Indicator: Available information for users about methodology and processes (Indicator 15.6 QAF)



Indicator 15.6: Users are kept informed about the methodology of statistical processes including the use and integration of administrative and other data.

Institutional methods

1. **Planning of the production of quality reports and methodological documents.** The regular production of standardised up-to-date user-oriented quality reports and methodological documents are included in the statistical work programme of the statistical authorities.

2. **Methodology of statistical processes.** The description of the methodology of statistical processes is available for users in user-oriented quality reports and other methodological documents).

Process/output methods

3. **Publication of methodology**. Staff responsible for statistical processes prepare relevant methodology documents and help to make them publicly available.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 56

The EURITO project has prepared and distributed openly the methodological notes that have supported the indicator construction task. All this information is available from the EURITO website (http://www.eurito.eu/) and OpenAIRE. We have also published open GitHub repositories with the code and documentation generated during indicator production in order to enhance transparency and reproducibility.

This means that the degree of fulfilment of the EURITO project with this criterion can be considered as high.

Accessibility Indicator: Information about quality criteria for users (Indicator 15.7 QAF)

Indicator 15.7: Users are kept informed about the quality of statistical outputs with respect to the quality criteria for European Statistics.

Institutional methods

1. **ESS standards on quality reporting**. User-oriented quality reports are based on ESS standards and guidelines for quality reporting. Quality reporting follows the ESS standard Single Integrated Metadata Structure (SIMS) on quality reporting as well as accompanying guidelines and handbooks.
2. **Central monitoring of publication of quality reports.** The publication of quality reports is monitored centrally by a quality management unit.
3. **Availability of quality reports.** Quality reports are available on the websites of the statistical authorities.

Process/output methods

4. **Publication of quality reports.** Staff responsible for statistical processes regularly prepare and make publicly available user-oriented quality reports on the websites of the statistical authorities.

Quality Assurance Framework of the European Statistical System (Statistical output, p. 57)

The EURITO project has been developed taking into account user diversity, and different profiles of users' needs have been considered when preparing the indicators. EURITO workshops and subsequent user research raised some questions around how diversity, equity and inclusion were considered in outputs. The analysis presented in the EURITO User Research Report (D5.3) included reflections on the extent to which user research outputs such as personas can support or detract from diversity, equity, inclusion and accessibility considerations in the project, and points to the need to supplement these outputs with a broader set of equity-oriented actions (e.g. adherence to best practices in designing for accessibility).

Regarding quality reports, all the analyses undertaken as part of the project include assessment of indicator quality through quantitative triangulation and qualitative validation with technical and policy experts. We will take the same approach when we publish the final project report.

We assign the project a “medium” level of compliance with this criterion.

Table 7. Summary of the validation of compliance - Accessibility

Indicator/principle	Degree of compliance
Indicator 15.1: Statistics and the corresponding metadata are presented, and archived, in a form that facilitates proper interpretation and meaningful comparisons.	Medium
Indicator 15.2: Dissemination services use modern information and communication technology, methods, platforms and open data standards.	High
Indicator 15.3: Custom-designed analyses are provided when feasible and the public is informed.	Irrelevant
Indicator 15.4: Access to microdata is allowed for research purposes and is subject to specific rules or protocols.	High
Indicator 15.6: Users are kept informed about the methodology of statistical processes including the use and integration of administrative and other data.	High
Indicator 15.7: Users are kept informed about the quality of statistical outputs with respect to the quality criteria for European Statistics.	Medium

7. Conclusion

The Quality Assurance Framework (QAF) of the European Statistical System (ESS) provides a very general framework for assessing the statistical quality of institutions, processes and outputs. The present report has focused on the last pillar of this framework, and it has assessed the degree of compliance of a subset of EURITO's available output with respect to the principles of statistical output (QAF-ESS principles 11 - 15). Confined to this domain, the overall degree of compliance of the EURITO project with the QAF-ESS principles of statistical output is high. See Table 8 for a summary of the degree of compliance of EURITO in the various QAF-ESS principles.

The project stands particularly well regarding the principles of relevance, timely indicators and accessibility. In this respect the indicators and methodology from the EURITO project are able to make significant and reliable contributions to better track and understand the R&D&I activity in real time in general, and in the particular case of the scientific response to the Covid-19 crisis.

The project has a low degree of compliance only in one sub-principle, the comparability of statistics over time. In part this is understandable because the EURITO project was invited to pivot towards the study of a very significant event as it was the outbreak of the Covid-19 crisis. Efforts to improve the intertemporal comparability of indicators would therefore improve the overall statistical quality of the project.

Table 8. Overall Summary of the validation of compliance.
ESS-QAF Principles 11-15.

Principle / Indicator description		Degree of compliance
Relevance	Indicator 11.1: Procedures are in place to consult users, to monitor the relevance and value of existing statistics in meeting their needs, and to consider and anticipate their emerging needs and priorities. Innovation is pursued to continuously improve statistical output.	High
	Indicator 11.2: Priority needs are being met and reflected in the work programme.	High
	Indicator 11.3: User satisfaction is monitored on a regular basis and is systematically followed up.	Medium
Accuracy & Reliability	Indicator 12.1: Source data, integrated data, intermediate results and statistical outputs are regularly assessed and validated	Medium / high
Punctuality & Timely indicators	Indicator 13.1: Timeliness meets European and other international release standards.	High
	Indicator 13.5: Preliminary results of acceptable aggregate accuracy and reliability can be released when considered useful.	Medium/high
Coherence & comparability	Indicator 14.1: Statistics are internally coherent and consistent (i.e. arithmetic and accounting identities observed).	High
	Indicator 14.2: Statistics are comparable over a reasonable period of time.	Low
	Indicator 14.3: Statistics are compiled on the basis of common standards with respect to scope, definitions, units and classifications in the different surveys and data sources.	Medium/high
	Indicator 14.4: Statistics from different data sources and with different periodicity are compared and reconciled.	High
Accessibility	Indicator 15.1: Statistics and the corresponding metadata are presented, and archived, in a form that facilitates proper interpretation and meaningful comparisons.	Medium
	Indicator 15.2: Dissemination services use modern information and communication technology, methods, platforms and open data standards.	High
	Indicator 15.3: Custom-designed analyses are provided when feasible and the public is informed.	Not relevant
	Indicator 15.4: Access to microdata is allowed for research purposes and is subject to specific rules or protocols.	High
	Indicator 15.5: Users are kept informed about the methodology of statistical processes including the use and integration of administrative and other data.	High
	Indicator 15.7: Users are kept informed about the quality of statistical outputs with respect to the quality criteria for European Statistics.	Medium

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Appendix: Summary of Covid-19 pivot rationale and consultation process

Rationale for Covid-19 pivot adapted from the project's amendment

COVID-19 has had a profound impact on the world, and EURITO is no exception. In the first instance there has been disruption to the working environment and working patterns of employees working on EURITO. Secondly, we are no longer able to hold the same number of in person meetings and events. Thirdly, COVID-19 has presented an opportunity to test the EURITO methodology and framework in real time, supporting the European Commission in the development and implementation of R&I policies to fight the impacts of COVID-19.

We have decided to take advantage of the opportunity presented by COVID-19 and pivot EURITO's activities towards supporting the fight against the pandemic. Through the pivot we will deliver real world value earlier than anticipated, learn from the application of EURITO which will support the validation of our methodology and framework which will result in a final EURITO product of higher quality as a result.

Through this pivot we will be able to:

- Analyse the composition of the EC innovation response to the pandemic
- Generate evidence about the impact of EC funded projects in the fight against COVID-19
- Identify other projects and organisations (outside of EC funding) that could play a role in the mission against COVID-19

Summary of consultation process informing the Covid-19 pivot of EURITO

Starting in April 2020, the EURITO team has been in close contact with the European Commission to inform the scope and nature of the pivot activities and to ensure that the project is meeting the real needs of end users. While the User Research Report (D5.3) helped the team to compile meaningful insights about EURITO's original end users, the new contextual circumstances and rapidly evolving data landscape in the context of Covid-19 meant that the original user research needed to be supplemented with additional input from a variety of relevant Commission stakeholders.

In April 2020, members of the EURITO team participated in a call with two core European Commission staff members who had identified this project as one that could potentially be reoriented toward the Covid-19 response. Some of the initial questions explored in this early discussion of how EURITO's activities could be reoriented included: what are the levels of Covid-related RDI in the EU and Member States? What ideas are being developed? Who are the key players? What is the structure of the collaboration networks? During the call, the EURITO team shared with the Commission how the EURITO project plan could be revised, and the anticipated implications for timelines and deliverables.

Over the course of April and May 2020, the Commission kept the EURITO team informed of relevant initiatives or events that could help to shape the project's pivot (e.g. invitation to participate in European Hackathon or invitation to participate in information sessions on rapid health-related approaches to respond to Covid-19).

From June to July 2020, the EURITO team continued to engage in email exchanges with Commission officials on the topic of the project pivot. In July 2020, Nesta shared a EURITO Covid-19 pivot document, summarising in more detail the potential goals and options for this work moving forward. The four key goals identified for further exploration were:

- Goal 1: Measure how existing H2020 projects are pivoting to tackle COVID-19 beyond those supported through targeted funding calls
- Goal 2: Identify other projects and organisations that could play a role in the mission against COVID-19
- Goal 3: Analyse the composition of the EC response to the pandemic
- Goal 4: Generate evidence about the impact of EC funded projects in the fight against COVID-19

In the pivot document, it was noted that the Commission had already undertaken some of this work manually using tools developed by the Joint Research Center that provide structured data about patenting and publication activity related to Covid-19. The pivot document further outlined several options for how to proceed, including 1) the additional analysis of existing data; 2) the collection of new data; and 3) linking datasets.

This pivot note provided the framework for a discussion with a wider set of Commission stakeholders at the end of July 2020. The aim of this discussion was to explore which of the four goals would provide the greatest value for the Commission's response to Covid-19, and to field any questions or concerns stakeholders had about the pivot more generally.

In September 2020, the EURITO team held another call with a smaller subset of Commission stakeholders to explore some specific questions around Goal 4 (generate evidence about the impact of EC funded projects in the fight against COVID-19), which was identified as a top priority during the July 2020 call.

In the period that has followed these consultations, the EURITO team has continued to engage in regular email exchanges with the two key Commission stakeholders, providing regular updates and exchanging information and questions relevant to the project pivot.

Appendix: Summary of indicator production streams, methodology and validation

Project stream	Output	Methodology and validation
Emerging technologies	Deep Learning, Deep Change	- Use of topic modelling to identify deep learning papers in the arXiv computer science corpus - Use of machine learning to identify companies related to AI - Triangulation of arXiv data with peer reviewed publications in Microsoft Academic Graph All code and data available in a GitHub repository: https://github.com/nestauk/arxiv_ai
Emerging technologies	A Narrowing of AI research?	- Use of keyword search to identify AI papers in the arXiv corpus. - Use of diversity metrics from economics, information science and scientometrics to calculate diversity in AI research - Use of 3 metrics and 3 parameter sets to ensure robustness - Qualitative validation of findings with policy and industry audiences. All code and data available in a GitHub repository: https://github.com/nestauk/narrowing_ai_research
Sustainability and inclusion	Research and innovation to advance Sustainable Development Goals	GEORGE to add
Sustainability and inclusion	Gender diversity in AI research	- Use of keyword search to identify papers in the arXiv corpus - Use of a gender inference system to infer researcher gender. - Use of probability thresholds to exclude inferences with low levels of uncertainty Qualitative validation of findings with policy and industry audiences
Covid-19 pivot	AI and the fight against Covid-19	- Use of keyword search to identify papers related to Covid-19 and AI in open pre-prints corpora - Topic modelling and clustering to identify segments of activity to tackle Covid-19

		- Qualitative validation of findings with policy audiences. All code and data available in this GitHub repository: https://github.com/nestauk/ai_covid_19
Covid-19 pivot	EURITO indicators about Covid-19 related activities in the CORDIS database	- Use of keyword search to identify projects related to Covid-19 in the CORDIS corpus - Use of various natural language processing and clustering methods to analyse the composition of the response to Covid-19 and the novelty of its activities. - Ongoing qualitative validation All code and data will be available in the project GitHub repository
Covid-19 pivot	Open science in the fight against Covid-19	- Use of keyword search to identify articles related to Covid-19 in preprints databases. - Use of topic modelling and clustering to identify segments of activity to tackle Covid-19 and study international differences and differences in impact and level of collaboration with a control group. - Ongoing qualitative validation All code and data will be available in the project GitHub repository
Covid-19 pivot	The global landscape of research funding to tackle Covid-19	Forthcoming analysis