OpenAIRE [1] shifts scholarly communication towards openness and transparency and facilitates innovative ways to communicate and monitor research by building global common standards for linking research, providing open science services and embedding open science into researcher workflows, aligning open science policies and facilitating transparency in research assessment process.

OpenAIRE links research outcomes (e.g. publications, data and software) to their creators (e.g. researchers, institutions and funders), enabling discoverability, transparency, reproducibility and quality-assurance of research. It also provides interoperability services [2] that connect research and enable researchers, content providers, funders and research administrators to easily adopt open science. It fosters the open science dialogue for policies and their implementation in Europe and beyond, provides open science support and training [3] and builds the European Research Information system that encompasses all research and enables ready-made reporting, monitoring and analysis. OpenAIRE's network of 34 National Open Access Desks [4] operates a European Helpdesk supporting a coordinated transition to open science. To move towards an effective and open global research ecosystem OpenAIRE works with similar initiatives around the world promoting and sharing common access and re-use policies and protocols for all research results and making all OpenAIRE research information freely available to all to build value added services.

OpenAIRE discovery portal [5] enables intelligent and contextualized research discovery. It is based on the OpenAIRE open scholarly communication graph that includes all research and scholarly activities, spanning all phases of the research life cycle. In addition to the usual search and browse mechanisms, the discovery portal provides end user functionalities, which allow users to find the most fitting repository to deposit their publication or data, authoritatively enrich the underlying content (e.g. linking research results to funding and linking research results to external sources), view, download reports or graphs of aggregated research outcomes (e.g. per funder, project, institution) and their statistics.

OpenAIRE aggregation service creates the **OpenAIRE scholarly communication graph** [6] by aggregating metadata from validated data providers, enriching by text mining and inference, and collecting information from end-users. The service makes the graph available via different types of APIs: OAI-PMH, HTTP API, Linked Open Data, SPARQL endpoint. And a stand-alone version of the aggregation service is offered for deployment for national or thematic infrastructures. OpenAIRE scholarly communication graph enables third-party service developers to realize services for scholarly communication and research analytics. It is indexed by two major

library services (EBSCO and ExLibris) and by the US Department of Energy's Office of Scientific and Technical Information.

ScholeXplorer [7] is a service that accepts publications-data or data-data links from validated sources, builds a de-duplicated graph and provides access to it. Objects and relationships are provided by data sources managed by publishers (e. g. CrossRef), data centers (e. g. DataCite and non-DataCite data archives) and repositories. The service aggregates links expressed in Scholix format and offers programmatic access (APIs) that allow third-party services to run queries/provision of the links in the graph. Science Direct, Scopus, and several data repositories are among the largest users of this service.

OpenAIRE Content Provider Dashboard [8] is a one-stop-shop web service where data providers (repositories, data archives, journals, aggregators, CRIS systems) interact with OpenAIRE. It provides the front-end access to many of OpenAIRE's backend services: **OpenAIRE validator** [9] based on the **OpenAIRE guidelines** for content providers [10], **OpenAIRE Broker** for the exchange of metadata and content amongst repositories, publishers or aggregators, and the enrichment of repository local metadata [11] and **OpenAIRE usage statistics** service providing aggregated, cleaned usage statistics that come from different sources and relate to the same object [12].

For funders, OpenAIRE offers a **Funder Dashboard** [13] making tracking, reporting and monitoring easier. It is built on the OpenAIRE graph and provides a monitoring and reporting mechanism (including visualization) that allows funders and policy makers to monitor all their funded research outcomes. Additional functionalities include private pages that allow configuration and deployment of on-demand visualization services. Funders have access to free, advanced monitoring tools to track their research outputs, produce publications reports, track projects results, funder stats and claiming of links between projects and scholarly objects. The European Commission uses this service for monitoring its Open Access policy as well as national funders e. g. FCT in Portugal, NOW in the Netherlands and more funders are coming on board.

OpenAIRE Research Analytics service identifies and annotates large archives of publications with thematic information, i.e., topics, and then leverage them as a means to link documents with other related information, e. g., authors, grants, and journals. Hence, the service analyses textual information (e. g. abstracts and content), relational information (e.g. publication citations, authorship network), and varied additional side information (e.g. authors, publication venues and grants) possibly including taxonomies and identifies overlapping entity clusters and related entity-to-cluster memberships, and characterize the clusters with multi-view thematic information (i.e. topics) combining all disparate information sources.

Zenodo [14] is a general purpose repository that enables researchers, scientists, projects and institutions to share, preserve and showcase multidisciplinary research results (data, software and publications) that are not part of the existing institutional or subject-based repositories of the research communities. It is founded in the trustworthy CERN data centre.

For researchers interested in open data sharing OpenAIRE offers **Amnesia** [15] that allows to anonymize sensitive data in order to share them with a broad audience. The researcher guides the anonymization process and decides on a flexible trade-off between privacy guaranty and data utility. The service is also offered through a web interface that allows users to explore the anonymized data visually. Moreover, the service detects duplicate anonymized files when they are uploaded to Zenodo. Amnesia reduces or eliminates the dangers to the privacy of the users that are associated with the data and allows data owners and curators to safely share the data with other experts and to benefit from their processing on them.

OpenAIRE Research Community Dashboard [16] is a virtual environment designed for research communities to share and link their research results (literature, datasets, software, other research products, and projects relative to the research community discipline), gather all research results in one place, monitor and report the community progress. It facilitates research communities' adoption of open science principles by supporting artefact publishing tools as-a-service.

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