

# **SURVEY OF ACTIVITIES ON SARS-CoV-2 and COVID-19 SUPPORTED BY ITALIAN RESEARCH INFRASTRUCTURES (ESFRI NODES AND NATIONAL RIs)**

**(11 May 2019)**

A survey of the national and European Research Infrastructures operating in Italy and offering access to research of direct relevance for SARS-CoV-2 and COVID-19 has been carried out. This initiative complements the monitoring on academic research projects promoted by MUR (Ministry of University and Research). This survey also fulfils the request of mapping national research activities in the framework of the COVID-19 platforms created by EOSC and ESFRI.

A questionnaire specialized to research infrastructures, with a structure similar to the one distributed by MUR to Academic and National Research Institutions, has been circulated to the list of the Italian reference scientists for the RIs.

The template was available for on-line compilation on the work-space of the ICDI (Italian Computing and Data Infrastructure) collaboration at GARR (attached, in Italian).

All the Italian contact persons of the participated-ESFRI infrastructures, the responsible persons for the Italian nodes of ESFRI distributed infrastructures and the contacts for all infrastructure projects of the Italian roadmap 2015 (PNIR) have been reached.

50 responses describe the research projects on SARS-CoV-2 and COVID-19, which are active at research infrastructures and are supported by access to instruments and data services, also under a fast-track procedure set up for the scope.

Research projects cover all ESFRI thematic areas, from social sciences, environment, engineering and physical sciences of matter, with a higher concentration of activities in life-sciences and e-infrastructures.

A classification of the research currently supported by RIs can be grouped as follows:

- CELL BIOLOGY-GENETICS-VIROLOGY
- BIOMEDICINE
- OMICS – SEQUENCING AND BIOINFORMATICS
- STRUCTURAL BIOLOGY AND MOLECULAR BIOLOGY FOR PHARMAKOLOGY, STRUCTURAL CHEMISTRY
- MATERIALS SCIENCE, BIOTECHNOLOGY, NANOSCIENCE
- EPIDEMIOLOGY, MONITORING OF POPULATION
- HIGH PERFORMANCE COMPUTING, CLOUD COMPUTING, MODELLING AND IN-SILICO SIMULATION OF INHIBITORS OF CORONAVIRUS AND OF VACCINES
- ARTIFICIAL INTELLIGENCE IN MEDICINE, MACHINE LEARNING, DATA MINING
- MATERIALS AND DEVICES FOR HUMAN PROTECTION AND SANIFICATION
- SCIENTIFIC COMMUNICATION

The resulting distribution is plotted in figure 1, which also shows the ESFRI thematic area of the RIs engaged in supporting the research project.

16 projects are based on RIs offering physical access to instrumentation and technology whilst 20 provide data and services. The details of the data services requested by the users and offered by the relevant infrastructures is given in figure 2.

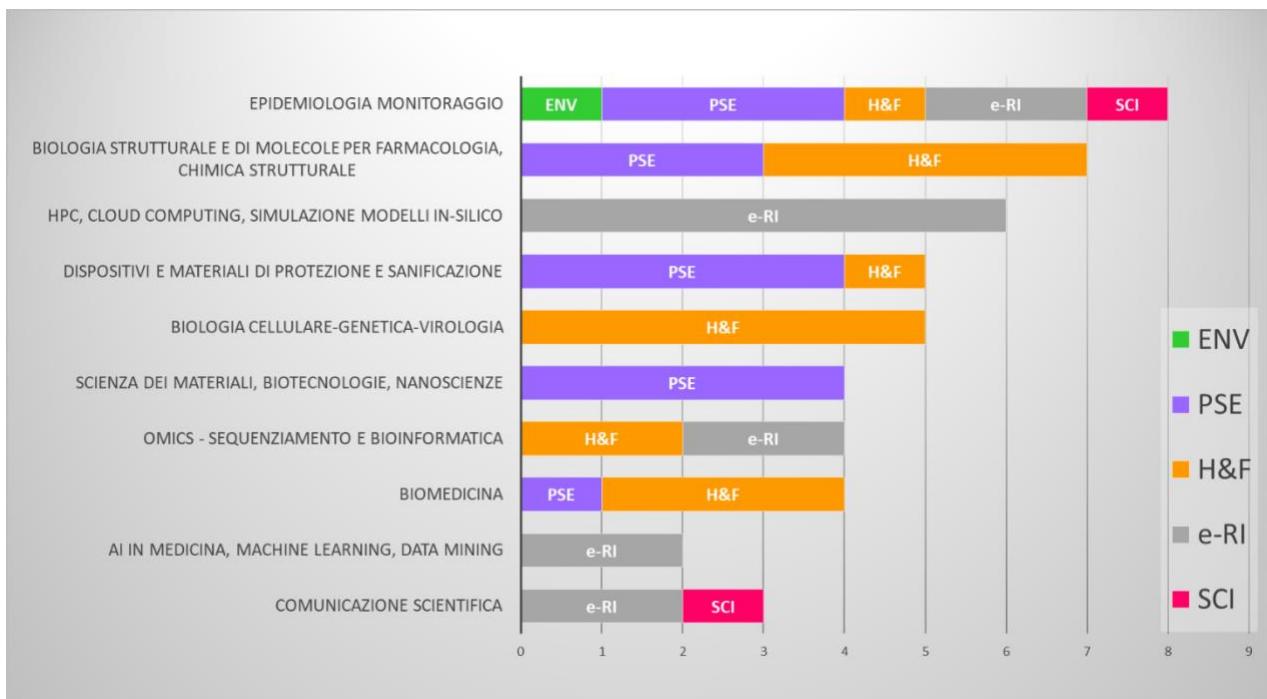


Figura 1

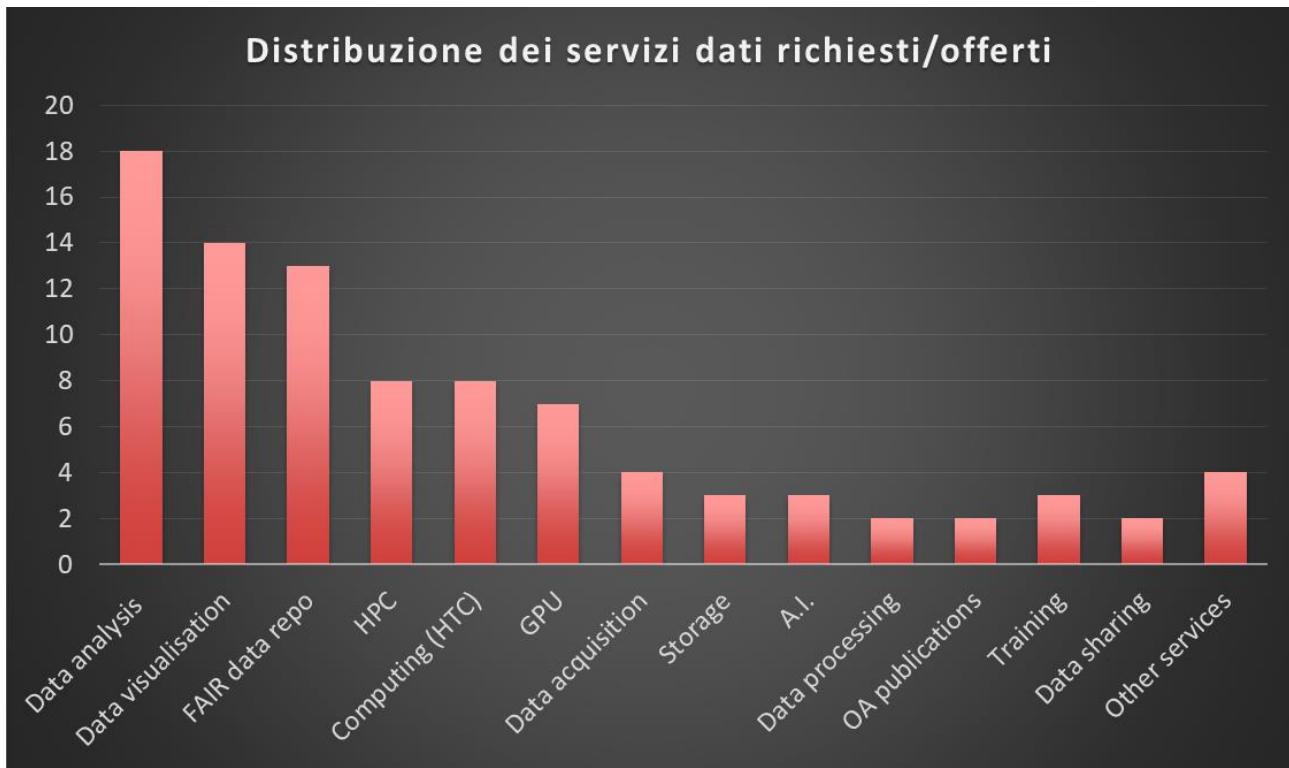


Figura 2

An analysis of the projects by availability of access to instrumentation, human resources, and multidisciplinary and cross-sectorial competences that exist at the national and ESFRI RIs can be done with respect to the following macro-domains:

- EPIDEMIOLOGY
- MODELLING, BIG DATA, A.I., MACHINE LEARNING, DATA MINING, HPC
- DIAGNOSTICS
- TREATMENT
- VACCINES
- MATERIALS CHARACTERIZATION, BIO&NANO TECH
- MANAGEMENT, ECONOMICS, SOCIAL SCIENCES & HUMANITIES

The top 5 macro-domains are those identified also by the European Commission to classify research projects connected with COVID-19.

Key-word recurrence analysis in each macro-area, within the collected data matrix, provides the project distribution in the macro-areas plotted in figure 3.

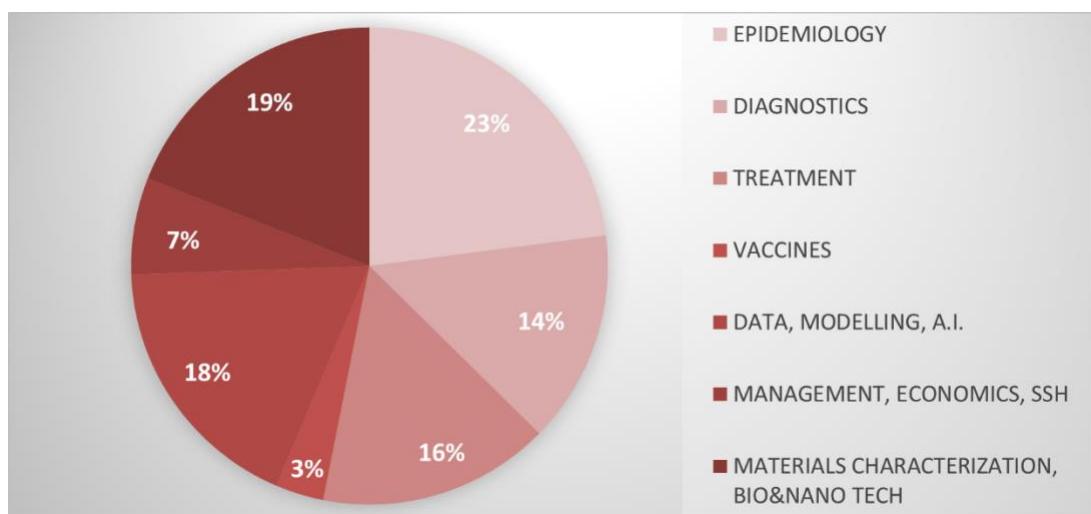


Figure 3

The same analysis for data services offered by the RI generates the plot of figure 4.

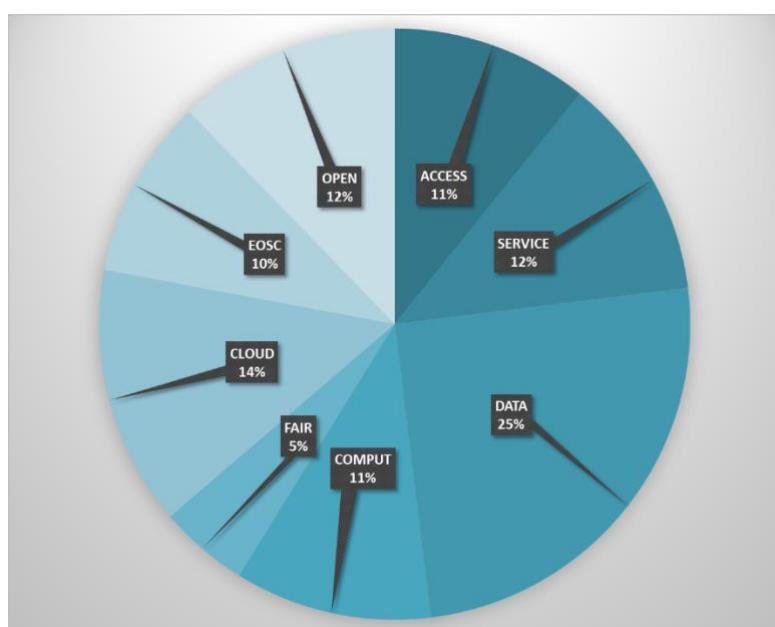


Figure 4

ESFRI RIs are the centrally coordinated pan-European organizations offering unique laboratories and services for advanced research. The present analysis, albeit limited, shows that, beyond the RIs of the Life Science sector already active in research projects (like those supported by bioinformatics and chemoinformatics services for the analysis of omic data of SARS-CoV-2, the identification of priorities in therapeutic targets, Gene-Expression studies, protein structure studies, advanced imaging), very impactful is the support of HPC, materials science and environmental science in connection to Life-Sciences.

The results of this survey meet the requests by EOSC about the data sources for COVID-19 and SARS-CoV-2 openly available in Italy, and the relevant repositories. EMBL-EBI set up the European COVID-19 Data Platform (<https://www.covid19dataportal.org/>) as a pilot of the EOSC. It is made of SARS-CoV-2 Data Hubs for virus data and COVID-19 Data Portal for pandemics data with contributions from the ESFRI bio-medical research infrastructures that all have national nodes in Italy (ELIXIR, BBMRI, EATRIS, ECRIN, Euro-Bioimaging, Eu-IBISBA, INFRAFRONTIER, INSTRUCT).

The COVID-19 emergency shows the coordination capability of research infrastructures that provide cross-disciplinary resources focused on an emerging scientific challenge.