

Executive Summary

ISIS@MACH ITALIA (IM@IT)

ISIS@MACH ITALIA (IM@IT¹), the Hybrid Italian Multidisciplinary Research Infrastructure for Complex Materials and Interfaces

Name of Research Infrastructure	ISIS@MACH ITALIA (IM@IT) – the Hybrid Italian Multidisciplinary Research Infrastructure (RI) for Complex Materials and Interfaces
Type of Research infrastructure	The Hybrid RI combines “distributed Small Research Facilities (SRFs)”, “Medium Range Facilities (MRFs)” and E-interface to “single-sited” Large Scale Facilities (LSFs)”
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Stage of development	Phase 2: Implementation Phase and Early Operation Phase– <i>ad interim</i> ²

¹ IM@IT is the short acronym for ISIS@MACH ITALIA.

² The Executive Summary is a ‘living document’ which is updated yearly on regular basis as new ideas come along and others become lower priorities. The present document is the 2022 update of the Executive Summary sent to the Ministry for University and Research (MUR) in December 2021.

Executive Summary

Most of the transformative changes in our society, such for example the revolutions in transport, medicine, and production techniques, the development of technologies for greenhouse gas removal, the constant increase in average life expectancy, are underpinned by improving and exploiting our knowledge of advanced materials. The latter are key to address global challenges, the transition ‘from research to business’, and driving sustainable economic development.

In this context, the solutions involve the development of both Complex Materials and Interfaces (CMI), and unprecedented and complementary experimental and theoretical tools for their deeper understanding represent the basis of innovation. Making advances in almost any industrial sector needs a profound understanding of the processing-microstructure-properties relationships and materials to be characterised chemically and structurally across many length scales. It is therefore key that researchers



August 2019

- ISISMACH project co-funded by Regione Lazio and UniRoma “Tor Vergata” (coordinator)

May 2020

- ISIS@MACH ITALIA (IM@IT) created and registered by MUR as RI; a partnership UniMilano Bicocca, UniRoma “Tor Vergata”, CSGI and AIRI

May 2021

- CNR and VIU join JRU IM@IT
- IM@IT appoints a committee of external experts for the annual evaluation of the RI

September 2021

- ISIS@MACH is listed as a high priority RI in PNIR 2021-2027 jointly with ISIS Facility

February 2022

- ISIS@MACH ITALIA submits a proposal in the framework of the PNRR call for strengthening of RIs

from public and private communities have access to a very wide range of multiple and complementary techniques for materials characterisation and investigation. However, it is rare that an individual researcher, or even a small group, have the full range of instrument kit or – equally important – expertise to use them all and successfully. Furthermore, some specialised techniques are only available in large, centralised facilities, only in a few countries. Even if such instrument kit is available, there can be a significant knowledge and expertise barrier to its use by those not based at Large Scale Facilities (LSFs).

ISIS@MACH ITALIA (IM@IT) is a hybrid national multidisciplinary and multi-level research infrastructure (RI) a people-centric RI for the analysis of Complex Materials and Interfaces; a complete and unique combination of Clusters of Expertise (CoE), tools, techniques, services, and training; open to access by a broad academic & industrial user community especially those who rarely have the expertise to access Small Research Facilities (SRFs), Medium Range Facilities (MRFs and LSFs, given the significant knowledge, skills and training required in their use.

ISIS@MACH ITALIA RI originates from the ISIS@MACH project, which in 2019 was funded (4.83 M €) within the POR FESR 2014-2020 program

(with 75% shares by Region Lazio and 25% by UniRoma Tor Vergata). In 2020, the Joint Research Unit (JRU) ISIS@MACH ITALIA was established (first registration: MUR official registry U. 0008642.28-05-2020 - 16th April 2020 – second registration MUR official registry U.0013837.04-08-2022 – 1st January 2022) as the first hub (external node) of the ISIS Facility. The JRU encompasses six partners integrating and promoting 9 units, and is committed to the pursuit and expansion of the core activities initiated within the seed project supported by Region Lazio ([Annex - Inauguration of IM@IT building](#)). The six partners -

the Universities of Milan Bicocca (UniMilano Bicocca), Rome Tor Vergata (UniRoma Tor Vergata), Venice International University (VIU), the National Research Council (CNR), the Research Centre for Colloid and Surface Science (CSGI-UniFirenze), and the Italian Association for Industrial Research (AIRI) – provide facilities located in nine different Units in Italy (Figure 1). In 2021 IM@IT has been included in the Italian Ministry of University and Research's Piano Nazionale delle Infrastrutture di Ricerca (PNIR 2021-2027) “*in the broader notion of ISIS*” and ISIS Facility and IM@IT are jointly listed in high priority RI's (see [Table 10 page 40 PNIR in 2021-2027](#)).

IM@IT targets both: a) the enhancement of ISIS@MACH, through the establishment and operation of an Italian network of distributed SRFs and single-sited MRFs and b) the enhancement of the hub to ISIS (UK), through the exploitation of innovative model access to LSFs. In this second mission IM@IT represents a new stage in the longstanding relationship between CNR and ISIS, dating back to 1985. IM@IT is a hybrid RI comprising 140 lab-based “distributed SRFs”, two “single-sited MRFs” with E-interface to “single-sited” LSFs and user access coordinated through a single point of access (Online Proposal System-OPS). It is a comprehensive and unique suite of services and techniques for a broad user community of public & industries, which allows researchers to address challenges on CMI from the atomic to the microscopic scales that cannot be accomplished by any single RI alone. Since 2019 the RI has been offering academic and industrial users and partners combined access to resources, services, and techniques at national academic-research centres-laboratories based and at the ISIS Facility through the OPS IT platform. By the end of 2022 additional user access to the ILL Reactor (F), listed with high priority in PNIR 2021-2027, will be established and by 2023 new access procedures to Diamond Light Source (UK) and Paul Scherrer Institute (PSI, CH) are being considered and it is intended to finalize them in 2023 (see [Figure 1](#)).

IM@IT is adopting ESFRI-compatible policies and practices with the ambition of maintaining inclusion in the ESFRI roadmap as a long-term aspiration.

Our strategic objectives are: to inspire the future generations and encourage them to pursue careers in Science, Technology, Engineering and Mathematics (STEM); to train skilled engineers, technicians and scientists to meet the increasing demands of research and industry; to stimulate the flourishing of an attractive ecosystem for academic and industrial users and partners at the IM@IT Units; to build and stimulate strategic partnership with public, SMEs and academic stakeholders, local and regional communities to develop a work-together approach.

The academic and CNR research centres lie at the core of IM@IT's contribution to the Italian research and innovation strategic plans (PNRR, PNR 2021-2027, PNIR). By attracting new users to access to our research, cutting-edge MRF facilities and SRF laboratories and network of experts, companies and private partners can stimulate business growth.

IM@IT addresses the needs of academic & industrial communities who rarely have the expertise to access SRFs, MRFs and LSFs, given the significant knowledge, skills and training required in their use.

IM@IT transformative nature sets up a scientific environment where large and distributed instrumental capacity and scientific capabilities based both at IM@IT and at the LSF, are made available to researchers from academic and industrial communities, explicitly tailored to transfer knowledge ‘from research to business’. This is a unique aspect which distinguishes IM@IT from all other national RIs operating in the field of material science. Further, a direct E-interface to international LSFs is another unique and distinctive feature of the hybrid nature of IM@IT. The RI addresses a diverse range of research topics from advanced functional materials, space-ICT-agri-food-pharmaceutical-cosmetic-nutraceutical technologies to cutting-edge life science.



Figure 1

Unique hallmark selling point: **IM@IT is a hybrid RI – “distributed” SRFs, and “single-sited” MRFs and LSFs analytical facilities** – a ‘*people-centric*’ vision with at its core the idea of sharing not only ‘*equipment but also expertise and training*, a novel multi-technique and multi-level articulation, tailored to user needs, operating in the Italian landscape and in EU.

Objective and ambition ([Link to IM@IT flyer](#))

Vision

The scientific ecosystem created by IM@IT offers users the opportunities to collaborate with pools of expertise with excellent skills and to access a suite of instrumental resources, offering to the academic and industrial research suitable instruments and solutions for the transition "from research to business". IM@IT is a platform to support:

- i. frontier **research activities of scientists** not fully provided with instrumental resources;
- ii. **open innovation models**, in which companies can increase their capacity to create additional value and expand their capacity to compete in the market also thanks to instruments and technological skills coming from universities and research institutes.

In both cases, thanks to the competence of the "*pools of expertise*" network, **IM@IT can support users in both the creation of new research lines with well-assessed return-on-investment and project proposals (long term proposals) and in the development of the experimental and training sessions at its suite of instrumentation (SRFs and MRFs) and at LSFs.**

Priorities

- Delivering a National-leading science program in partnership with our users.
- Developing and deploying national-technology and infrastructure.
- Building partnerships and collaborations.
- Empowering and developing the CoE within IM@IT.
- Operating effectively, efficiently, safely, and sustainably and being an example of comprehensive operational excellence.

Mission

The innovative approach is the pursuit of new approaches to access LSFs through the construction of a network of alliances with international LSFs and the deployment of targeted funding for specific types of access. More broadly, all components of the IM@IT (provisions of SRFs and MRFs linked through a common user-access platform, as well as the projection towards LSFs) are functional to achieve a better alignment of Italian infrastructure funding with national priorities.

In this context a unique advantage is that RI team will train users to make staged steps with a suite of small and medium equipment that is cognate to that at LSFs, but not nearly as expensive in terms of beamtime cost. This is a crucial point making the IM@IT concept extremely innovative in facilitating this transition to LSFs.

The proposed RI will have a strong focus on major societal challenges and on those exploring feasibility for technologically/industrially relevant research on 'applied science, i.e., ready for the leap to higher Technology Readiness Levels yet financially accessible to SMEs.

The project structure adopts methodologies based both on mapping the user community and the technical capability and capacity of IM@IT, and on how IM@IT can deliver access and follow-up, to allow efficient fulfilment to the challenges in this multi-scale project. IM@IT partners have set-up a collaborative structure to pursue sustainable investments and operation, and to implement open science and innovation practices, as demonstrated by the ramped-up path from ISIS@MACH to IM@IT.

Governance

IM@IT has designed the simplest possible *governance* (see [Figure 2](#)) and *access* models required to fulfil the spirit of the ESFRI requirements. The goal is to free research teams from bureaucratic tasks as much as possible, so that they can focus their capabilities on supporting and teaching/transferring science and technology. It foresees one external body, the **Scientific Advisory Committee (SAC)**, and two internal bodies, the **General Assembly (GA)** and the **Board of Directors (BoD)**.

The **GA** is the highest governing body of IM@IT with full decision-making powers on its policies in scientific, technical, and administrative matter, including: admission of new Partners, establishment of the Scientific Advisory Committee, appointment of the Executive Director and of Unit Directors, approval of IM@IT Technical Programs, approval and adoption of the annual budget proposal, requests for external financial contributions.

The **BoD** oversees the scientific and technical coordination and implementation of the strategies approved by the GA and acts as an internal advisory body to the Executive Director serving as chair of the BoD. A more structured governance could always be implemented in case IM@IT decided to apply for ESFRI.

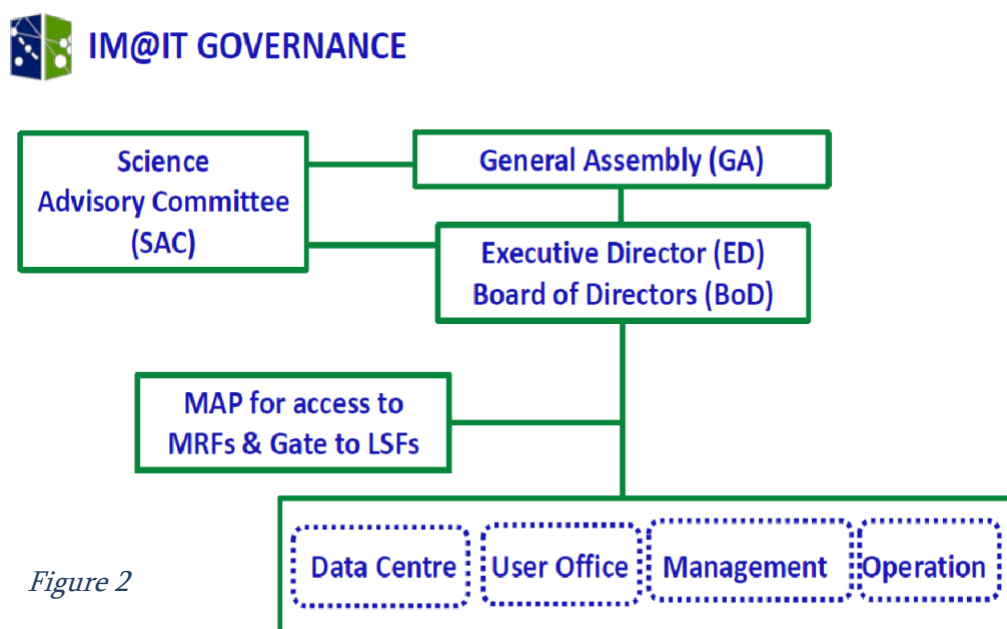


Figure 2

IM@IT operates a **Medium Range Facilities Access Panel (MAP)** to peer review all experimental proposals to access MRFs. Nine independent members of the **MAP** have been appointed upon selection within the academic and industrial community and will be in charge for three years. For future appointments, members will be selected, through periodic calls.

The evaluation panel will meet twice a year, in April and October. Two IM@IT representatives will provide technical support during the meetings.

The first call for Direct Access to MRF1 is scheduled by middle January 2023 and the first **MAP** meeting for the evaluation of the experimental proposals is scheduled for 13-14 April 2023 at UniMilano Bicocca.

Articulation of the Facilities

The hybrid IM@IT comprises elements of both single-sited and distributed analytical facilities (SRFs, MRFs and LSFs) with appropriate peer-reviewing procedures set up for user access only to MRFs and LSFs. The management structure and operational concept is continuously adapted to progressively enable IM@IT to deliver operation standardized to EU procedures. So far, users have been accessing both the

instrumentation/training resources available at the IM@IT Units and the neutron and muon beamlines at ISIS, through a single point of access, E- interface (OPS IT platform), banking on the appropriate facilities, support, and in-house collaboration of multidisciplinary CoE. The latter are anchored across the IM@IT Units, and assist users from academia and industry, focusing with them on problem-led identification of the most suitable technical solution and operate at the different levels/scales of the RI, *i.e.*, SRFs, MRFs and LSFs to support users' needs.

The users' first contact with IM@IT is through a dedicated IT portal ([Annex - Website and OPS IT Platform](#)) equipped with informative documentation on SRFs, MRFs, and LSFs and related techniques and IT tools for data acquisition and analysis. Through the portal, users will be able to discuss and negotiate with a team of experts in the field of their interest, and build a personalized access program. STEM and communication experts address users to the suitable CoE or instrument scientist, who will collaborate with and/or assist users for the writing of a proposal for service, instrument, or training access.

The scales/level of articulation:

1. A network of department - or university-level facilities and equipment (SRFs) [[Annex - Small Research Facilities \(SRFs\)](#)] available both to academics in other institutions and to industry. Presently, the RI operates through two uniform and transparent access routes: **open access** ($\geq 30\%$ per year per equipment) or **with a costing scheme** (see [Annex - Reference Market & Business model and specific success criteria](#)). Researchers have access to SRFs at any time through a light touch procedure; access procedures are simplified and streamlined, with assessment of feasibility being done by a panel of experts of the Unit that 'owns' the equipment as to engender a culture of sharing. These node specific CoE have been created and provide a powerful incentive to access the infrastructure rather than using a similar kit back home.
2. Two Medium Range Facilities MRFs - "flagships projects"³ [[Annex - Medium Range Facilities FOURDIM and SOURIRE](#)] have been created, unique at the national level. They are clustered together with ancillary equipment and linked to groups of researchers holding the relevant expertise and training capabilities. Access types are as for SRFs. Researchers will have access to these specialised facilities through a peer reviewed proposal system, with IM@IT staff providing support and the proposal success rate being much improved because of the preliminary work carried out using IM@IT instrumentation. Through the OPS, users will also be able to apply for an outline program, for which the individual experimental needs would then be assessed (peer-reviewed) on a 6-month basis by the MAP. Where access to LSFs is needed this could either be granted through the normal open access proposal system (again with IM@IT staff providing support and the proposal success rate being much improved because

National Cluster Facilities MRF "flagships projects": FOURDIM "4D Imaging of Complex Systems" and SOURIRE "Nuclear Irradiation Facility". Details in Section 2.3

of the preliminary work carried out using IM@IT instrumentation) or at a limited level through a special agreement with the facility. A uniform access template will also be adopted to future MRFs.

Becoming a user of a LSF is a 'hard hill to climb', much more than of SRFs and MRFs. A priority objective of IM@IT is to train users to make 'gradual steps' using 'simpler' and less expensive equipment (SRFs and MRFs) to perform preliminary investigation and only subsequently move to LSFs. The kind of expertise and training provided to users by the pools of researcher is typically not LSFs-specific but tend to straddle different levels. This is an aspect which makes the IM@IT concept extremely innovative and attractive for new users, and, as experienced in the past two years, facilitated the new users to make the transition from MRFs to LSFs and have attracted an increasing number of new users in both Italy and, through the E-interface, to ISIS with a high success rate. In this procedure users access IM@IT installations (SRFs and MRFs) for their preliminary investigation and, subsequently, the ISIS beamlines. The SRFs and MRFs E-Interface to ISIS (UK), operating since the end of 2019, is a unique feature of the hybrid IM@IT. In the forthcoming years we plan to inspire to the model set up for ISIS applying and expanding it to other LSFs (e.g., ILL, DIAMOND, and PSI).

3. There is some evidence that the standard access model for LSFs' is being increasingly challenged. On one hand funding authorities are keen to see a more direct link between the access they fund and their 'flagship programs', on the other LSFs are increasingly expanding their 'from research to business' - training programs to attract new users from the "academic & industrial communities". Thus, in February 2022 the IM@IT team has developed together with ISIS "a new user access tailored to long term projects" ([Annex - Letter ISIS & Agreement](#)) and with ILL a new special' agreement ([Annex- Letter ILL & MOU](#)). In the case of ISIS, priority will be given to 'project proposals' within 'long term projects' that have exploited the instrumentation available at IM@IT to fully prepare and support the need for ISIS beamtime and the implementation of ISIS. The 'long term projects' - based on IM@IT Case Studies - will prioritise the participation of pools of industry, including SMEs, and of new users. Successful proposals peer-reviewed by panels of experts, would be granted the suggested "flagged" status, thus ensuring that the successful proposers will be able to complete any experiments planned. In the case of the agreement with ILL. We expect the two "new access channels" with ISIS and ILL to impact on the research programs associated to SME start-ups, post-doctoral research associates and PhDs. We plan to seek recourses to fund the new access channels through national and international programs.

Clusters of Expertise (CoE)

The core of IM@IT are the interdisciplinary and multidisciplinary capacities and capabilities of its CoE identified around existing and new equipment (SRFs) ([Annex - Small Research Facilities \(SRFs\)](#)), and the 'flagship projects' to be transferred into national MRFs (see [Annex - Medium Range Facilities FOURDIM and SOURIRE](#)). The node-specific CoE, assist users requesting access to IM@IT to do it at its best. Academic or industrial users who do not have sufficient skills or the relevant experience to be able to directly access the suite of analytical facilities (SRFs and MRFs) or LSFs are initially trained to become

actual users. The CoE establishes multilevel dialogue and actions, starting from the 'grassroot' level of direct communication and by specific actions between these experts and academic/industrial users.

The main scope of CoE is to foster the development of CMI to increase their potential of facing specific societal challenges such as sustainability, water remediation, health, cultural heritage and make the advanced materials sustainable as an effective deep technology able with a disruptive impact on the future society. This is achieved through a multistep access infrastructure where SRFs are available alongside with specific expertise as well as competences on designing, preparation-characterization and validation of materials. This scope is pursued through specific activities performed using the analytical facilities as well as in advancement of competences. The topics of CoE are briefly described in [Annex - Clusters of Expertise](#).

Activities and perspectives

Activities carried out by the IM@IT Units between 1/9/2021-31/7/2022 are:

Research projects

- Creation and submission of research projects and activation of a PhD fellowship on PNRR funds, Mission n.4, component 2 "*From Research to Enterprise*" – Investment n. 3.3 " in partnership with Thales Alenia Space Italia, which provides access to the Italian and LSF network in 2022 and 2023
- Research Project with Arterra Bioscience SpA that provides access to the Italian network SRFs, MRFs and LSFs (ISIS, ILL, DIAMOND and PSI).

Organization of Research & Training workshops

- *International Meeting: "[1st Workshop on Global challenges and the role of science, technology, and diplomacy](#)"*, which will take place at the Centro Alti Studi Difesa (CASD), Rome 8-9 November 2022
- II International Meeting which will take place on 2-6 May 2023 at the Centro di Cultura Scientifica Ettore Majorana (Erice).

User access to SRFs and MRFs instruments

- **103** users have accessed services, experiment, and training at IM@IT SRFs and MRFs. These correspond to a total of **18** user access: a) **16** user access to SRFs corresponding to **330** instrument-days; **2** user access to MRF1 corresponding to **48** instrument-days

Expression of interest for IM@IT

- Since 2020, IM@IT team has continued to carry out actions aimed to increase the staff and tools (SRFs and MRFs) and services to users at national and international level. A call for Expressions of interest (Manifestazioni di interesse) to collaborate with IM@IT was opened in February 2022. Over 160 responses (see [Figure 3](#)) have been received from public & private stakeholders from Universities (18), Associations (6), Research Centres (10), SMEs (96), Foundations (8), Research

Infrastructures (7), Public Agencies (12), Italian Ministries (4) ([Annex - Public & Private Stakeholders](#)) which we grouped according to the task they are related to: FUNDERS – SUPPORTERS – USERS and SERVICES PROVIDERS & ACCESS & TRAINING – FACILITATORS (see also Section “Business Model and specific success criteria” below).

A geographical visualisation of the public and private stakeholders can be accessed at the link [Geographical Visualisation of Stakeholders](#)

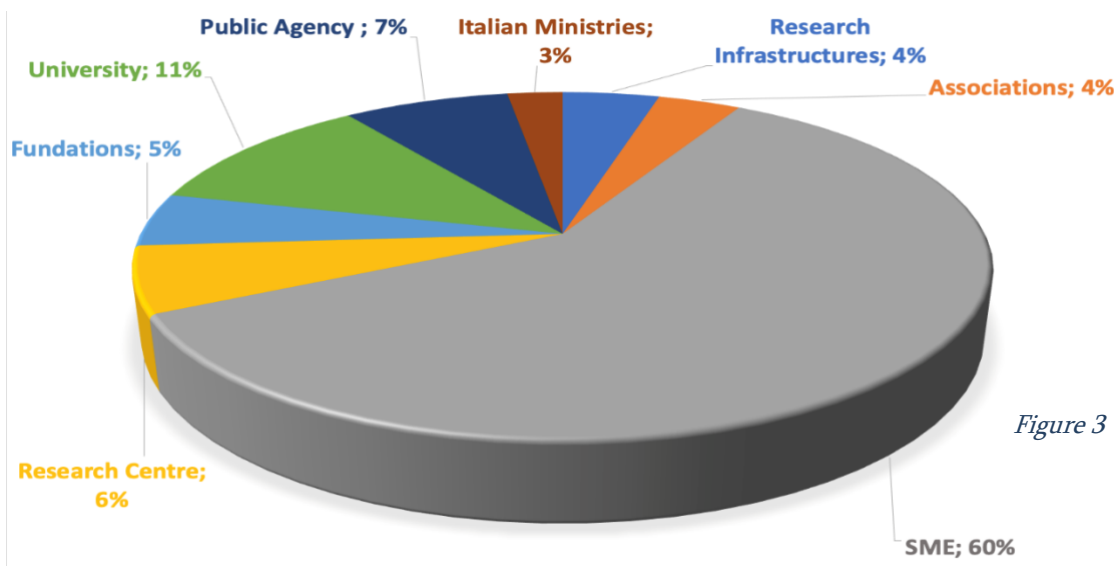


Figure 3

Perspectives

In line with the ongoing activities and with the SAC suggestions, IM@IT intends to continue and strengthen its growth by:

- i. enriching the research portfolio, skills and tools, implementing case studies and developing new ones with stakeholders;
- ii. strengthening its Units distributed throughout the territory to act as a catalyst for a more effective involvement of SMEs;
- iii. strengthening and extending support to users for access proposals and experimental campaigns at SRFs and MRFs national network of instrumentation as well as at LSFs.

The ongoing strengthening activities include:

- development and interoperability of the users IT interface with the MRFs and SRFs national network;
- support to SME service requests and to new public users and digital transformation of RIs;
- upgrade of the infrastructure instrumentation;
- implementation of the European Open Science Cloud (EOSC) and FAIR (Findability, Accessibility, Interoperability, and Reusability) principles;

- implementation of the RI connectivity with national and international inter/multidisciplinary community networks

in line with the EU Horizon Europe programs that provide four different levels of IR evolution (calls for INFRADEV, INFRASERV, INFRAEPOCH, INFRAEOSC, INFRANET).

Case Studies

The pool of expertise jointly with new stakeholders, responding to the Expressions of interest, refined the Case Studies (CSs) proposed in the 2021 executive summary, according to the needs of the new public & industrial users, and identified opportunities to make an impact. The CSs envisage the use of a new kind of translational access to SRFs, MRFs and to ISIS and the necessary training for the new users, ranging from PhD students through early-career researchers to Principal Investigators. Stakeholders involved in each CS will have the opportunity to apply for training and access to SRFs, MRFs (peer reviewed) and E- interface to ISIS-STFC through the single point of access (OPS IT platform) if translational access to ISIS were fully funded. The access will be through the new agreement with ISIS with priority given to proposals within “long term projects” that primarily would exploit the instrumentation available at IM@IT. These ‘long term projects’ - based on IM@IT Case Study projects - will prioritize the participation of pools of industry, including SMEs, and of new users. These are summarised in the following and detailed in [Annex - Case Studies](#).

Case Study 1

“Single particle structure and dYnamics of Macromolecules, BIOcomplexes and aggregaTEs” (SYMBIOTE)

IM@IT Units: CSGI-UniFirenze (Coordinator), CNR-IPCB (Institute for Polymers, Composites and Biomaterials), UniMilano Bicocca, UniRoma Tor Vergata

Stakeholders: MediaLab MIT (US), BioMerieux, CONFAPI, AmypoPharma

Case Study 2

“NEw MAterials and meThODology for rEstoration of art” (NEMATODE)

IM@IT Units: CSGI-UniFirenze (Coordinator), CNR-IPCB, UniMilano Bicocca, UniRoma Tor Vergata

Stakeholders: Peggy Guggenheim Collection (Venice), Museo Egizio (Turin), Foundation Venaria (Turin), Museo Archeologico di Reggio Calabria (MARC), Chiesa di Sant’Adamo (Cantalupo, Rieti), Contamination hub, Zetema s.r.l., NIKKO Chemical (Tokyo), NOURYON (Sweden)

Case Study 3

“Development of new Integrated particle-, and neutron characterization tools for materials, Coatings, and Electronic components Qualification” (DICEQ)

IM@IT Units: UniRoma Tor Vergata (Coordinator), UniMilano Bicocca, CNR-ICMATE (Institute of Condensed Matter Chemistry and Technologies for Energy), CNR-IPCB

Stakeholders: Thales Alenia Space Italia, Ministero della Difesa, INFN - Roma TRE

Case Study 4

“Supercooled Water study using Atmospheric data and Neutron Spectroscopy” (SWANS)

IM@IT Units: CNR- IMAA (Coordinator), UniRoma Tor Vergata, UniMilano Bicocca, UniFirenze

Stakeholders: Ministero della Difesa, Rolls Royce, EUMETSAT, ESA, CONFAPI Basilicata

Case Study 5

“Training and Outreach” (THROU)

IM@IT Units: VIU (coordinator), AIRI, CNR-ICMATE, CNR-ICB, UniMilano Bicocca, UniRoma Tor Vergata

Stakeholders: Centro Alti Studi Difesa (CASD), SIF, University College London, University of Padua, QZABRE Zurich

Case Study 6

“Green Transitioning through Sustainable and Circular Chemistry” (GRETA)

IM@IT Units: CNR-ICMATE (Coordinator), CNR-ICB, UniMilano Bicocca, UniRoma Tor Vergata

Stakeholders: University Camerino

A new kind of translational access tailored on the example of the six Case Study ‘long term projects’ has been shaped together with ISIS ([Annex - Letter ISIS & Agreement](#)) and ILL ([Annex- Letter ILL & MOU](#)). Priority is given to proposals that would exploit the instrumentation available at IM@IT before accessing LSFs.

Access to MRFs & Large Scale Facilities

In 2022 IM@IT team has identified together with experts from ISIS and ILL a new access model for users, to ensure rapid exploitation and to address bottlenecks in terms of capacity. The core of the model is detailed in ([Annex - Medium Range Facilities FOURDIM and SOURIRE](#)).

Training and outreach

The training within IM@IT aims to provide new opportunities to both building capacities and disseminating opportunities of exploitation of the IM@IT analytical facilities and working with pool of expertise, for public and SMEs users. The latter are engaged in training and capacity building activities as well as in the development of a strong industrial outreach program. The scope is to enable potential users in industry and academia to expand their capacity in using the SRFs and become users of MRFs and LSFs. This is pursued by developing a vibrant environment of exchanges, starting from a ‘language and practise’ that are accessible to potential industrial partners. This would be extremely beneficial for early-

career researchers on the academic side, providing them with career opportunities outside academia of which they are likely unaware at present. Targets of the training are: i) members of academia and industry, with a particular emphasis on the latter, to become actual users of IM@IT facilities and LSFs; ii) young scientists, to help them to become experts instrument scientists of laboratory-scale equipment (SRFs and MRFs) and users of the LSFs. Specific training for new scientific and technical staff will be tailored to develop technological skills. Some of the students and staff members at IM@IT Units and visiting research groups are expected to move to industry at some point in their careers, producing a flow of skills from the research community into the private sector, with the added benefit of helping to strengthen the engagement of industry in manufacturing related sectors.

More details on the multiple purposes of training being available within IM@IT are described in ([Annex - Training and outreach](#)).

Management, implementation of Head Office & Civil Infrastructures.

IM@IT has established and maintain constant coordination and communication among the Units, along with monitoring sustainable availability of resources required for personnel, daily operation of analytical facilities, data centre and civil infrastructures, ([Annex - Management and Implementation of Head Office and Civil Infrastructure](#)). The operational structure of the IM@IT is streamlined in [Figure 4](#).

Project framework and main expected impact

Italy's polycentric academic and research ecosystem is very different from models which feature 'global research powerhouses' with a large critical mass of equipment and expertise. In the Italian context, access to a distributed network of SRFs and MRFs, linked through a single portal to LSFs and to the relevant expertise, training, and tools of outreach-dissemination, will have a broad impact on research output and on recruitment and retention of scientists and technologists. IM@IT aims at generating distinct and transformative advances in the Italian industrial and research landscape across a broad range of areas, reflecting its highly diverse community, with a strong engagement of facility scientists. Its remit bring forward a class of problems of academic/industrial relevance and identify opportunities to have an impact, focused onto a 'people-centric' vision, enabling potential users of facilities and associated techniques to become actual users, including both academia and industry but with a particular emphasis on the latter.

The main drivers for scientific, economical, and societal impact will be pursued towards academic advances, across and within disciplines, towards research that demonstrates improvement and protection of health and well-being, and improvements to products or processes. Direct funding from national and regional sources shall remain the core of the funding model to mobilise the substantial resources for its sustainability: direct public funding can ramp down slowly and be replaced in large part by project-based funding (for academia and industry engaging in 'open science') and paid-for access for proprietary industrial research. Funding of the RI will be achieved through the adoption of a variable scheme that shall adequately support major financial investments and requirements, operation, and upgrade in the medium- and long-term commitments.

These funds will then also be addressed to support projects that are relevant for societal challenges and exploitation of industry collaboration, to provide funders with a direct link to impact cases and scientific results, motivations to support user access to the RI and incentives for the commitment. The cost of the distributed facility management, coordination and operation could be overcompensated by the higher capacity of the distributed RI to obtain financial means from the HE programs and short-term projects. Furthermore, IM@IT intends to expand open access to maintain the goal of a positive balance with respect to the sum of the national contributions to the individual Units, considering revenues from paid access or user fees for those RI Units providing access to science services, proprietary research, and technology transfer for industry. In this regard, a suitable and transparent access pricing scheme will be developed to define the fees that could be charged in case of specific services or specific users (e.g., users from industry for proprietary research). User fees may partially or fully cover the access costs incurred for providing services, and the user fees charged may also depend on the availability of co-funding from the users (e.g., via research grants to (co)-finance world-class research enabled by RI service, specific collaboration agreements, funds from central and regional programs to industry). World-class science depends heavily on the availability of state-of-the-art equipment, but that it is often very difficult for a single unit to provide its researchers with every advanced technique they may require access to. Our capital investment strategy therefore seeks to realise the scientific and financial benefits that can arise when equipment is shared at an appropriate level. A commitment to simplify, rationalise and strengthen shared facilities for research; this will enable long-term, sustainable capital investment in cutting-edge equipment and infrastructure.

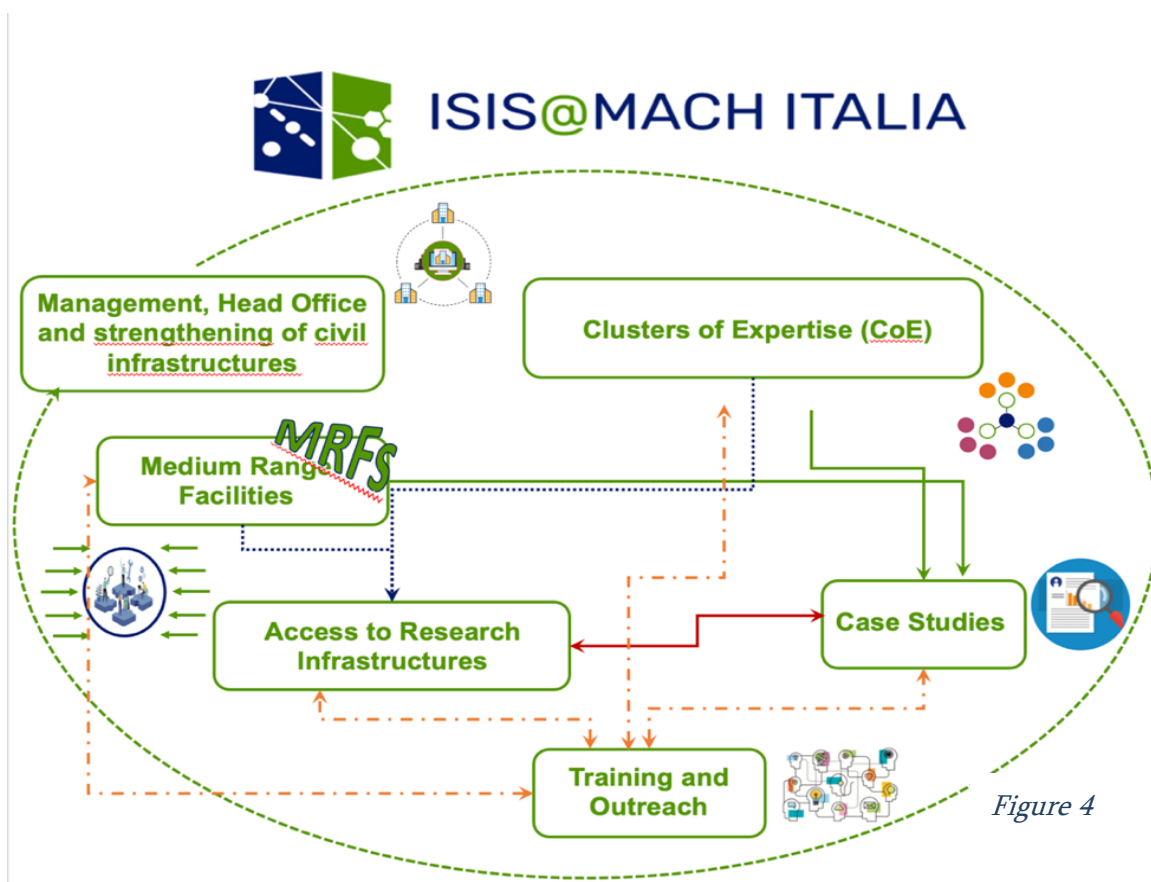


Figure 4

Attracting new users – a core remit of IM@IT – will be achieved by focussing on enabling potential users of facilities to become actual users, i.e. to attract those academic and industrial users who do not have sufficient skills or the relevant experience to be able to directly access small- or large-scale infrastructures ([Annex - Training and outreach](#), [Annex - Reference Market & Business model and specific success criteria](#)). In many cases, access of academic and industrial users is hindered by the high level of competencies required to exploit even small RIs. Many enterprises, especially but not exclusively SME, must acquire 'basic literacy' in analytical techniques before they can even consider becoming partners in open-science projects, let alone committing their own funds to proprietary research. IM@IT Clusters will contribute to reducing these gaps by establishing a multilevel dialogue and actions, starting from the 'grassroot' level by direct communication and specific actions agreed between experts and academic/industrial users.

Data Management plan and Implementation of FAIR principle
([Annex - Data Management plan and Implementation of FAIR principle](#))

Do No Significant Harm (DNSH) strategies
([Annex - Do No Significant Harm \(DNSH\) strategies](#))

Gender equality plan
([Annex - Gender equality plan](#))

Reference Market & Business model and specific success criteria

The business' goal of IM@IT RI is to provide users from academic and industrial community with specialised skills, tools, and services. Enterprises, associations, and research organisations that have already been partners or users of IM@IT, as well as those who have expressed interest (see [Annex – Public & Private Stakeholders](#)), have been surveyed to draw a representative scenario of IM@IT reference market in terms of categories (based on their mission, ownership, and size), areas of interest (also in the Horizon Europe framework) and potential benefits.

The business goal of IM@IT is to provide academic and industrial users with specialised skills, tools, and services, strengthening competitiveness at the industrial level and fostering scientific excellence. Enterprises, associations, and research organisations that have already been partners or users of ISIS@MACH, as well as those who have expressed interest, have been surveyed to draw a representative scenario of the IM@IT reference market in terms of categories (based on their mission, ownership, and size), areas of interest (also in the HE framework) and potential benefits. The survey shows that prospective users of IM@IT homogeneously impact the categories of: a) Public, Academic and Research Organisations; b) Large Enterprises; c) SME and industrial associations, with a slight prevalence of the last one. When crossed with the Global Challenges and European Industrial Competitiveness defined by Pillar II in, HE, the interest of IM@IT users spreads across all its CoE, highlighting the multi-disciplinary and cross-sectorial potential of the RI. The articulation into SRFs and MRFs allows users' needs to be competently addressed: SRFs are well-suited to provide a timely answer to technological problems, while

MRFs are expected to contribute with highly specialised skills and tools: MRF1 is expected to have a stronger impact on SMEs, while the unique level of skills in MRF2 will intercept the high level of technology most frequently found in Large Enterprises and Research Organisations. IM@IT is bringing together the main Italian sites with the highest presence of RI users in neutron science at the national level, facilitating the formation of consortia targeting specific problems of national relevance, and share expertise on best practice in proposals writing. The IM@IT hybrid nature will gradually form the basis for cataloguing data on COI to be acquired and for generating technological platforms for material and biomaterial resources, high-throughput techniques, and other IT tools for data analysis ([Annex - Reference Market & Business model and specific success criteria](#)).

Risk management and implementation strategies to assure RI Sustainability ([Annex - Risk management and implementation strategies to ensure RI Sustainability](#))

List of critical risks ([Annex - List of Critical Risks](#))

Implementation and Operation, Costs and Timeline

Reason for funding ISIS@MACH ITALIA over the next four years is to allow IM@IT the establishment of its infrastructure, processes, and scientific activities which would focus on:

- strengthening CoE around existing and new equipment,
- identifying ‘flagship projects’ and converting them into national Cluster Facilities MRFs,
- broadening the interface to national and international LSFs,
- strengthening the training, industrial outreach, and dissemination elements, both at the central and at the cluster levels,

before the RI is able to seek other funding sources.

In February 2022 the full IM@IT cost has been detailed in 32 M€ IM@IT – for the period of thirty months, beginning from January 2023. Such full costing includes implementation, operation, other components, i.e. management, SRFs (applying the cost model used for MRFs in the Executive Summary 2021), personnel, consumables, maintenance of existing equipment and acquisition of new one, translational access, civil infrastructure, data centre and Head Office.

Public funding should remain the ‘bedrock’ upon which the infrastructure is built and sustained.

In 2021 MUR has included IM@IT among the list of RIs at high priority in the National Plan for Research Infrastructures, a national strategic plan for the RIs, with CNR proposing institution; in 2022 MUR, has funded it with 550 k€ IM@IT within FOE.

The highest priority for IM@IT is to continue seeking funding from public institutions (FOE-MUR, POR-FESR, PON, Horizon Europe, European Innovation Council, European Institute of Innovation & Technology) and from its private stakeholders to realise its mission described above.

List of Annexes:

1. [Annex - Inauguration of IM@IT building](#)
2. [Annex - Website and OPS IT Platform](#)
3. [Annex - Small Research Facilities \(SRFs\)](#)
4. [Annex - Reference Market & Business model and specific success criteria](#)
5. [Annex - Medium Range Facilities FOURDIM and SOURIRE](#)
6. [Annex - Letter ISIS & Agreement](#)
7. [Annex- Letter ILL & MOU](#)
8. [Annex - Clusters of Expertise.](#)
9. [Annex - Public & Private Stakeholders](#)
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10. [Annex - Case Studies](#)
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