REALISATION OF NATIONAL FACILITIES OPEN TO THE SCIENTIFIC COMMUNITY AT HUMAN TECHNOPOLE

FINAL REPORT OF THE TECHNICAL COMMITTEE ON THE 2021-2 TWO-STAGE CONSULTATION

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EXECUTIVE SUMMARY AND TECHNICAL COMMITTEE FINAL RECOMMENDATIONS

In compliance with the provisions of the *Convenzione*[1], the Technical Committee conducted the first two-stage public consultation aimed at identifying the priorities of the Italian scientific community in terms of research infrastructures, within the Human Technopole scientific focus. The consultation was performed in two phases: the first engaging stakeholders representing Universities, IRCCSs, Public Research Institutions, Industry, Regions, social partners, and Third Sector entities that conduct or fund research in the life sciences, the second addressed to the entire scientific community.

Taking into consideration as main criteria the overlap with national and EU facilities, the public funding already available and planned for RIs, and the size of the potential pool of users of proposed National Facilities to be established at HT, the contribution of the invited stakeholders led to the identification of three main core areas in which there was a high demand for National Facilities: 1. the OMICS domain - including Genomics, Single Cell Multiomics, Genome engineering, Proteomics, Metabolomics (Nutrition); 2. the IMAGING domain - which will bridge across scales to include Cellular Imaging and Structural Biology; 3. the DATA HANDLING AND ANALYSIS core - which will support the two domains above.

The Second Level Consultation, open to the entire national scientific community, confirmed that the access to the identified technologies/services was considered very important by a high proportion of the participating researchers. In fact, of the 1624 participants, 91%, 87% and 88%, respectively, indicated that the implementation of these three areas is a very high or high priority, confirming the strong demand for these services. In particular, 65% of the participants deems the offer of OMICS services a very high priority, followed by DATA HANDLING AND ANALYSIS and IMAGING with 56% and 53% of the contributors identifying them as very high priority, respectively.

On the basis of the outcome of the consultation, described in detail in this report, the Technical Committee proposes the following recommendations to the HT Supervisory Board and to the Ministries.

The National Facilities (NFs) provided for by the *Convenzione* will be an integral part of Human Technopole and contribute to fulfil its mission. Through the consultation, the Technical Committee surveyed the current needs of the Italian scientific community in terms of research infrastructures and defined how HT might support Italian scientists with regard to access to cutting-edge technologies within the HT scientific focus.

The Human Technopole National Facilities will grant access to innovative technologies to external research laboratories with original biological questions that cannot afford the instrumentation or other costs and/or lack the expertise to complete the experimental workflows required for their projects. The NFs will gain added value by working in an integrated manner as established under the *Convenzione*. In addition to this, the interactions at national and international level with established infrastructures are expected to be mutually beneficial, establishing a framework for sharing knowledge and tools for technology development.

A brief description of technologies and services that should be considered in the implementation plan is available at Annex 1 (p. 21).

A regular evaluation should be carried out in order to avoid duplication with structures / infrastructures that will be implemented with publicly funded programs. A structured programme of collaboration with these national and international structures / infrastructures should be developed. Because the NFs will be built over a period of time as new building construction at HT proceeds, integration with existing facilities will be very useful to avoid duplication.

[1] https://www.mur.gov.it/sites/default/files/2021-07/Convenzione MEF_MUR_Min Salute_HT.pdf

A detailed plan of the space necessary both for the installation of the equipment and for the support laboratories must be carried out, taking into account the need to: a) define pathways based on the work to be carried out (also considering biosecurity levels), b) assess requirements for air conditioning, electricity, technical gases, load bearing, etc.; c) plan adequate space for the studies to be carried out by visiting users of NFs.

The rapid evolution of technologies implies a requirement for regular upgrades of, and better integration between, the NFs to be realised in the coming years. This will go in parallel with the incorporation of new specialized analytical tools. Together, these dynamic changes make it difficult for individual laboratories and/or Institutions to keep up with technological innovation. Users of the NFs and the national community should be periodically consulted about new requirements. Only cutting-edge equipment should be considered for the NFs.

For the purchase of equipment, contracts for co-development with the manufacturing companies should be pursued. This can facilitate advanced access to new technical and structural requirements necessary to maintain the facilities at state of the art.

A cost forecast, and an allocation of resources, for the maintenance of the equipment (also through full risk maintenance contracts), must be performed to ensure a constant instrumentation update and investment in the most promising and innovative techniques bringing benefits to the whole scientific community. The cost to stipulate full risk maintenance contracts on all instruments are expected to be a significant percentage of purchase prices but are an essential component of the running costs of National Facilities. As stated in the *Convenzione*, access to the NFs at HT will be granted on the basis of scientific merit and available resources. As a complement to the procedure foreseen by the *Convenzione*, external experts in the relevant fields can be involved to assist selecting and prioritising the requests submitted for access. These experts will be remunerated according to internal rules.

To achieve their mission, all NFs should be organized as a set of integrated units, with an adequate number of dedicated and technically proficient personnel. The companies supplying the equipment should be asked to guarantee the initial supply of and, if appropriate, periodic training for the NFs personnel at each update of the equipment.

A comprehensive implementation plan for the NF, covering business plan, human resources, data management, access management plan and related cost book, is strongly recommended.

Considering that, for the most part, the new National Facilities provided for by the *Convenzione* will be implemented in the South Building (available after 2026) and in order to allow the access of the scientific community to the facilities that are already under construction at HT and that will be available starting in 2023, the TC agreed on this statement: *The Technical Committee, informed by its technical and scientific analysis of the proposals for National Facilities, is of the opinion that the relevant parties should agree on a way that technical facilities already activated or in construction by Human Technopole, as per Art. 3.4 of the Convenzione, are made available by different mechanisms to internal and external users.*

1. Introduction

Human Technopole (HT) is a life science research institute established by national Law 11 December 2016, nr. 232 and supported by core funding from the Ministries of University and Research (MUR), of Health (MoH), and of Economy and Finance (MEF). Human Technopole aims to become a centre of excellence and an internationally competitive research institute. Envisioned as a large-scale national research structure, once fully developed it will employ around 1,000 scientists and a total of roughly 1300 staff, positioning itself as one of the largest institutes for life science research in Europe.

Human Technopole's overarching mission is to contribute to human health and well-being by carrying out frontier research in the biomedical sciences, with a particular focus on biological problems relevant to human health, ultimately aimed at developing novel approaches for personalised and preventive medicine. The research activities at HT pursue a comprehensive and interdisciplinary approach to the study of human biology – with scientists in diverse fields, including biology, bioinformatics, chemistry, engineering, physics, mathematics, computational and health data science, working together on research topics of biomedical relevance. By combining the most advanced experimental and computational technologies – including, prominently, high-throughput -omics and advanced imaging methods – HT's science investigates the basic mechanisms regulating biological systems across all scales of organisation – from single molecules and complexes over organisms, to communities and populations. Currently, HT's research activities, which span a broad range of topics, are mainly focused around the areas of genomics, neuroscience, computational biology, integrative structural biology and health data science.

The *Convenzione* signed on December 30, 2020 between the Ministries of Economy and Finance (MEF), of Health (MoH), and of University and Research (MUR), and the Human Technopole Foundation governs the realisation at Human Technopole of National Facilities, which must meet the definition of research infrastructure adopted by the European Strategy Forum on Research Infrastructures (ESFRI) , i.e., facilities, resources and related services used by the scientific community to conduct high-quality research in their respective fields, independent of institutional or national affiliation.

In compliance with the provisions of Law 160 of 2019 (art. 1, paragraphs 275, 276 and 277), the *Convenzione* also provides that such NFs be identified following a public consultation in two phases: the first engaging stakeholders representing Universities, IRCCSs, Public Research Institutions, Industry, Regions, social partners, and Third Sector entities that conduct or fund research in the life sciences, the second addressed to the entire scientific community.

Between July 2021 and July 2022, the Technical Committee, composed of the Director of Human Technopole (Chair), Professor Iain W. Mattaj, the Director General of Internationalization and Communication, MUR, Doctor Gianluigi Consoli, the Director General for Research and Innovation in Healthcare, MoH, Professor Giuseppe Ippolito, (Vice-Chairs), one of the Italian representatives in the European Strategy Forum on Research Infrastructures (ESFRI), Doctor Gelsomina Pappalardo, and the Chair of the Scientific Committee of Human Technopole, Professor Walter Ricciardi, conducted the first two-stage consultation. The results are summarised in this report, with a description and the prioritisation of the services, activities and technologies in high demand by the national scientific community.

2. First Level Consultation

The First Level Consultation involved hundred and sixty-seven (167) stakeholders (Annex 2) identified by the Technical Committee and representing the main actors in the national research system, who were invited to contribute to the identification of the priorities of the national life science community in terms of research infrastructures. The interested stakeholders were requested to submit their proposals, adequately motivated, regarding possible NFs to be implemented at HT, through an online questionnaire (Annex 3) that was made available from July 23rd, 2021, to September 30th, 2021. The questionnaire was prepared by the Technical Committee and was inspired by the form that ESFRI uses to collect proposals for the construction of research infrastructures to be included in the European roadmap. The proposers were requested to explain why the facility is required, who will use it and what it should include in terms of both equipment and technical expertise.

Through the questionnaire, the TC aimed to identify the national life science community's priorities with regard to research infrastructures relevant for life science research, in particular in the fields of health, genomics, data and decision science, nutrition, structural and cellular biology and additional areas of research aimed at illness prevention and health, which represent the wide domain of HT's research interests as defined by Law 11 December 2016, nr. 232. The questionnaire was not, therefore, aimed at collecting the desires of individual researchers or small groups, but rather at collecting aggregate indications that reflect the common vision of a large part of the research community.

To increase the visibility of the ongoing consultation, several stakeholders representing scientific societies, professional associations and networks (Annex 4) were informed of the launch of the consultation and asked for their support to increase participation by the scientific community, by encouraging their members in participating in the consultation by forwarding their proposals to the heads of the respective institutions.

2.1. Proposed National Facilities

As a result of the First Level Consultation, a total of 60 questionnaires were submitted, 48 derived from initiatives supported by several institutions and 12 from single institutions. Several of the questionnaires described different infrastructural units of the same facility. Overall, the stakeholders invited to participate in the consultation proposed **29 different National Facilities** in various fields, including imaging, omics technologies, health and drug discovery, among others.

Below is the full list of the proposed National Facilities.

- **ID 1**. Cellular imaging: platform for the validation and the translational application development of nanobodies. Animal imaging: fmri platform for small laboratory animals and plaftorm for cellular imaging (multiphoton, miniscope)
- **ID 2**. National platform for genomics (NP-GENOMICS)
- **ID 5**. National platform for vector and cell engineering (VERDI)
- **ID 6**. National platform for integrated single cell multiomics (INsCELL)
- **ID 10**. Peptide platform as an useful tool for the fight against infectious diseases (PePdis)
- **ID 11**. National platform of advanced services for precision nutrition of the 4p's (prediction, prevention; personalization, participation) (NUTRI4PSERVICE)
- **ID 12**. Nursing science network "NURSINGNET"
- **ID 13**. National platform for animal imaging (ANIMA)

- **ID 21**. National platform for molecular & cellular imaging integrated multimodal and multiscale biophysical analysis (NP – IMBI)
- **ID 25**. National platform for drug discovery and development acronym of the np: drug discovery platform (DDP)
- **ID 29**. National platform for proteomics & metabolomics integrated proteomics and metabolomics (IPROMET)
- **ID 33**. National platform for structural biology (SBIP)
- **ID 38**. National platform for bioinformatics and biological data (Bioinfo)
- **ID 43**. National platform for human imaging (PHI)
- **ID 48**. Nanomedicine (Nano-2-Bed)
- **ID 49**. Ecotron facility for experimental ecosystem studies (EF4EES)
- **ID 50**. High-throughput and high-content screening (HTHC_S)
- **ID 51**. National infrastructure for human health for space exploration (NI2HSE)
- **ID 52**. National platform for nanomedicine (PN-NANOMED)
- **ID 53**. Personalised and sustainable nutrition (PERSUSNUT)
- **ID 54**. National platform for access promotion and staff training (NP4PT)
- **ID 55**. Nutrition and health (NUTH-RI)
- **ID 56**. Cloud for the human technopole (IC4HT)
- **ID 57**. Quantum computing for life sciences (QCLS)
- **ID 58**. Three dimensional approaches and knowledges to drive the dialogue between cells and (bio)materials (3D BIOTALK)
- **ID 59**. Rehabilomics and advanced biomedical technologies for basic and translational research on health & life sciences enabling wellbeing and active ageing (RENEW)
- **ID 60**. Mediterranean inflammasome drug discovery platform (MINERVA)
- **ID 61**. Intelligent real world data analytics platform, a national platform for the extraction and the intelligent analysis of clinical real world data (IRWAP)
- **ID 62**. National centre for biological resources (CNRB)

Copy of the submitted proposals are available in Appendix 1.

2.2. Evaluation procedure

The questionnaires received were evaluated with the aim of defining priorities in terms of research infrastructures in high demand by the national scientific community, to be submitted to the second level consultation.

The evaluation was performed in three consecutive steps:

i. Eligibility check

ii. Opinions expressed by external experts

iii. Opinions and evaluation by the Technical Committee

A detailed description of and the results of the three steps are provided in the following sections.

2.2.1. Eligibility check

A first eligibility check was performed by the Technical Committee to identify the proposals compliant

with the requirements set out in the *Convenzione* and the guidelines provided. Each questionnaire was in principle aimed at collecting one suggestion for a NF of interest for the national community, with a description of the facility, its functional subdivisions (Infrastructural Units, IU), including the technologies and personnel required, with a maximum character limit for some of the questions. Out of the 60 questionnaires submitted, 41 did not describe independent facilities but instead a set of 10 facilities with the component infrastructural units. In this group, only the questionnaires entitled "Summary" were compliant in format with the guidelines. Nevertheless, the Technical Committee agreed to include in the further process all questionnaires related to a single NF, which were grouped under a single ID (e.g. ID2 includes ID 2a, 2b, 2c). The proposals deriving from questionnaires that were not compliant with the guidelines but that were nonetheless included in the further process were: ID2, ID5, ID6, ID13, ID21, ID 25, ID29, ID38, ID33, ID43.

A total of **18 proposals were considered eligible** and moved forward in the process.

Below, the list of proposals that were considered unsuitable, including a brief description of the reasons for ineligibility.

- ***ID 1**. Cellular imaging: platform for the validation and the translational application development of nanobodies. Animal imaging: fmri platform for small laboratory animals and platform for cellular imaging (multiphoton, miniscope)*

  The proposal was very poorly described, and no technical details were provided, therefore it was not possible to define the mission and the services provided by the proposed platform.

- ***ID 10**. Peptide platform as a useful tool for the fight against infectious diseases (PEPDIS)*

  The proposal did not describe a National Facility offering services but instead a facility to mainly carry out research in the field of epitope-specific based vaccines formulated with synthetic peptides.

- ***ID 11**. National platform of advanced services for precision nutrition of the 4p's (prediction, prevention; personalization, participation*) (NUTRI4PSERVICE)

  The proposal did not describe a facility to be implemented at HT, rather it aimed at establishing a network of infrastructures where each partner University represented one IU. The goal of the proposal was to request funding for the universities involved.

- ***ID 12**. Nursing science network "NURSINGNET"*

  The proposal was not aimed at implementing a National Facility but rather at creating a network of public health and nursing researchers.

- ***ID 51**. National infrastructure for human health for space exploration (NI2HSE)*

  The proposal did not describe a National Facility offering services but a facility to mainly carry out research on its own in the field of space science, a research area not foreseen by the law 232/2016.

- ***ID 54**. National platform for access promotion and staff training (NP4PT)*

  The proposal did not describe a National Facility offering services, rather it offered support

for managing access and staff training. The proposal was not considered further, but the TC recommended to consider "training" as a fundamental aspect and goal of the National Facilities.

- ***ID 56**. Cloud for the human technopole (IC4HT)*

  The proposal did not describe a National Facility offering services but instead offered resources and IT solutions to be used by HT and other users on a fee for service basis.

- ***ID 58**. Three dimensional approaches and knowledges to drive the dialogue between cells and (bio)materials (3D BIOTALK)*

  The proposal did not describe a National Facility offering services but a facility to mainly carry out research on its own in the field of biomaterials.

- ***ID 59**. Rehabilomics and advanced biomedical technologies for basic and translational research on health & life sciences enabling wellbeing and active ageing (RENEW)*

  The proposal did not describe a National Facility offering services but a facility to mainly carry out research on its own in the field of rehabilitation.

- ***ID 60**. Mediterranean inflammasome drug discovery platform (MINERVA)*

  The proposal did not describe a National Facility but a research hub on diseases related to chronic inflammation with a particular focus on the role of inflammasomes.

- ***ID 61**. Intelligent real world data analytics platform, a national platform for the extraction and the intelligent analysis of clinical real world data (IRWAP)*

  The proposal did not describe a National Facility but was a request for funding to perform research.

2.2.2. Opinions provided by external experts

Considering the wide range of technologies described in the proposals and the lack of sufficiently broad expertise among the Members of the Technical Committee, the involvement of external experts in the scientific and technological fields focus of the proposals was agreed. Expertise in the field and experience in managing research infrastructures or technological facilities were the main criteria for the selection of the external advisors. The absence of conflicts of interest with the proposing institutions was also confirmed.

Guidelines for the external experts were prepared to describe the aim of the ongoing consultation and the subsequent procedure (Annex 5). Emphasis was given to the fact that the proposals' main goal was the implementation of research infrastructures (National Facilities) supporting the access of external users as opposed to setting up a facility to mainly carry out research on its own.

The experts were invited to express their opinion on specific aspects of the facilities as described by the respondents, with a particular focus on the scientific relevance as well as feasibility and functionality of the facilities as proposed (is the choice of equipment reasonable, is the facility functional as a stand-alone entity or does it require other technical support infrastructure, is the

number of staff proposed reasonable in terms of the projected number of users and type of equipment, etc.). To synthesise the experts' opinion, the system provided for the use of four scores, "Low", "Medium", "High", "Very High". Experts were also asked to explain the basis for their assigned scores, using the "Comment" sections included in the form (Annex 6). Each proposal was submitted to three independent experts and each expert was asked to express her/his opinion on different proposals in related scientific fields. (Note: ID 13, ID 21 and ID 43 were reviewed by two experts only since the third expert did not provide the requested feedback despite several reminders. Considering that the two submitted opinions were in agreement, it was decided to take no further action).

The feedback of the external experts was generally positive. They expressed their appreciation for the initiative and they recognised the clear impact the planned investments would be likely to have on the Italian research system.

A few proposals (IDs 21, 48, 53, 62) received a feedback of limited enthusiasm (scores "medium" or "low"). The main criticisms were related to the lack of a clear planning of the activities described, a lack of infrastructural units needed to fulfil the mission as stated, an incorrect estimation of the costs, space and/or personnel required for facility implementation and management, or insufficient information to understand the overall facility mission and offered services.

The complete set of forms submitted by the external experts are available upon request.

2.2.3. Evaluation by the Technical Committee

The advice of the external experts contributed to the evaluation performed by the Technical Committee. The most important criteria considered for defining the technologies to be included in the second level consultation were:

1. whether substantial overlap existed with National and/or European RIs,
2. whether substantial overlap existed with current or planned National public investments in RIs,
3. the magnitude of the proportion of the national scientific community potentially interested in utilising the proposed facilities.

The list of all criteria considered by the Technical Committee for finalising the evaluation of the proposals is available in Annex 7.

Here we report the evaluation and recommendation for each submitted proposal. The complete evaluation is available in Appendix 2 that includes the TC's full evaluation forms for each proposal.

- ***ID 2**. National platform for genomics (NP-GENOMICS)*
  There is a high demand in the Italian community for genomic services and there is no overlap with any large national or ESFRI infrastructure. Moreover, the feedback provided by the external experts is positive.
  Currently there is a lack of national coordination for omics science in Italy, therefore a reference facility would be very useful, also for coordinating national efforts in this field. The governance and the coordination with other Italian facilities offering similar services should be defined in accordance with the interests of the players involved.
  Genomic services should be included among those presented to the national community for the Second Level Consultation.

- ***ID 5**. National platform for vector and cell engineering (VERDI)*
  Considering the importance of these technologies, a cell/genome engineering facility is important for the Italian scientific community. The feedback provided by the external experts is positive and there is no overlap with other national or European facilities.
  These technologies require a lot of cell handling, and the capacity is expected to be significantly lower compared to the genomics unit as it is hard to automate procedures using different cell types with diverse requirements.
  At this stage, the facility should focus on cellular engineering but without the generation of organisms from the cells produced. It is not considered feasible for a single facility to carry out such work on the variety of organisms used in the scientific community. Instead, the individual labs working on the organism have the expertise and can implement this part of the process.
  Since cell engineering services are part of the offer planned by the Automatic Stem Cell and Organoid Facility at HT, some level of integration among the facilities is warmly recommended.
  Vector and cell engineering services should be included among those presented to the national community for the Second Level Consultation.

- ***ID 6**. National platform for integrated single cell multiomics (INSCELL)*
  The proposal received a positive feedback from the external experts.
  Single cell multiomics analysis is complementary to both the genomics as well as the proteomics and metabolomics proposals, these services **should be included among those presented to the national community for the Second Level Consultation**. Both this facility and the more standard nucleic acids-based genomics facility are in implementation at Human Technopole and the TC warmly recommends to integrate the HT existing facilities into the future NFs to serve external users as well.

- ***ID 13**. National platform for animal imaging (ANIMA)*
  The proposed facility partially overlaps with services offered by Italian RIs that are recognised as being of high priority for the National Plan for Research Infrastructures (*Piano Nazionale per le Infrastrutture di Ricerca* – PNIR) and are widely supported by both MUR and the MoH. Considering the importance of avoiding duplication and redundancy among infrastructures supported by public funding, the priority of implementing this facility is low and **the proposal cannot be considered further**.

- ***ID 21**. National platform for molecular & cellular imaging integrated multimodal and multiscale biophysical analysis (NP – IMBI)*
  Even if the proposal is very broad and partially overlaps with the services offered by EuroBioimaging, as highlighted in the concerns expressed by two of the external experts, some of the services described are of clear interest for the community.
  Considering the strong and clear overlap with EuroBioimaging, an RI that has been also recognised as high priority by the PNIR, the development of targeted services should be coordinated with EuroBioimaging and its Italian nodes, as emphasized by one of the external experts.
  Since HT is implementing a Light Imaging Facility, for the sake of efficiency and effectiveness of the investment, the TC recommends creating a single Light Imaging Facility that has enough capacity to serve internal and external users.
  Molecular and cellular imaging services should be included among those presented

to the national community for the Second Level Consultation.

- ***ID 25**. National platform for drug discovery and development (DDP)*
  Some of the services described in this proposal such as imaging, genome engineering and structural biology, overlap with those foreseen in other proposed facilities.
  The most important criticism, highlighted also by the external experts, is that the proposal does not envisage plans for medicinal chemistry services, and this strongly limits the potential impact of the facility on drug discovery.
  Considering that Italy is not part of the European RI EU-OPENSCREEN and that the CNCCS consortium (*Collezione Nazionale di Composti Chimici e Centro Screening*) has been recognised as having only medium priority by the PNIR, there is clearly limited national interest in such services. **The proposal should not be considered further**.

- ***ID 29**. National platform for proteomics & metabolomics (IPROMET - integrated proteomics and metabolomics)*
  The external experts highlighted how critical it would be for the national scientific community to have access to such a facility. Moreover, the HT strategic plan envisages the implementation of a facility focusing on proteomics and metabolomic analysis.
  Proteomics & Metabolomics services are complementary to and should complete the other omics-related services included among those presented to the national community.

- ***ID 33**. National platform for structural biology (SBIP)*
  Despite the very positive feedback of the external experts who highlighted the importance of such a facility for the national and the European scientific community, this proposal overlaps with the services offered by INSTRUCT and several of the technologies described are already available at the ESFRI Italian nodes.
  However, since a gap exists in protein production testing services and in Cryo-EM analysis, these two aspects of the proposal should be considered further.
  The HT CryoEM facility is already planning to offer its services to external users and, for this function, can be supported by the *Convenzione*.
  Regarding the protein production, a facility that focuses on pilot-scale protocol optimisation for the production of specific proteins submitted by external uses is considered very useful.
  Cryo-EM services should be included among those presented to the national community for the Second Level Consultation.

- ***ID 38**. National platform for bioinformatics and biological data (BIOINFO)*
  Even if the external experts confirmed the very good quality of the proposal, considering that bioinformatic analysis is too varied and too specialist to be offered as a service to the entire research community, this facility should not be focused on detailed analysis support but instead should represent the data handling and storage core for the National Facilities, including first-line data analysis (but not in-depth analysis). This DATA HANDLING AND ANALYSIS CORE should collect the data produced by the omics units as well as by the imaging facilities, harmonise them and deliver them to the researchers and the community.
  It should be submitted to the Second Level Consultation
  To avoid duplicating skills that are already rare, the TC recommends connecting the data handling core area to the HT Data Centre, thus increasing the capacity of HT in terms of data storage and data handling and provision to external users. Connections to other

national HPC sites should be developed.

- ***ID 43**. National platform for human imaging (PHI)*
  External experts considered this proposal positively. However, the proposed facility partially overlaps with services offered by Italian RIs (in particular EuroBioimaging) that are recognised as being of high priority by the PNIR and are widely supported by both MUR and the Ministry of Health. Considering the importance of avoiding duplication and redundancy in the infrastructures supported by public funding, the priority of implementing this facility is low and **the proposal should not be considered further**.

- ***ID 48**. Nanomedicine (NANO-2-BED)*
  The external experts identified several weaknesses in the proposal. Among others was the lack of the infrastructure needed for *in vivo* evaluation of the nanomedicines produced that greatly reduces the translational impact of the facility.
  Some of the services described in these proposals such as imaging, proteomics and metabolomics are already part of other NFs that have been defined as core areas.
  Since the remaining services would support the demand of a small community and considerable investments are planned by the Ministries for the implementation of national centres for RNA research (Padua and Siena) that partly overlap, **this proposal should not be considered further.**

- ***ID 49**. Ecotron facility for experimental ecosystem studies (EF4EES)*
  Although related to a priority issue and positively evaluated by the external experts, this proposal seem to be relatively 'tangential' to the coherent domains the identified 'core areas' refer to.
  Moreover, there is a clear overlap with AnaEE ERIC and LifeWatch ERIC. In fact, Italy has several ecotrons and simulation centres for agriculture supported by the Ministries, and other larger facilities to which Italian scientists have access exist in Europe.
  It is also worth noting that there would be no synergy with the main HT focus. **The proposal should not be considered further.**

- ***ID 50**. High-throughput and high-content screening (HTHC_S)*
  As highlighted by the reviewers, the most important criticism in this proposal is that it does not envisage plans for medicinal chemistry services, and this strongly limits the potential impact of the facility on drug discovery.
  Considering that Italy is not part of the European RI EU-OPENSCREEN and that the CNCCS consortium (*Collezione Nazionale di Composti Chimici e Centro Screening*) has been recognized as having only medium priority by the National plan for RIs, there is clearly limited national interest in such services. **The proposal should not be considered further**.

- ***ID 52**. National platform for nanomedicine (PN-NANOMED)*
  The external experts identified several weaknesses in the proposal. Among others, the lack of the infrastructure needed for *in vivo* evaluation of the nanomedicines that would greatly reduce the translational impact of the facility and the breadth of the technologies offered that undermines the feasibility of the proposal.
  Some of the services described in the proposal such as imaging, proteomics and metabolomics are already part of other facilities that have been defined as core areas.
  Since the remaining services would support the demand of a small community and

considerable investments are planned by the Ministries for the implementation of national centres for RNA research (Padua and Siena) that partly overlap, **this proposal should not be considered further.**

- ***ID 53**. Personalised and sustainable nutrition (PERSUSNUT)*
  The external experts highlighted several weaknesses in the proposal from the broad list of technologies offered to the lack of clear link between personalised and sustainable nutrition, providing a negative overall score.
  Important investments in the field of nutrition have been made by the two ministries (MUR, MoH) and are also planned in the PNRR. The request of technologies highlighted by this proposal as wells as by ID55 are mainly covered by the Genomics, Proteomics and Metabolomics services that will be part of the OMICS domain core area that is expected to support the research in this field. **The facility as described should not be considered further.**

- ***ID 55**. Nutrition and health (NUTH-RI)*
  Although the proposal is of high quality and addresses an important field of nutrition as reported by the external experts, important investments in the field of nutrition have been made by the two ministries (MUR, MoH) and are also planned in the PNRR. The request of technologies highlighted by this proposal as well as by ID 53 are mainly covered by the Genomics, Proteomics and Metabolomics services that will be part of the OMICS domain core area that is expected to support the research in this field. **The facility as described should not be considered further.**

- ***ID 57**. Quantum computing for life sciences (QCLS)*
  The main criticism highlighted by the external experts is the fact that quantum computing is still under development and not mature enough to be efficiently used in life sciences (and other disciplines). This approach is still experimental and not ready to be offered as a service. In addition, the proposal offers facilities that can be accessed by Human Technopole for a fee, not the creation of a new facility. Important is also the fact that national investments through the PNNR are already planned in this field. **This proposal should not be considered further.**

- ***ID 62**. National centre for biological resources (CNRB)*
  The external experts agreed on the fact that the proposal lacks important details to allow a correct understanding of the services offered by and the technologies available in this facility. Moreover, this proposal fully overlaps with European and national biobanks. There are huge public investments in biobanks, therefore further investments in this field cannot be considered. **The proposal should not be evaluated further**.

2.3. Summary and results of the First Level Consultation

During the First Level Consultation, carried out between July 23rd 2021 and September 30th 2021, stakeholders representing the main actors of the Italian research system submitted their proposals regarding possible National Facilities to be implemented at Human Technopole. Their contribution allowed the identification of the priorities of the national scientific community in terms of research infrastructures in the field of life sciences.

Eighteen (18) out of the 29 proposals submitted were defined eligible and evaluated by the Technical Committee with the advice of external experts in the fields of focus of the proposals.

Taking into consideration the overlap with national and EU facilities, the public funding already available and/or planned for RIs, and the size of the potential pool of users of proposed National Facilities to be established at HT**, the Technical Committee identified three main core areas with high demand for National Facilities offering access in the respective fields**:

1. the **OMICS domain** - including Genomics, Single Cell Multiomics, Genome engineering, Proteomics, Metabolomics (Nutrition) services described in proposals **ID 2, 5, 6 and 29**

2. the **IMAGING domain** - which will bridge across scales to include Cellular Imaging and Structural Biology, encompassing services described in proposals **ID 21 and 33**

3. the **DATA HANDLING AND ANALYSIS core** - which will support the two domains above as partially described in proposal **ID 38**

2.3.1. OMICS domain

The OMICS domain area includes a wide range of multi-omics technologies applied to different organisms and model systems, comprising:

a. the analysis of **genomes and transcriptomes** with a wide range of methods and applications (DNA, RNA, epigenetics, epitranscriptomics) in every area of the life sciences; among others, cutting-edge genomic technologies for structural and functional characterisation of genomes, the latest sequencing tools and liquid handlers for library preparation, established technologies for low-cost array-based high-throughput genotyping, copy number variation (CNV), and DNA methylation analysis;

b. **single cell** studies with state-of-the-art technologies for scRNAseq and single nucleotide variant detection, fluorescent cell sorters, single molecule fluorescent *in situ* hybridisation instruments, mass cytometry, full-length transcript detection, laser-equipped cell sorter capable of physically separating single cells from different cell populations;

c. quantitative and qualitative identification and analysis of **proteins and metabolites** using state-of-the-art mass spectrometry technologies (LC-MS/MS), possibly supplemented by Nuclear Magnetic Resonance (NMR) technologies if required; studies will cover a wide range of life science disciplines (cell biology, precision medicine, biomarker discovery, human exposure, nutrition science, metabolic profiling of diseases and of drug response, analysis of post-translational modifications at the level of cells, tissues and organisms) will be considered, with applications in diverse fields driven by technology and data;

d. construction of various types of **vectors** (**including viral**) for *in vitro* and *in vivo* gene transfer and cell engineering, including the production of CRISPR/Cas9 libraries for genome-wide functional screening for unbiased gene discovery. The facility may also include the design and production of high-quality pseudo-viral particles for the transfer of nucleic acids.

2.3.2. IMAGING domain

The IMAGING domain aims to implement technologies that are instrumental for research in cellular and molecular imaging as well as structural biology. The domain includes:

a. **advanced optical microscopy** including confocal and super-resolution microscopy (e.g.,

STED or STORM);

b. classical **electron microscopy,** which allows three-dimensional reconstruction (tomography) of observed samples, super-resolution microscopy in combination with 3D electron microscopy and atomic force microscopy, allowing to investigate biological processes at nano and atomic resolution;

c. **cryoelectron microscopy** for structural biology studies, including single particle analysis and *in vitro* and *in situ* tomography, 3D visualisation of macromolecular assemblies, high-throughput crystallisation methods; the possibility of implementing a facility that focuses on pilot-scale protocol optimization for *in vitro* recombinant protein production will be considered.

2.3.3. DATA HANDLING AND ANALYSIS core

The DATA HANDLING AND ANALYSIS core for the National Facilities will be essential to collect the large amount of data produced by the other NFs and to support its first pass analysis and transfer to the researchers for their further use and detailed analysis. Instrumentation with high memory and computational capacity will be integrated, and future software and hardware developments will be considered as they become robust enough to support service activities. Main components: a HPC cluster with High-Memory GPU and CPU nodes; a cloud-oriented data centre for deploying basic and bioinformatics services and applications in isolated and secure environments; multi-tier storage capabilities; cybersecurity solutions at the hardware, procedure and policy levels.

3. Second Level Consultation

The initial phase of consultation allowed the identification of areas with high demand for National Facilities offering access in the respective fields. These facilities should allow Italian researchers to access a broad range of services from omics technologies to imaging and structural analysis.
The first core area was represented by the OMICS DOMAIN, that includes a broad spectrum of technologies, from nucleic acids to proteins and metabolites analysed either from tissues or from single cells. This domain should support researchers working in different areas of life sciences.
The second core area was the IMAGING DOMAIN that includes several imaging technologies at multiple scales, from atoms over molecules to cells, tissues and organs, again applicable to many different biomedical fields.
These domains should produce large quantities of data and need the support of a DATA HANDLING AND ANALYSIS CORE for the National Facilities, that is essential to collect the data generated by the omics units as well as by the imaging facilities, harmonise them, carry out first level analysis and deliver them to researchers for in-depth analysis.

The results of the First Level Consultation were submitted to the Italian scientific community for comments. Researchers were invited to express their opinion on the identified core areas in terms of priority for the national research system and to propose any motivated additions and/or deletions through an online questionnaire drafted by the Technical Committee (Annex 8). A slide deck with detailed information regarding the results of the First Level Consultation was prepared and published (CONVENZIONE_Ministeri-HT-consultazione_secondo_livello_versione-22_05_02.pptx).

To disseminate information about the initiative and how to participate, a communication campaign

was launched through the webpage of Human Technopole https://humantechnopole.it/en/news/convenzione-ministries-human-technopole-second-level-consultation-open/), MUR (https://www.mur.gov.it/it/news/mercoledi-04052022/ricerca-iniziata-consultazione-di-secondo-livello-prevista-da-convenzione) and MoH (https://www.salute.gov.it/portale/news/p3_2_1_1_1.jsp?lingua=italiano&menu=notizie&p=dalministero&id=5882) as well as through social network channels.

3.1. Results of the Second Level Consultation

The Second Level Consultation questionnaire was aimed at collecting the opinion of the national research community on three main aspects: 1. the priority of implementing facilities offering services in the three domains identified by the Technical Committee, 2. the lack of any technology/service considered essential and currently missing at the national level, and not included in the identified domains, 3. the presence in the three domains of technologies/services already available to the Italian research community (i.e. redundant and/or unnecessary). Moreover, to assess the level of participation of the Italian research community, the participants were requested to indicate which type of institute they were affiliated to, their job title and their scientific area of expertise.

Copy of the submitted questionnaires are available in Appendix 3.

3.1.1. Response of the national scientific community

The Second Level Consultation, open to the Italian scientific community for 42 days, from April 19th, 2022, to May 31st, 2022, was characterised by a broad participation, with **1624 questionnaires submitted**.

Most of the participants (83%) were affiliated to academic institutions and they were primarily researchers/scientists or professors (associate or full professors) with main expertise in molecular biology, metabolomics and genomics (Figure 1). The contribution of stakeholders from industry was limited, with only 1% of the participants working in the private sector.

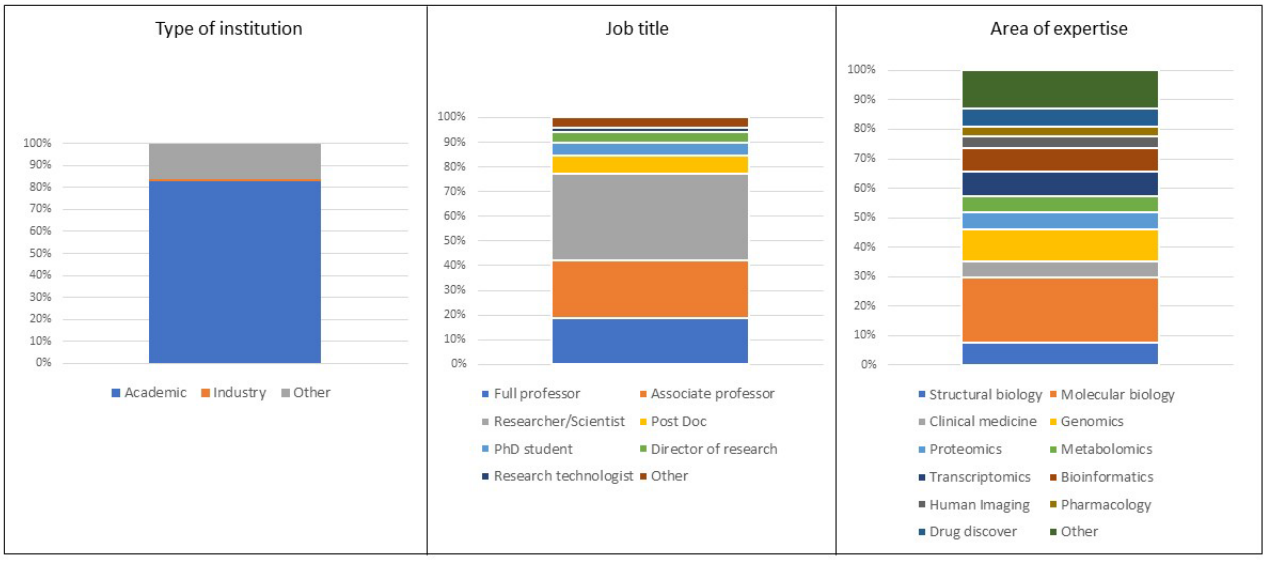

Figure 1: Graphical representation of participants' profiles

3.1.2. Priority of the identified domains for the scientific community

For each domain, Italian researchers were asked to select the level of priority, choosing among *very high, high, medium* and *low,* of realising NFs in these fields at HT. The overall results of the Second Level Consultation confirmed that the access to OMICS, IMAGING and DATA HANLDING AND ANALYSIS technologies/services is considered important by a wide part of the scientific community (Figure 2). In fact, of the 1624 participants, 91%, 87% and 88%, respectively, indicated that the implementation of these three areas has a very high or high priority, confirming the strong demand for these services. In particular, 65% of the participants deems the offer of OMICS services a very high priority, followed by DATA HANDLING AND ANALYSIS and IMAGING with 56% and 53% of the contributors identifying them as very high priority, respectively.

Interestingly, for all the domains, when the implementation of the related technologies was considered a medium or low priority, this was not justified by identifying the presence of unnecessary technologies, thus suggesting other reasons for this opinion.

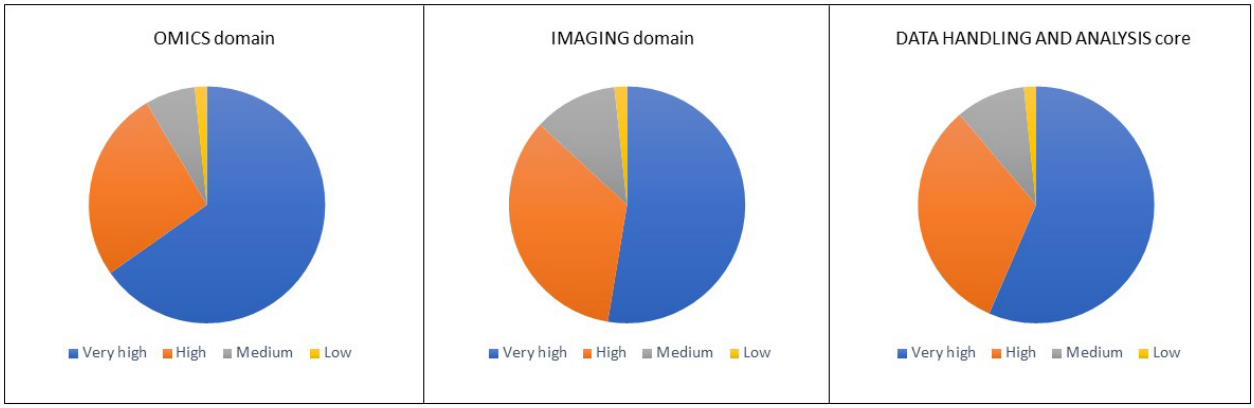

Figure 2: Graphs showing the level of priority (very high, high, medium, low) of implementing the identified domains as expressed by the participants

3.1.3. Missing technologies

The second important goal of the questionnaire was to collect the opinion of Italian researchers on the lack of specific technologies of fundamental importance for the scientific community that were not included in the three domains identified by the analysis of the First Level Consultation results.

More than half of the participants (53%) evaluated the proposed domains as comprehensive of all the technologies and services in demand by the scientific community. Those who considered that the technological areas as described were not complete (47%), were invited to indicate any missing technologies within the mission areas of HT (i.e. Health, Genomics, Data and decision science, Nutrition, Structural Biology, and additional areas of research aimed at prevention and health) by using 5 keywords. 631 participants specified one or more fields that were missing or not clearly described in the domains covered by the consultation. The first general analysis of the opinions provided was performed with the support of a Word Cloud text data visualisation tool. This preliminary analysis clearly highlighted the high demand in the national scientific community for

technological facilities with a focus on genomics and structural biology services, including high-throughput protein production.

From the following qualitative, in-depth analysis of all submitted answers, it was possible to group them in four main classes: 1. Answers that suggested the implementation of technologies already considered for implementation in one of the three domains; 2. Answers that referred to research fields that should be strengthened at national level; 3. Answers that indicated technologies that had already been submitted to the First Level Consultation but that were not included in the Second Level Consultation; 4. Answers that suggested further technologies not proposed by the stakeholders in the First Level Consultation.

In summary:

1. Several technologies requested by the participants are planned as part of the areas for implementation. In particular, the lack of facilities offering genomics services such as short- & long-read sequencing, meta- & epi-genomic and transcriptomic analysis, microRNA, miRNA profiling, genome mapping as well as genome editing was highlighted. These services, applied to cells, plants and animals, should be offered by the facilities part of the OMICS domain, that will be also equipped with instruments for single cell analysis. This group of facilities will also offer the requested services in the field of library preparation and genome editing. Not only genomics analysis, but also technologies for proteomics, metabolomics and lipidomics analysis will form part of the OMICS facilities. Spatial proteomics and single cell analysis will also be explored.

   The second technological field characterised by high demand is the one covering services for structural biology analysis such as CryoEM and protein production. These services will be offered by the structural biology facility included in the IMAGING domain that will mainly focus on CryoEM analysis and protein production. Importantly, as discussed during the analysis of the First Level Consultation contributions, protein production will encompass support in the optimisation of protein production protocols, but not large-scale production.

2. In total, the facilities proposed for implementation will support Italian researchers performing studies in a wide range of scientific fields such as biomarker discovery, personalised medicine, nutrition and prevention, food security, etc. It is important to note, in fact, that several participants did not specify lacking technologies, rather they suggested specific research areas that should be strengthened at national level. Examples are the request of support for studies in the field of orphan diseases, extracellular vesicles, metabolic diseases, neuroscience, immunology, among others. This information may be useful to the Ministries that support research in Italy. The implemented facilities and the services offered will also positively impact national research in the fields above, being widely applicable to different research areas.

3. A small number of submitted opinions highlighted the lack of technologies, such as those covering the different stages of drug discovery and development, animal and human imaging and digital pathology, which were already reported during the First Level Consultation, but that were not included in the Second Level Consultation for different reasons, such as consistent ongoing public investment and/or planned investments in the field through other funding programmes.

   Several participants highlighted the need for further support in the data and decision science field, requesting computational modelling services, AI approaches, a national bioinformatic

service provider and data repository. During the First Level Consultation, similar suggestions were submitted. Considering the national involvement in European initiatives such as ELIXIR, that among other things, is aimed at creating a central data repository, as well as the fact that bioinformatic analysis must be performed by researchers with a deep knowledge and understanding of the scientific background that brought to the creation of specific data, it was agreed that HT will focus on the implementation of a facility mainly aimed at collecting the data produced by the omics units as well as by the imaging facilities, harmonising them and delivering them, after a first-pass analysis, to the researchers and the community for more in-depth study, that requires specialist knowledge and expertise in the field of study.

4. The last group of submitted answers included technologies that were not specifically part of the three domains and that will be considered for future developments. Among those, 3D models, stem cell and organoids will be considered as future implementation of HT facilities in terms of services for the analysis (OMICS and IMAGING) of such experimental models.

3.1.4. Unnecessary technologies

As provided for by the *Convenzione*, the participants were also requested to indicate any technologies that they felt were redundant or unnecessary among those included in the three domains identified by the Technical Committee, and to explain the reasons for their opinion. Except for very few contributors who highlighted the current availability of several highly skilled omics facilities as well as low-cost genomic analysis services, almost all participants (97-98%) identified the technologies included as necessary services to be offered to the Italian scientific community. This shared opinion clearly demonstrated that making these technologies and services available to the Italian community will positively impact the national research system.

Annex 1 Description of technologies that should be considered in the implementation of the National Facilities

Please note that this list is indicative and by no means exhaustive. Decisions should be taken on the basis of real future demand.

A) OMICS

The **OMICS** National Facility should include the following Infrastructural Units:

1) Genomics
2) Single cell technologies
3) Proteomics and metabolomics
4) Genome engineering

1) Genomics

Genomics should address the following points:

i. Provide state-of-the-art genomic technologies to the research community. Genomics will implement state-of-the-art DNA and RNA sequencing technologies for the structural and functional characterization of genomes, transcriptomes, epigenomes, etc.
ii. Structured training in all genomic technologies, disseminating existing knowledge and know-how through the creation of appropriate training programs.
iii. Provide scientific advice to research groups or institutions on the implementation of local infrastructural investments in the area of Genomics.

Nucleic acid sequencing technologies will include both short read sequencing (SRS), often referred to as second generation sequencing and long read sequencing (LRS or third generation sequencing) technologies. The latter method offers single molecule resolution in real time with read lengths up to hundreds of kilobases in a single run, thus permitting the resolution of entire genomes, overcoming some of the problems encountered with SRS. LRS technologies are currently developing rapidly and can be used for the characterization of DNA and RNA modifications.

2) Single cell technologies

Single-Cell (SC) technologies offer unprecedented opportunities to unveil the molecular bases underlying complex physiological processes and disease pathogenesis through a detailed mapping of cell types/states, differentiation and evolution trajectories, cell-to-cell interactions, as well as providing a novel spatial context to the analyses but are expensive and technically demanding, making them, in the view of the TC, a good choice for integration into the National Facilities.

Single cell technologies can be used to address the following research problems, among others:

i. Spatial omics, to decipher the degree of molecular heterogeneity within healthy and pathological tissues, as is obvious from their application to date in cancer biology, where it reveals spatially resolved intra-tumoral molecular diversity. Similarly, this approach may unravel the complexity of cell-cell interaction in other physiological and pathological processes.
ii. Spatial Transcriptomics (ST) can, for example, be employed with tissue sections to study the consequences of interactions between cell types and can be used with other

technologies such as flow cytometric cell fractionation to better characterize tissue heterogeneity.

iii. Studies of the immune response are another example of the insight gained when carrying out analysis at the single cell level.

3) Proteomics and metabolomics

This IU should be dedicated to the proteome and metabolome characterization, up to a spatial and single cell resolution, in a technology- and data-driven manner.

The following main research subjects should be addressed:

i. Metabolomics: the added value should be the integration of different aspects of the metabolomics realm. The complexity of the whole metabolome is exemplified by metabolomics subfields such as lipidomics, glycomics and others. The metabolic processes involved in metabolite production and degradation are dynamic and their functional operation can be investigated by studying metabolic fluxes (Metabolomic Flux Analysis).

ii. Proteomics: this section should be able to carry out global quantitative proteomics and post-translational modification (PTM) analysis to define the dynamic description of the proteome in a specific cellular context. Proteomics can be applied to cells, organoids, tissues or whole organisms. The Proteomics component should also develop specific methods for the analysis of post-translational modifications (PTMs) and protein-protein interaction (Interactomics) which are of central importance to depict the molecular machines governing pathophysiological processes. Access to cross-linking MS (CL-MS) pipelines, which have recently been developed, is desirable. CL-MS will be able to provide expertise and support not only to structural biologists but also to others focusing on macromolecular complexes.

iii. Data analysis: the component on data analysis should be integrated into the data handling and analysis core.

4) Genome engineering

Genome Engineering should offer leading-edge technologies for targeted genetic and epigenetic genome modification. The most advanced methods for efficient and rapid epi/genome editing in a variety of selected cell types should be implemented. Given the growing diversity of molecular tools for genome engineering and their related intrinsic caveats, this facility could accelerate the availability of high quality genetically modified cells produced with CRISPR/Cas9 or other state-of-the-art procedures within the Italian research community.

There are a variety of viral or CRISPR-based technologies for genome engineering and the facility should establish expertise in their use and application in order to support the needs of the community.

B) IMAGING

The National Facility for **IMAGING** should be composed of distinct but highly integrated units, equipped with state-of-the-art technologies combining multimodal analysis capabilities, and thus offering excellent technological support for biomedical research.

The potential Infrastructural Units are:

1) Molecular, cellular, and tissue imaging

This is an area composed of an integrated set of Light and Electron Microscopy technologies that enables multiscale investigation of biological samples from the tissue, through the cell to molecular and atomic resolution. For cell and tissue imaging there are a wide variety of possible

imaging modalities that are adapted for use with both fixed and living specimens. There are an enormous variety of existing technology and currently many new developments in this area. The facility will continue to grow and adapt on the basis of the needs of the user community, as expressed via successful project proposals.

2) Structural biology
This should be equipped with state-of-art instruments to cover the whole workflow from cloning to protein production, purification and characterization. A facility that focuses on pilot-scale protocol optimisation for the production of specific proteins and protein complexes submitted by external users is considered very useful. It should offer services for the expression in different pro- and eukaryotic systems.

3) Cryo-electron microscopy techniques
This should support selected requests for access in fields related to structural biology as well as, at lower resolution, to molecular and cellular biology. It should provide expertise in Cryo-electron Tomography (CryoET), which allows cellular structures to be visualized within their natural physiological environment at a low-medium resolution. The CryoET technology is one of the technologies that helps bridge between *in vivo* light microscopy and *in vitro* atomic resolution structural methods.

4) Structural mass spectrometry (MS)
As described above in the Proteomics section, this will offer equipment and expertise to support not only structural biologists or others focusing on macromolecular complexes. Access to cross-linking MS (CL-MS) pipelines, which have recently been developed is desirable.

C) DATA HANDLING AND ANALYSIS

The **DATA HANDLING AND ANALYSIS** National Facility will be essential to collect the large amount of data produced by the other NFs and to support its first pass analysis and transfer to the users/researchers for their further detailed analyses. Instrumentation with high memory and computational capacity will be integrated, and future software and hardware developments will be considered as they become robust enough to support service activities. Technical specialists in data storage, data compression and analysis, including tool development, will be essential.

The Infrastructural Units should include:
1) Data pipeline design
This section will collaborate with the other National Facilities to design for each technological service offered specific data pipelines that meet the requirements of the subsequent bioinformatic analysis.

2) First line data analysis
This unit should analyze the data collected from the OMICS and IMAGING National Facilities and ensure that data reach quality standards for further analysis.

3) Data storage and data sharing with the project owner
Data should be stored for a defined period and shared with the project owner for detailed, project-specific analysis by bioinformaticians within the research group.

The main components should be:
i. an HPC cluster with High-Memory GPU and CPU nodes;

ii. a cloud-oriented data centre for deploying basic and bioinformatics services and applications in isolated and secure environments;
iii. multi-tier storage capabilities;
iv. cybersecurity solutions at the hardware, procedural and policy levels;
v. occasional development and provision of data resources for the community.

Annex 2 List of stakeholders invited to contribute to the First Level Consultation

Istituti di Ricovero e Cura a Carattere Scientifico (IRCCS)

- Bambino Gesù Ospedale Pediatrico
- Casa di Cura Multimedica
- Casa di cura San Raffaele Pisana
- Centro Cardiologico S.P.A. Fondazione Monzino
- Centro di Riferimento Oncologico
- Centro di riferimento oncologico della Basilicata
- Centro Neurolesi Bonino Pulejo
- Centro San Giovanni di Dio Fatebenefratelli
- Ente Ospedaliero specializzato in gastroenterologia Saverio De Bellis
- Fondazione Ca'Granda – Ospedale Maggiore Policlinico
- Fondazione del Piemonte per l'oncologia (Candiolo)
- Fondazione Don Carlo Gnocchi
- Fondazione G.B. Bietti per lo studio e la ricerca in oftalmologia
- Fondazione Istituto Nazionale per lo studio e la cura dei tumori
- Fondazione Istituto Neurologico Carlo Besta
- Fondazione Istituto Neurologico Casimiro Mondino
- Fondazione Policlinico San Matteo
- Fondazione Policlinico Universitario Agostino Gemelli
- Fondazione Salvatore Maugeri
- Fondazione Santa Lucia
- Fondazione SDN per la ricerca e l'alta formazione in diagnostica nucleare
- Fondazione Stella Maris
- IRCCS Policlinico di Sant'Orsola di Bologna
- ISMETT Istituto Mediterraneo per I Trapianti
- Istituti fisioterapici ospitalieri - Istituto Dermatologico Santa Maria e San Gallicano
- Istituti fisioterapici ospitalieri - Istituto Regina Elena
- Istituto Auxologico Italiano
- Istituto Clinico Humanitas
- Istituto delle Scienze Neurologiche
- Istituto Dermopatico dell'Immacolata (IDI)
- Istituto Eugenio Medea
- Istituto Europeo di Oncologia
- Istituto Farmacologico Mario Negri
- Istituto Giannina Gaslini
- Istituto in tecnologie avanzate e modelli assistenziali in oncologia
- Istituto Nazionale di Riposo e Cura per Anziani
- Istituto nazionale tumori Fondazione Giovanni Pascale
- Istituto Neurologico Mediterraneo Neuromed
- Istituto Oncologico Veneto
- Istituto Ortopedico Galeazzi
- Istituto Ortopedico Rizzoli
- Istituto per le Malattie Infettive Lazzaro Spallanzani

- Istituto scientifico romagnolo per lo studio e la cura dei tumori (IRST)
- Istituto tumori Giovanni Paolo II
- Oasi di Maria Santissima
- Ospedale Casa Sollievo della Sofferenza
- Ospedale infantile Burlo Garofolo
- Ospedale policlinico San Martino
- Ospedale Sacro Cuore don Calabria
- Ospedale San Camillo
- Ospedale San Raffaele
- Policlinico San Donato

Universities

- University of Bari
- University of Basilicata
- University of Bergamo
- University of Bologna
- University of Bolzano
- University of Brescia
- University of Cagliari
- University of Camerino
- University of Campania
- University of Cassino
- University of Catania
- University of Catanzaro
- University of Chieti e Pescara
- University of Ferrara
- University of Firenze
- University of Foggia
- University of Genova
- Humanitas University
- University of Insubria
- University of L'Aquila
- University of Macerata
- University of Marche
- University of Messina
- University of Milano
- University of Milano Bicocca
- University of Modena e Reggio Emilia
- University of Molise
- University of Napoli Federico II
- University of Napoli Parthenope
- University of Padova
- University of Palermo
- University of Parma
- University of Pavia
- University of Perugia
- University of Piemonte orientale
- University of Pisa
- Politecnico Bari

- Politecnico Milano
- Politecnico Torino
- University of Reggio Calabria
- University of Roma La Sapienza
- University of Roma Tor Vergata
- University of Roma Tre
- University of Salento
- University of Salerno
- University of Sannio
- University of Sassari
- University of Siena
- University of Teramo
- University of Torino
- University of Trento
- University of Trieste
- University of Tuscia
- University of Udine
- Università Campus Biomedico
- Università Cattolica Sacro Cuore
- Università Vita-Salute San Raffaele
- University of Verona
- Scuola Internazionale superiore di studi avanzati di Trieste
- Scuola Normale Superiore di Pisa
- Gran Sasso Science Institute
- Scuola Superiore Sant'Anna Pisa

Public Research Institutions

- Agenzia Spaziale Italiana (ASI)
- Consiglio Nazionale delle Ricerche (CNR)
- Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria (CREA)
- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA)
- Istituto Superiore per la protezione e la Ricerca Ambientale (ISPRA)
- Istituto Nazionale di Fisica Nucleare (INFN)
- Istituto Superiore Sanità (ISS)
- Stazione Zoologica Anton Dohrn

Research Institutes

- Biogem
- CEINGE - Biotecnologie avanzate
- Fondazione EBRI - European Brain Research Institute Rita Levi-Montalcini
- Fondazione Edmund Mach
- Fondazione RiMed
- Italian Institute for Genomic Medicine (IIGM)
- Istituto Italiano di Tecnologia (IIT)
- Fondazione Bruno Kessler
- Istituto Nazionale Genetica Molecolare (INGM)
- Area Science Park

Third sector

- Fondazione Telethon
- Fondazione AIRC per la ricerca sul cancro
- Fondazione Piemontese per la Ricerca sul Cancro
- Fondazione Grigioni per il morbo di Parkinson
- Fondazione Italiana Sclerosi Multipla
- Fondazione Umberto Veronesi
- Fondazione Banca degli Occhi del Veneto
- Fondazione Italiana di Ricerca per la SLA
- Fondazione CNAO
- Fondazione PTV Policlinico Tor Vergata
- Fondazione Istituto Firc di Oncologia Molecolare (IFOM)
- Fondazione per il tuo cuore onlus - Heart Care Foundation
- Fondazione Regionale per la Ricerca Biomedica (FRRB)
- Fondazione Cariplo
- Fondazione Compagnia di San Paolo
- ACRI
- Assifero (associazione fondazioni ed enti filantropici)

Industry associations

- Assobiotec
- Assolombarda
- Confindustria
- Confindustria Dispositivi Medici
- Egualia
- Farmindustria

Regions

- Conferenza delle Regioni

ESFRI Italian Nodes and European Research Centres

- BBMRI.it Biobanking and BioMolecular Resources Research Infrastructure of Italy
- ELIXIR - Infrastruttura Italiana di Bioinformatica
- ECRIN - Italian Clinical Research Infrastructure Network ITACRIN
- EuroBioImaging - Multi Modal Molecular Imaging Italian Node
- European Advanced Translational Research Infrastructure in medicine
- INSTRUCT - Integrated Structural Biology CERM
- E-BRAINS
- EIRENE RI - Research Infrastructure for EnvIRonmental Exposure assessmeNt in Europe
- ISBE - SYSBIO Centre for System Biology
- Federazione Italiana Scienze della Vita (FISV)
- European Laboratory for Non-Lineary Spectroscopy (LENS)

Annex 3 First Level Consultation questionnaire

HUMAN TECHNOPOLE

CONSULTATION OF INSTITUTIONAL STAKEHOLDERS ON THE REALIZATION OF NATIONAL FACILITIES OPEN TO THE SCIENTIFIC COMMUNITY *AT HUMAN TECHNOPOLE*

The Convention signed on December 30, 2020 between the Ministries of Economy and Finance, of Health and of University and Research and the *Human Technopole Foundation* governs the realization at *Human Technopole* of National Facilities (NFs), which must meet the definition of research infrastructure adopted by the European Strategic Forum for Research Infrastructures (ESFRI)[1], i.e., facilities, resources and related services used by the scientific community to conduct high-quality research in their respective fields, independent of institutional or national affiliation.

In compliance with the provisions of Law 160 of 2019 (art. 1, paragraphs 275, 276 and 277)[2], the Convention also provides that such NFs be identified following a public consultation in two phases: the first engaging stakeholders representing Universities, IRCCSs, Public Research Institutions, Industry, Regions, social partners, and Third Sector entities that conduct or fund research in the life sciences, the second addressed to the entire scientific community.

The questionnaire that follows, aimed at fulfilling the first phase of consultation, was prepared by the Technical Committee (TC) provided for in the Convention to collect proposals, adequately motivated, regarding possible NFs to be implemented at *Human Technopole* (HT), and is inspired by the form that ESFRI[3] uses to collect proposals for the construction of research infrastructures to be included in the European roadmap.

Through the questionnaire, the TC aims at identifying the national life science community's perceived priorities with regard to research infrastructures. **It is not, therefore, at this early stage, a collection of the desires of individual researchers or small groups, but rather aimed at collecting aggregate indications that reflect the common vision of a large part of the community**.

[1] From ESFRI Roadmap 2018 *"RIs are facilities, resources or services of a unique nature, identified by European research communities to conduct and to support top-level research activities in their domains. They include major scientific equipment – or sets of instruments; knowledge-based resources like collections, archives and scientific data; e-Infrastructures, such as data and computing systems and communication networks; and any other tools that are essential to achieve excellence in research and innovation".*
[2] https://www.gazzettaufficiale.it/eli/id/2019/12/30/19G00165/sg
[3] https://www.esfri.eu/esfri-roadmap-2021

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HUMAN TECHNOPOLE

1. **Name of the proposed NF** (full name and acronym)*

2. **Proposing Institution/Consortium***

3. **Contact email***
   The data controller of the personal data consisting of the identity and contact details of the proposing Institution/Consortium's contact person is Fondazione Human Technopole, Viale Rita Levi - Montalcini n. 1, 20157, Milan, tel. 02-30247001, e-mail: gdpr@fht.org (whose Data Protection Officer may be contacted at the e-mail address: dpo@fht.org).
   Said data will be processed for subsequent communications aimed at achieving the objectives of the consultation and for an adequate time to said purpose. The legal basis for the processing is (i) the performance of the relationship established with the proposing Institution/Consortium through participation in the consultation and (ii) the performance of the tasks that the above-mentioned legislation has entrusted to the Data Controller.
   The provision of said data is optional and failure to provide them shall not cause any disadvantage. If said data are provided, the proposing Institution/Consortium will make this information available to the interested data subject.
   In the specific foreseen cases, the data subject may request to the Data Controller access to, rectification, cancellation or portability of their data; they may also object to or request limitation of the processing or file a complaint with the Supervisory Authority (Garante per la protezione dei dati personali).

4. **Considering that National Facilities (NFs) are classify as 'research infrastructures' (RI) according to the ESFRI definition, i.e. "facilities, resources and related services used by the scientific community to conduct high quality research in their respective fields, independent of institutional or national affiliation", what is the scientific and technological field that the proposed NF should cover?***
   a. Health
   b. Genomics
   c. Data and decision sciences
   d. Nutrition
   e. Structural and cellular biology
   f. Additional areas of research aimed at prevention and health

5. **Is the scientific and technological field covered by the proposed NF among those already covered by existing European or national RIs?***
   By way of example and for reference, the following list is provided of RIs in fields related to HT's research areas, as defined by law – health, genomics, data and decision sciences, additional areas of research aimed at prevention and health:
   European RIs (ESFRI roadmap)
   – *AnaEE - Infrastructure for Analysis and Experimentation on Ecosystems*
   – *BBMRI ERIC - Biobanking and BioMolecular Resources Research Infrastructure*
   – *EATRIS ERIC -European Advanced Translational Research Infrastructure in Medicine*
   – *EBRAINS - European Brain ReseArch INfrastructureS*
   – *ECRIN ERIC - European Clinical Research Infrastructure Network*
   – *EIRENE RI - Research Infrastructure for EnvIRonmental Exposure assessmeNt in Europe*
   – *ELIXIR - A distributed infrastructure for life-science information*
   – *EMBRC ERIC - European Marine Biological Resource Centre*
   – *EMPHASIS - European Infrastructure for Multi-scale Plant Phenomics and Simulation*
   – *ERINHA - European Research Infrastructure on Highly Pathogenic Agents*
   – *EU-IBISBA European Industrial Biotechnology Innovation and Synthetic Biology Accelerator*
   – *EU-OPENSCREEN - European Infrastructure of Open Screening Platforms for Chemical Biology*
   – *Euro-BioImaging - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences*

– *INFRAFRONTIER - European Research Infrastructure for the generation, phenotyping, archiving and distribution of mouse disease models*
– *INSTRUCT ERIC - Integrated Structural Biology Infrastructure*
– *ISBE - Infrastructure for System Biology Europe*
– *METROFOOD-RI - Infrastructure for Promoting Metrology in Food and Nutrition*
– *MIRRI - Microbial Resource Research Infrastructure*
National RIs (PNIR)
– *2HE (PON) (Univ. del Salento) Human and Environmental Health Research Center*
– *AQUARIUM (Univ. Politecnica delle Marche) Infrastruttura Acquari Marini DiSVA-UNIVPM*
– *Bio-Memory (CNR)*
– *BRIEF (Scoular superiore S. Anna PI) Biorobotics Research and Innovation Engineering Facilities*
– *CeTrA (Venezia - Cà Foscari) Centre for Trace Analysis*
– *CNCCS (CNR) Collezione Nazionale dei Composti Chimici e Centro Screening*
– *D4Science (CNR) D4Science - Innovative Data Infrastructure promoting Open Science*
– *EPTRI (CNR) Paediatric Translational Research Infrastucture*
– *FNH-RI-IT (CNR) Food Nutrition and Health – Italian Research Infrastructure*
– *Health Demographic Change and Wellbeing (Univ. di Teramo)*
– *MIRACLE (Univ. Politecnica delle Marche) Piattaforma MIRACLE per le Tecnologie per gli Ambienti di Vita*
– *TECHEA (ENEA) Technologies for Health "*
– *TOP-IMPLART (ENEA) Terapia Oncologica con Protoni-Intensity Modulated Proton Linear Accelerator for Radiotherapy*

a. Yes
b. No

6. **If so, please provide a brief rationale to support the proposal to implement, at HT, a NF in an area already supported**
[max 1000 characters]

7. **Provide a brief description of the Mission of the proposed NF***
[max 2000 characters]

8. **Provide a description of the facility, its functional subdivisions (Infrastructural Units, IU), including the technologies and personnel required***
[max 4000 characters, if the number of characters is not sufficient for a complete answer, please use the space available at the following number 9]

9. **Additional space for a more comprehensive answer to question 8**
[max 3000 characters]

10. **Provide an approximate cost estimate for implementing the proposed NF***
    a. Up to 10 million euros
    b. Up to 20 million euros

11. **Briefly illustrate the elements that led to the estimate provided in response to the previous question***
[max 1000 characters]

12. **Provide an estimate of the operating cost of the proposed NF, including the costs required for assistance/training of external researchers who will attend the NF and for their hospitality ***
    a. Up to 5 million euros/year
    b. Up to 10 million euros/year

13. **Briefly illustrate the elements that led to the estimate provided in response to the previous question***
[max 1000 characters]

14. **If possible, provide an estimate of the timeframe for implementation of the proposed NF**
    a. Less than 1 year
    b. Less than 2 years
    c. Less than 3 years

15. **Briefly illustrate the elements that led to the estimate provided in response to the previous question**
[max 1000 characters]

16. **Provide, if possible, an estimate of the space needed for the proposed NF**
[max 1000 characters]

17. **Envisage, if possible, the time of obsolescence of the scientific and technological field of the proposed NF**
    a. Less than 5 years
    b. Less than 10 years
    c. More than 10 years

18. **Briefly illustrate the elements that led to the estimate provided in response to the previous question**
[max 1000 characters]

19. **Indicate the main access mode to the NF, infrastructural units and services provided***
    a. "simple" access to the facility, the infrastructure unit or the individual instrument
    b. access to the facility services: instrumentation, technologies and expertise
    c. access to services including training

20. **Provide an estimate of the number of researchers who, each year, might apply for access to the proposed NF***
    a. Few units
    b. Few dozens
    c. Few hundreds
    d. Few thousands

21. **Briefly illustrate the elements that led to the estimate provided in response to the previous question** [max 1000 characters]

22. **Provide an estimate of the impact of the facility on the Italian research system***
[max 3000 characters]

23. **Describe the possible interaction with other research infrastructures, including in different thematic areas***
[max 1000 characters]

Annex 4 List of stakeholders informed of the ongoing First Level Consultation

IRCCS networks

- Alleanza Contro il Cancro (ACC)
- Rete delle Neuroscienze e della Riabilitazione (RIN)
- Rete Cardiologica - Associazione per lo Studio delle Malattie Cardiovascolari
- Rete Italiana salute Dell'Età evolutivA (IDEA)
- Associazione Rete Aging
- Rete Apparato Muscolo Scheletrico (RAMS)

Universities

- Conferenza dei Rettori delle Università Italiane (CRUI)

Public research institutions

- Consulta dei Presidenti degli Enti Pubblici di Ricerca
- CNR - Dipartimento Scienze bio-agroalimentari
- CNR - Dipartimento Scienze biomediche
- CNR - Dipartimento Scienze chimiche e tecnologie dei materiali
- CNR - Dipartimento Scienze fisiche e tecnologie della materia

Social Partners

- Confederazione Italiana Sindacati Lavoratori (CISL) Scuola
- Federazione Lavoratori della Conoscenza (FLC CGIL)
- Unione Italiana del Lavoro (UIL) Scuola RUA
- Unione Sindacale di Base (USB)

Professional associations

- Federazione Nazionale degli Ordini dei Fisici e dei Chimici
- Federazione nazionale Ordini dei Tecnici sanitari radiologia medica e delle professioni sanitarie tecniche, della riabilitazione e della prevenzione
- Federazione Nazionale degli Ordini dei Medici Chirurghi e degli Odontoiatri (FNOMCeO)
- Federazione Nazionale Ordini Professioni Infermieristiche (FNOPI)
- Ordine Nazionale dei Biologi

Scientific societies

- Società Italiana Brevetti (SIB)
- Società Italiana di Biofisica e Biologia Molecolare (SIBBM)

Annex 5 First Level Consultation evaluation guidelines for external experts

HUMAN TECHNOPOLE

Consultation of institutional stakeholders on the realisation of national facilities open to the scientific community *at Human Technopole*

EVALUATION GUIDELINES
For external reviewers

BACKGROUND AND CONTEXT

Human Technopole (HT) is a new life science research institute in Milan, Italy. It was established by National Law in 2016 and is supported by core funding from the Italian Government in the amount of ca. 130 million euros per year. Human Technopole aims to become a centre of excellence and an internationally competitive research institute. Envisioned as a large-scale national research infrastructure, once fully developed it will employ around 1,000 scientists and a total of roughly 1300 staff, positioning itself as one of the largest institutes for life science research in Europe.

Human Technopole's overarching mission is to contribute to human health and well-being by carrying out frontier research in the biomedical sciences, with a particular focus on biological problems relevant to human health, ultimately aimed at developing novel approaches for personalised and preventive medicine. HT's research takes a comprehensive and interdisciplinary approach to the study of human biology – with scientists in diverse fields, including biology, bioinformatics, chemistry, engineering, physics, mathematics, health science and computational and data science working together on research topics of biomedical relevance. By combining the most advanced experimental and computational technologies – including, prominently, high-throughput -omics and advanced imaging methods – HT's science investigates the basic mechanisms regulating biological systems across all scales of organisation – from single molecules and complexes through to whole organisms, communities and populations. In this initial phase, HT's research activities, which span a broad range of topics, are mainly focused around the areas of genomics, neuroscience, computational biology, integrative structural biology and health data science.

Human Technopole and its three funding Ministries (Economy and Finance, Health and Universities and Research) recently signed an agreement (Convenzione - ITA only) that governs the realization at *Human Technopole* of National Facilities (NFs), which must meet the definition of research infrastructure adopted by the European Strategic Forum for Research Infrastructures (ESFRI)[1], i.e., facilities, resources and related services used by the scientific community to conduct high-quality research in their respective fields,

[1] From ESFRI Roadmap 2018 *"RIs are facilities, resources or services of a unique nature, identified by European research communities to conduct and to support top-level research activities in their domains. They include major scientific equipment – or sets of instruments; knowledge-based resources like collections, archives and scientific data; e-Infrastructures, such as data and computing systems and communication networks; and any other tools that are essential to achieve excellence in research and innovation".*

1

independent of institutional or national affiliation.

The Convention provides that these NFs will be identified following a public consultation in two phases: the first engaging stakeholders representing Universities, research hospitals, Public Research Institutions, Industry, Regions, social partners, and Third Sector (Charitable) entities that conduct or fund research in the life sciences, the second phase will be a summary of the first and will be addressed to the entire scientific community for comments.

To fulfil the first phase of consultation, a questionnaire (*Annex A*) was prepared by the Technical Committee (TC) provided for by the *Convenzione* and submitted to the institutional stakeholders to collect proposals for NFs that might be implemented at *Human Technopole* (HT). Each proposal should explain why the facility is required, who will use it and what it should consist of in terms of both equipment and technical expertise.

Through the questionnaire, the TC aimed at identifying the national life science community's perceived priorities with regard to research infrastructures that are related to the following scientific fields

- Health
- Genomics
- Data and decision science
- Nutrition
- Structural and cellular biology
- Additional areas of research aimed at prevention and health

It was not, therefore, at this early stage, a collection of the desires of individual researchers or small groups, but rather aimed at collecting aggregate indications that reflect the common vision of a large part of the Italian scientific community.

A total of 60 questionnaires were submitted, 48 derived from initiatives supported by several institutions and 12 from single institutions. Overall, the stakeholders invited to participate in the consultation proposed 29 different National Facilities in various fields including imaging, omics technologies, health and drug discovery, among others.

EVALUATION PROCEDURE

The questionnaires received will be evaluated with the aim to select and prioritize those proposals that will be included in the list of technological facilities in high demand by the national scientific community that will be published during the second phase consultation.

A first eligibility check has been performed by the Technical Committee and a list of proposals of interest has been defined and moved forward in the evaluation process.

The evaluation process is composed by two parts. One, carried out by the Technical Committee and aimed at assessing the overlap with national infrastructures offering similar services, the alignment with the "Convenzione", among others.

The second involves independent reviewers selected among the international experts in the scientific fields focus of the proposals who are asked to evaluate the scientific relevance as well as feasibility and functionality of the facilities as proposed (is the choice of equipment reasonable, is the facility functional as a stand-alone entity or does it require other technical support infrastructure, is the number of staff proposed reasonable in terms of the projected number of users and type of equipment, etc.). Each proposal will be reviewed by three independent experts and each expert will be asked to evaluate different proposals in related scientific fields.

Reviewers are asked to evaluate the quality of proposals whose main goal is the implementation of research infrastructures supporting the access of external users as opposed to setting up a facility to mainly carry out research on its own. We ask reviewers to explain the basis for their assigned scores, using the "Comment" sections included in the evaluation form.

The results of the two evaluations will then contribute to the final score attributed to each proposal, that will be used by the Technical Committee for the finalization of the list of facilities of national interest that the Committee will submit to the Italian scientific community for comment during the second phase consultation.

The evaluation system provides for the use of a score composed of four grades, "Low", "Medium", "High", "Very High". For each proposal, the criteria reported below will be evaluated and an overall scoring will be given.
It has been estimated that the evaluation of each proposal will require a maximum of 1 day. A modest compensation will be paid for each evaluated proposal.

Each reviewer will be provided with:

- the current guidelines for evaluation
- the full text of the proposals to be evaluated
- the evaluation form
- Conflict of Interest and Confidentiality form

and he/she will be requested to submit his/her feedback within 21 days after the receipt of the proposals by sending the completed evaluation form via email to infrastructure.consultation@fht.org.

For any questions, please contact Alessandra Silvestri at infrastructure.consultation@fht.org.

Annex 6 First Level Consultation proposal evaluation form for external experts

HUMAN TECHNOPOLE

Consultation of institutional stakeholders on the realisation of national facilities open to the scientific community *at Human Technopole*

EVALUATION FORM (External reviewers)

REVIEWER (Surname, Name):
PROPOSAL NUMBER:

All fields are mandatory, including "Comments". Please, for each criterion, use the "Comments" session to explain the elements that led to the assigned score.

a. **Scientific relevance for and impact on the national and international research community**
   - ☐Low
   - ☐Medium
   - ☐High
   - ☐Very high

   Comments: *[Min 200, max 1000 characters]*

b. **Overlap, in terms of scientific and technological field and/or mission, with existing European facilities (Ref Q5 and Q6 + personal evaluation)**
   - ☐Low = overlap with existing facility open and easily accessible by the scientific community
   - ☐Medium = overlap with existing facility but to which limited access is available (platform open to external users but with only limited open calls for access)
   - ☐High = overlap with existing facility that is either not open to external users or open to external users but without available open calls for access
   - ☐Very High = no overlap

   Comments: *[Min 200, max 1000 characters]*

c. **Feasibility of the technological platform as described in the proposal**

   i. **The proposal describes state-of-the art technologies**
   - ☐Low = No
   - ☐Medium = some of the described technologies are state-of the-art
   - ☐High = most of the described technologies are state-of the-art
   - ☐Very High = Yes

   Comments: *[Min 200, max 1000 characters]*

1

ii. **The proposal includes all the Infrastructural Units (IUs) and required technologies to fulfil the described mission**

☐Low = IUs that are fundamental to fulfil the mission are missing
☐Medium = Some IUs that would improve performance are missing
☐High = Most of the necessary IUs are described
☐Very High = All the necessary IUs are described

Comments: *[Min 200, max 1000 characters]*

iii. **Estimation of costs for implementation (Ref. Q10 and 11)**

☐Low = not realistic
☐Medium = for the implementation of a fully functional facility costs are substantially (more than 20%) higher/lower
☐High = for the implementation of a fully functional facility costs are partially (less than 20%) higher/lower
☐Very High = realistic

Comments: if the estimation of the costs is not realistic, please provide a realistic estimate *[Min 200, max 1000 characters]*

iv. **Estimation of costs for operation (Ref. Q12 and 13)**

☐Low = not realistic
☐Medium = for the implementation of a fully functional facility costs are substantially (more than 20%) higher/lower
☐High = for the implementation of a fully functional facility costs are partially (less than 20%) higher/lower
☐Very High = realistic

Comments: if the estimation of the costs is not realistic, please provide a realistic estimate *[Min 200, max 1000 characters]*

v. **Estimation of personnel required**

☐Low = not realistic
☐Medium = for the implementation of a fully functional facility the number of personnel required is substantially (more than 20%) higher/lower
☐High = for the implementation of a fully functional facility the number of personnel required is partially (less than 20%) higher/lower
☐Very High = realistic

Comments: if the estimation of the personnel required is not realistic, please provide a realistic estimate (If not provided by the applicant, please indicate n.a.) *[Min 200, max 1000 characters]*

vi. **Estimation of space required (Ref. Q16)**

☐Low = not realistic
☐Medium = for the implementation of a fully functional facility a substantial (more than 20%) increase/decrease of the space required is needed

☐High = for the implementation of a fully functional facility a limited (less than 20%) increase/decrease of the space required is needed
☐Very High = realistic

Comments: if the estimation of the personnel required is not realistic, please provide a realistic estimate (If not provided by the applicant, please indicate n.a.) *[Min 200, max 1000 characters]*

vii. Ability of the proposed facility to cater for the expected number of users (Ref. Q20)
☐YES
☐NO

Comments: *[Min 200, max 1000 characters]*

d. Interaction with other research infrastructures (Ref. Q23)
☐Low = no opportunities for interaction
☐Medium = few opportunities for interaction
☐High = good opportunities for interaction
☐Very High = strong opportunities for interaction

Comments: *[Min 200, max 1000 characters]*

OVERALL SCORE
☐Low
☐Medium
☐High
☐Very High

OVERALL COMMENT: *[Max 2000 characters]*

Annex 7 First Level Consultation proposal evaluation form (Technical Committee)

HUMAN TECHNOPOLE

Consultation of institutional stakeholders on the realisation of national facilities open to the scientific community *at Human Technopole*

EVALUATION FORM (Technical Committee)

The present form reports the criteria and scoring system to be used for the evaluation of the proposals received from the institutional stakeholders during the first level consultation regarding the possible realisation of national facilities (NF) to be implemented at Fondazione Human Technopole (HT).

To ensure that the proposals have been submitted by the stakeholders consulted, using the appropriate institutional email address as requested in the invitation, a first eligibility check has been performed during the consultation. For all proposals received from different email addresses, the proposer has been contacted and requested to resubmit the questionnaire using the correct email address.

The proposed **main criteria** for the evaluation of proposals are listed below [including references – where applicable – to the relevant survey question(s)].

The evaluation system provides for the use of a score composed of four grades, i.e. "Low", "Medium", "High", "Very High". For each proposal, various criteria will be evaluated (see below) and an overall score will be given.

1

PROPOSAL NUMBER:

All fields are mandatory, including "Comments". Please, for each criterion, use the "Comments" session to explain the elements that led to the assigned score.

a. **The proposal aims at implementing a National Facility for external users, as defined by ESFRI and in the Convenzione, as opposed to setting up a facility to mainly carry out research on its own**

☐YES = the proposal will be evaluated further
☐NO = the proposal will not be evaluated further

Comments:

b. **The proposed National Facility will be located at HT**

☐YES = the proposal will be evaluated further
☐NO = the proposal will not be evaluated further

Comments:

c. **Alignment of the proposed NF to the Convenzione**

☐YES = the proposal will be evaluated further
☐NO = the proposal will not be evaluated further

Comments:

d. **Overlap, in terms of scientific and technological field and/or mission, relative to existing national facilities (Ref Q5 and 6 + TC evaluation)**

☐Low = overlap with existing facility open and easily accessible by the scientific community
☐Medium = overlap with existing facility but to which limited access is available (platform open to external users but with only limited open calls for access)
☐High = overlap with existing facility that is either not open to external users or open to external users but without available open calls for access
☐Very High = no overlap

Comments:

e. **Overlap, in terms of scientific and technological field and/or mission, relative to the national priorities in terms of research infrastructures, as illustrated in the PNRR, PNR 2021-2027, PNIR 2021-2027, PNRS 2020-2022, POS/complementary plan and other strategic national plans.**

☐Low = full overlap
☐Medium = partial overlap (overlap of IUs)
☐High = limited overlap (overlap of single services)
☐Very High = no overlap

Comments:

f. Dependency of the proposed National Facility on other facilities proposed in the consultation

☐Low = to perform its activities adequately, the NF needs other facilities and cannot be implemented as proposed
☐Medium = to perform its activities adequately, the NF needs other facilities but these can be easily implemented independently
☐High = interconnection with other proposals will further improve the services offered by the NF but the general mission can be fulfilled independently
☐Very High = the NF is independent of other proposals and can therefore be implemented as proposed

Comments:

g. Number of potential users (per year) (Ref. Q20 + Q21)

☐Low
☐Medium
☐High
☐Very High

Comments:

h. Impact of the facility on the Italian research system (Ref. Q22 + Q20)

☐Low = limited impact
☐Medium = medium impact
☐High = major impact
☐Very High = strong impact

Comments:

i. Interaction with other research infrastructures (Ref. Q23)

☐Low = no opportunities for interaction
☐Medium = few opportunities for interaction
☐High = good opportunities for interaction
☐Very High = strong opportunities for interaction

Comments:

Overall score [for Technical Committee evaluation]

☐Low
☐Medium
☐High
☐Very High

Overall comment [for Technical Committee]

3

Final score [based on Technical Committee evaluation and Reviewers Evaluation]

☐Low
☐Medium
☐High
☐Very High

Final comment and recommendation to include or not the proposal in the second level consultation

Annex 8 Second Level Consultation questionnaire

HUMAN TECHNOPOLE

CONSULTATION OF THE ITALIAN SCIENTIFIC COMMUNITY ON THE REALIZATION AT HUMAN TECHNOPOLE OF HIGH-IMPACT NATIONAL FACILITIES

The *Convenzione*[1] signed on December 30, 2020 between the Ministries of Economy and Finance, of Health and of University and Research and the Human Technopole Foundation governs the realization at Human Technopole of National Facilities (NFs), which must meet the definition of research infrastructure adopted by the European Strategic Forum for Research Infrastructures (ESFRI)[2], i.e., facilities, resources and related services used by the scientific community to conduct high-quality research in their respective fields, independent of institutional or national affiliation.

The *Convenzione* provides that these NFs will be identified following a public consultation in two phases: the first engaging stakeholders representing Universities, research hospitals, Public Research Institutions, Industry, Regions, social partners, and Third Sector (charitable) entities that conduct or fund research in the life sciences, the second phase consists in collecting the views and comments of the entire scientific community on a summary list of possible NFs elaborated by the Technical Committee, based on the output of the first phase.

On September 30th 2021, the first level consultation was completed. This consultation involved more than 160 stakeholders and aimed to identify the priorities of the national scientific community in terms of research infrastructures (RIs) in the field of life sciences.

Several technological facilities proposed by the participants in aggregate or individual forms were compliant with the requirements set out in the *Convenzione*. These proposals were further examined by the Technical Committee, taking into consideration the advice of international experts in the technological areas covered by the proposed facilities. The most important criteria were whether substantial overlap existed with National and/or European RIs, as well as with current or planned National public investments in RIs, and the magnitude of the proportion of the national scientific community potentially interested by the proposed facilities.

Overall, this initial phase of consultation allowed the identification of 'core areas' with high demand for NFs offering researchers a free access (respecting the criteria and procedures foreseen in the *Convenzione*) in the respective fields. These NFs will allow Italian researchers to access a broad range of services from omics technologies to imaging and structural analysis.
One of these core areas is represented by the OMICS DOMAIN, that includes a broad spectrum of technologies, from nucleic acids to proteins and metabolites, analysed either from tissues or from single cells. This domain will support researchers working in different areas of life sciences.
Another core area is the IMAGING DOMAIN. This includes several imaging technologies at multiple scales, from atoms over molecules to cells, tissues and organs.

[1] https://www.mur.gov.it/sites/default/files/2021-07/Convenzione MEF_MUR_Min Salute_HT.pdf
[2] From ESFRI Roadmap 2018 *"RIs are facilities, resources or services of a unique nature, identified by European research communities to conduct and to support top-level research activities in their domains. They include major scientific equipment - or sets of instruments; knowledge-based resources like collections, archives and scientific data; e-Infrastructures, such as data and computing systems and communication networks; and any other tools that are essential to achieve excellence in research and innovation".*

HUMAN TECHNOPOLE

Both core areas of OMICS and IMAGING will produce large quantities of data and will need to be supported by a DATA HANDLING AND ANALYSIS CORE for the NFs that will be essential to collect these data, carry out first level analysis and deliver them in workable format to external researchers for in-depth analysis.

The above-summarised results of the first level consultation are now submitted to the Italian scientific community for comments. With this questionnaire we invite researchers to express their opinion on the identified core areas and to propose any motivated additions and/or deletions.
First you will be asked to indicate the level of priority of the identified domains for the Italian scientific community. In the next section you will have the opportunity to indicate possible facilities that you think are missing in the identified domains and that you consider fundamental for the Italian scientific community. Moreover, you will have the possibility to indicate if any of the proposed facilities is unnecessary for the community, for example because there is no demand for a particular technology, or because that technology is already sufficiently covered by existing facilities.
At the end of the questionnaire, you will be asked to indicate which type of institute you are affiliated to and your job title. This information will be used for statistical purposes to assess the level of participation of the Italian scientific community.

1. Core area OMICS – covering nucleic acid, protein and metabolite omics, as well as genome engineering

   Which is the priority of implementing this facility for the Italian research community?

   ☐Very High Priority
   ☐High Priority
   ☐Medium Priority
   ☐Low Priority

2. Core area IMAGING – including technologies to cover the multiple scales of biology

   Which is the priority of implementing this facility for the Italian research community?

   ☐Very High Priority
   ☐High Priority
   ☐Medium Priority
   ☐Low Priority

3. Core area DATA HANDLING AND ANALYSIS

   Which is the priority of implementing this facility for the Italian research community?

HUMAN TECHNOPOLE

☐Very High Priority
☐High Priority
☐Medium Priority
☐Low Priority

4. Do the proposed core areas lack any scientific and technological fields covered by HT (i.e. Health, Genomics, Data and decision science, Nutrition, Structural Biology, and Additional areas of research aimed at prevention and health) that you consider fundamental for the Italian scientific community?
   ☐Yes
   ☐No
5. If Yes, please use this section to
   a) specify which technological field(s) is(are) missing - choosing among HEALTH, GENOMICS, DATA AND DECISION SCIENCE, NUTRITION, STRUCTURAL BIOLOGY and ADDITIONAL AREAS OF RESERACH AIMED AT PREVENTION AND HEALTH - and
   b) motivate your answer using for each selected field a MAXIMUM OF 5 KEYWORDS SEPARATED BY A COMMA
6. Do the proposed core area OMICS include technologies that are unnecessary?
   Yes
   No
7. If Yes, please use this section to specify which technologies and to motivate your answer using a MAXIMUM OF 10 KEYWORDS SEPARATED BY A COMMA
8. Do the proposed core area IMAGING include technologies that are unnecessary?
   Yes
   No
9. If Yes, please use this section to specify which technologies and to motivate your answer using a MAXIMUM OF 10 KEYWORDS SEPARATED BY A COMMA
10. Do the proposed core area DATA HANLDING AND ANALYSIS include technologies that are unnecessary?
    Yes
    No
11. If Yes, please use this section to specify which technologies and to motivate your answer using a MAXIMUM OF 10 KEYWORDS SEPARATED BY A COMMA
12. Type of institution
    ☐Academic
    ☐Industry
    ☐Other

HUMAN TECHNOPOLE

13. Job title
    - ☐Full professor
    - ☐Associate professor
    - ☐Researcher/Scientist
    - ☐Post Doc
    - ☐PhD student
    - ☐Director of research
    - ☐Research technologist
    - ☐Other (specify)

14. Main area of expertise
    - ☐Structural biology
    - ☐Molecular biology
    - ☐Clinical Medicine
    - ☐Genomic
    - ☐Proteomic
    - ☐Metabolomic
    - ☐Transcriptomic
    - ☐Bioinformatic
    - ☐Human Imaging
    - ☐Animal Imaging
    - ☐Pharmacology
    - ☐Drug discovery
    - ☐Other (specify)

Appendix 1 First Level Consultation: submitted questionnaires (full proposals)

See Attachment “Appendix 1” (to see the Attachments open the file with Acrobat Adobe Reader)

Appendix 2 Evaluation forms by Technical Committee

See Attachment “Appendix 2” (to see the Attachments open the file with Acrobat Adobe Reader)

Appendix 3 Second Level Consultation: submitted questionnaires

See Attachment “Appendix 3” (to see the Attachments open the file with Acrobat Adobe Reader)

This document, entitled "**Realisation of national facilities open to the scientific community at Human Technopole - Final report of the Technical Committee on the 2021-2 two-stage consultation"** has been prepared and approved by all Members of the Technical Committee ("Comitato Tecnico nominato ai sensi dell'art. 3 della CONVENZIONE adottata ai sensi e per gli effetti della, legge 27 dicembre 2019, n. 160, art. 1, co. 276, tra il Ministero dell'Università e Ricerca, Ministero della Salute, Ministero dell' Economia e delle Finanze e la Fondazione HUMAN TECHNOPOLE).

Iain Mattaj

Director Human Technopole, Chair of the Technical Committee

Iain W. Mattaj
Firmato da Iain William Mattaj
Data: 09/09/2022 11:34:03 CEST

Gianluigi Consoli

Director General of Internationalization and Communication, Ministry of University and Research, Vice- chair of the Technical Committee

Giuseppe Ippolito

Director General for Research and Innovation in Healthcare, Ministry of Health, Vice- chair of the Technical Committee

Gelsomina Pappalardo

Italian representative in the European Strategy Forum for Research Infrastructures

GELSOMINA PAPPALARDO
08.09.2022 14:54:50
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Walter Ricciardi

Chair Scientific Committee, Human Technopole