

**CALL FOR APPLICATIONS FOR  
XXXVIII DOCTORATE CYCLE GRANTS  
AS PART OF THE NATIONAL RECOVERY AND RESILIENCE PLAN (NRRP)  
MISSION 4 COMPONENT 2 "FROM RESEARCH TO BUSINESS"  
A.A. 2022/2023**

**Rectoral Decree. no. 1185**

**THE RECTOR**

- IN VIEW OF Law 476 (13 Aug 1984) on regulations governing scholarships and doctorate research programmes at Italian universities;
- GIVEN Law 105 (5 Feb 1992), specifically art.20 and subsequent modifications and additions;
- GIVEN Law 675 (31 December 1996) and subsequent modifications and additions;
- GIVEN Law 210 (3 Jul 1998), as modified by Law 240 (30 Dec 2010);
- GIVEN Ministerial Decree 224 (30 Apr 1999);
- GIVEN Ministerial Decree 509 (3 Nov 1999) on didactic autonomy of universities;
- GIVEN Presidential Decree 445 (28 Dec 2000), Consolidated Law on legislative measures and regulations for administrative records;
- GIVEN Legislative Decree 82 (7 Mar 2005) and subsequent modifications and additions;
- GIVEN Prime Ministerial Decree of 9 Apr 2001 on measures for equal treatment for rights to university studies;
- GIVEN Legislative Decree 68 (29 Mar 2012), specifically art.18.8;
- GIVEN Apulian Regional Law 45 (28 Dec 2012), specifically art.11;
- GIVEN Ministerial Decree 270 (22 Oct 2004);
- GIVEN Ministerial Decree 198 (23 Oct 2003), arts. 3 and 6, Ministerial Decree 263 (9 Aug 2004) and Ministerial Decree 492 (3 Nov 2005);
- GIVEN current Ministerial and Rector's measures for the containment and management of the Covid-19 emergency;
- GIVEN the "Protocol for Public Examination Procedures" published as part of the Ministry of Health decree of 25 May 2022;
- GIVEN the Politecnico di Bari Statute issued by Rectoral Decree no.175/2019;
- GIVEN the Politecnico di Bari Ethical and Behavioural Code, issued as part of Rector's Decree 582 (28 Sept 2018);
- GIVEN Ministerial Decree 226 (14 Dec 2021), "Regulations concerning accreditation procedures for institutes and doctorate programmes and criteria for establishment of doctorate programmes on the part of accredited institutes";
- GIVEN the Politecnico di Bari Doctorate Research Programme Regulations, issued as part of Rectoral Decree 288 (11 Mar 2022);

- GIVEN Ministerial Decree 247 (23 Feb 2022), modifying the Ministerial Decree 40 (25 Jan 2019) regarding annual amount of PhD programme grants, which from 01/07/2022 increase from €15,343.28 to €16,243.00 (gross total before social security contributions made by the beneficiary);
- HAVING ASCERTAINED the availability of financial resources pertaining to study grants funded by the Politecnico di Bari;
- GIVEN the 2022-23 Fees and Contributions Regulations;
- SUBJECT TO Ministry of Universities and Research regulations, with the consent of ANVUR, regarding institute accreditation and/or establishment of PhD Programmes for the XXXVIII Cycle, for which the Politecnico is the administrative centre;
- GIVEN the National Recovery and Resilience Plan – NRRP;
- GIVEN the public notice for the presentation of project proposals to enhance research structures and create “National Champions” in R&D for Key Enabling Technologies, to be funded as part of the NRRP, Mission 4 Component 2 Investment 1.4, European Union NextGenerationEU (Ministry of Universities and Research Ministerial Decree no. 3138 (16 Dec 2021));
- GIVEN the participation of Politecnico di Bari in two National Centre programmes entitled “National Centre for Sustainable Mobility - CN MS” as part of the Sustainable Mobility topic area CUP D93C22000410001 and “National Centre for HPC, Big Data and Quantum Computing Research – CN HPC” as part of the High Performance Simulations, Calculations and Analysis topic area CUP D93C22000430001;
- GIVEN Ministry of Universities and Research Decree no. 548 (32 Mar 2022), “public notice for the presentation of project proposals to enhance research structures and create “National Champions” in R&D – NRRP – MUR – “phase 1, approval of project proposal shortlist”;
- GIVEN MUR Director’s Decree no. 1033 (17 Jun 2022) granting funding for a National Centre for Sustainable Mobility – CN MS;
- GIVEN MUR Director’s Decree no. 1031 (17 Jun 2022) granting funding for a National Centre for HPC, Big Data and Quantum Computing Research – CN HPC;
- GIVEN the public notice for the presentation of project proposals to create “Extended Partnerships for Universities, Research Centres and Companies to Fund Basic Research Projects” as part of NRRP, Mission 4 “Education and Research” – Component 2 “From Research to Business” – Investment 1.3, to be funded by the European Union NextGenerationEU programme (MUR Ministerial Decree no. 341 (15 Mar 2022));
- GIVEN the participation of Politecnico di Bari in three Extended Partnerships entitled “RESTART - RESEARCH and Innovation on Future Telecommunications Systems and Networks, to make Italy more smART” as part of topic area “Telecommunications of the Future” – CUP D93C22000910001, “3A-ITALY” as part of topic area “Made-in-Italy Circular and Sustainable” – CUP D93C22000920001 and “NEST - Network 4 Energy Sustainable Transition” as part of topic area 2 “Future Energy Scenarios - Subtopic 2.a. Future Green Energy” – CUP D93C22000900001;
- GIVEN Director’s Decree no. 1243 (2 Aug 2022) “Public notice for the presentation of project proposals to create Extended Partnerships for universities, research centres and companies to fund basic research projects” – “phase 1, approval of project proposal shortlist”;
- GIVEN MUR Director’s Decree no. 1549 (11 Oct 2022) granting funding for Extended Partnerships entitled “RESTART - RESEARCH and innovation on future telecommunications systems and networks, to make Italy more smART”;

VISTO MUR Director's Decree no. 1561 (11 Oct 2022) granting funding for Extended Partnerships entitled "NEST - Network 4 Energy Sustainable Transition";

VISTO MUR Director's Decree no. 1551(11 Oct 2022) granting funding for Extended Partnerships entitled "3A-ITALY";

GIVEN the "Reporting Guidelines for Implementors of Initiatives under Mission 4 Component 2";

HAVING ASCERTAINED the availability of financial resources;

HEREBY DECREES

### Art. 1: INITIATIVE OBJECTIVES AND AVAILABILITY

Politecnico di Bari is holding a public selection process to **allocate 19 Doctorate Research grants as part of the National Recovery and Resilience Plan (NRRP), Mission 4 component 2 "From Research to Business"**, financed by the European Union's NextGenerationEU project for XXXVIII cycle Doctorate Research courses, academic year 2022/23 at the Politecnico di Bari's Doctorate School (SCU.DO.).

It is hereby specified that the abovementioned selection procedure is **exclusively for the allocation of doctorate research positions with grant funding**.

The 19 places available are distributed as follows:

- 9 as part of "National Centres" (NC),
- 10 as part of "Extended Partnerships" (EP);

Grants will be allocated to Politecnico di Bari Doctorate Research courses as follows:

DOCTORATE RESEARCH COURSE	INVESTMENT	
	NC	EP
<b>Ph.D. IN MECHANICAL AND MANAGEMENT ENGINEERING</b> <i>(hereafter abbreviated to DRIMEG)</i>	2	7
<b>Ph.D. IN ELECTRICAL AND INFORMATION TECHNOLOGY ENGINEERING</b> <i>(hereafter abbreviated to DRIEI)</i>	2	/
<b>Ph.D. IN RISK, ENVIRONMENTAL, TERRITORIAL AND BUILDING DEVELOPMENT</b> <i>(hereafter abbreviated to DRSATE)</i>	4	/
<b>Ph.D. IN HERITAGE PLANNING: KNOWLEDGE, TRADITION AND INNOVATION</b>  <i>Programme:</i> <ul style="list-style-type: none"> <li>• Programme 1 – Historical Heritage</li> <li>• Programme 2 – City and Local Area</li> <li>• Programme 3 - Construction</li> <li>• Programme 4 – Computational Design and Digital Manufacturing</li> </ul> <i>(hereafter abbreviated to CTI)</i>	/	3
<b>INTER-UNIVERSITY Ph.D. (WITH UNIVERSITY OF BARI "ALDO MORO") IN INDUSTRY 4.0</b> <i>(hereafter abbreviated to DRI4.0)</i>	1	/

PhD programmes have a 3-year duration, with a starting date of 1 Jan 2023. All teaching is carried out in English.

Doctorate research programmes are established on the condition that they meet the accreditation regulations stipulated under Ministerial Decree 226/2021. Where a PhD programme does not receive accreditation, the selection procedure will not take place and only in these circumstances will applicants be notified directly.

The current call is deemed official notification to all intents and purposes. All correspondence with candidates for this public notice will be by e-mail. To this end, the e-mail address used by candidates on their application form will be used.

## Art. 2: GRANT DETAILS

The following grants will be available for the Doctorate Research courses set out below;

### 1. Ph.D. IN MECHANICAL AND MANAGEMENT ENGINEERING – DRIMEG

*Coordinator: Prof. Giuseppe Casalino*

*Department of Mechanics, Mathematics and Management*

Extended Partnership (EP) "Made in Italy: Circular and Sustainable"(3A-ITALY)				
SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 5</b> "Factories and Processes for Sustainability and Circularity"	Prof. S. Digiesi	Prof. S. Digiesi	1	Evaluation of circular performances and social impacts of the use of I4.0 technologies in the manufacturing sector.
<b>Spoke 6</b> "Additive Manufacturing as disruptive enabler of twin transition"	Prof. L. Galantucci	Prof. L. Galantucci	1	The context of this research project is the development of innovative process chains able to realize sustainable structures, designed according to green principles and obtained by using topology optimization, generative design and other bio-inspired algorithms. In particular, the research project will focus on hybrid manufacturing processes comprising the combinations of Additive Manufacturing (AM) technologies and subtractive technologies applied to conventional or innovative materials. The aim is to combine the advantages of each process to obtain parts with improved dimensional tolerance and surface quality and with notable impact on overall process sustainability (i.e. by reducing the buy-to-fly ratio). Research will be preparatory to the realization of sustainable lightweight complex structures and it will include materials of interest for different industrial sectors.
<b>Spoke 7</b> "New and consumer-driven business models for resilient and circular SCs"	Prof.ssa I. Giannoccaro	Prof.ssa I. Giannoccaro	2	Research will focus on the design of innovative Circular Business Models (CBMs) and Circular Supply Chains (CSCs), referring to ecosystem industrial symbiosis synergies, servitization methods and sharing platform solutions for products, manufacturing equipment, and infrastructures, and circular input enabled by bio and recycled materials. Research will also explore the role of specific enabling digital technologies with an

				emphasis on blockchains, Internet of things, Industrial Augmented Reality and Industrial Virtual Reality. Research activities will concern the transition process by analysing the effect of their implementation on consumers, managers, and operators. In particular, their cognitive and physical efforts as well as their behavioural attitudes will be investigated and new models to assess them will be developed with the aim of optimizing performance.
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**Extended Partnership (EP)**

**“Network 4 Energy Sustainable Transition” (NEST)**

SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 4</b> “Clean Hydrogen and Final Uses”	Prof. M. Torresi	Prof. M. Torresi	1	Systems and Technologies for end uses <i>(see topic description in Attachment 1)</i>
<b>Spoke 5</b> “Energy Conversion”	Prof. G. Monopoli	Prof. P. Tamburrano	1	Innovative systems for the liquefaction of renewable fuels such as hydrogen and biomethane.
<b>Spoke 5</b> “Energy Conversion”	Prof. G. Monopoli	Prof.ssa S. Cherubini	1	Development of digital twins for wind turbines and wind farms in optimization and control of plant power production.

**National Centre (NC)**

**“National Centre for Sustainable Development” (MOST)**

SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 14</b> “Hydrogen and New Fuels”	Prof. M. Torresi	Prof. M. Dassisti	1	Impacts and Life Cycle Assessment of Innovative Fuels. <i>(see topic description in Attachment 2)</i>
<b>Spoke 11</b> “Innovative Materials and Reduction”	Prof. G. Palumbo	Prof. G. Casalino, Prof.ssa Casavola	1	Enhancing Wire-Based Additive Manufacturing for Large Structural Multi-Metal Component Production. <i>(see topic description in Attachment 3)</i>

**2. Ph.D. IN ELECTRICAL AND INFORMATION TECHNOLOGY ENGINEERING**

**- DRIEI**

*Coordinator: Prof. Mario Carpentiere*

*Department of Electrical Engineering and Information Technology*

**National Centre (NC)**

**“National Centre for Sustainable Mobility” (MOST)**

SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 8</b> “MaaS & Innovative Services”	Prof. M. Ottomanelli	Prof. T. Di Noia	1	Location-Based Recommendations for MaaS. <i>(see topic description in Attachment 4)</i>

National Centre (NC) "National Centre for Big Data and Quantum Computing" (HPC)				
SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 8</b> "In-Silico Medicine and Omics Data"	Prof. F. Attivissimo	Prof. F. Attivissimo	1	Development of machine vision algorithms for radiomics

### 3. Ph.D. IN RISK, ENVIRONMENTAL, TERRITORIAL AND BUILDING DEVELOPMENT - DRSATE

Coordinator: Prof. Vito Iacobellis

Department of Civil, Environmental, Land, Building Engineering and Chemistry

National Centre (NC) "National Centre for Sustainable Mobility" (MOST)				
SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 7</b> "CCAM & Smart Infrastructures"	Prof. M. Ottomanelli; Prof. M. Binetti	Prof. M. Ottomanelli; Prof. M. Binetti	1	Resilience of Networks, Structural Health Monitoring and Asset Management. <i>(see topic description in Attachment 5)</i>
<b>Spoke 8</b> "MaaS & Innovative Services"	Prof. M. Ottomanelli	Prof. A. Messeni Petruzzelli	1	Business and Organizational Models for Mobility as a Service (MaaS) <i>(see topic description in Attachment 6)</i>

National Centre (NC) "National Centre for Big Data and Quantum Computing" (HPC)				
SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 5</b> "Environment and Natural Disasters"	Prof.ssa F. Cotecchia	Prof.ssa F. Cotecchia	2	Modelling of Disaster Inducing Processes and Assessment of Consequent Damage and Loss.

### 4. Ph.D. IN HERITAGE PLANNING: KNOWLEDGE, TRADITION AND INNOVATION - CTI

Coordinator: Prof. Giuseppe Fallacara

Department of Architecture, Construction and Design

Extended Partnership (EP) "Made in Italy - Circular and Sustainable" (3A-ITALY)				
SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
<b>Spoke 6</b> "Additive Manufacturing as Disruptive Enabler of Twin Transition"	Prof. L. Galatucci	Prof. N. Parisi	1	Digital Architecture: Form Finding & Liquid Deposition Modelling.
<b>Spoke 7</b> "New and Consumer-Driven Business Models for Resilient and Circular SCs"	Prof.ssa I. Giannoccaro	Prof.ssa A. Di Roma	2	The research will concern the innovation of the traditional supply chains in the Made in Italy industries in a sustainable and responsible way. In particular, the research will explore the role played by the design approaches and digital

				technologies, the effect of cultural traditions, and the importance of social factors for the transformation of the supply chains. A particular emphasis will be given to the contexts characterized by local highcraftsmanship production systems and SMEs
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## 5. INTER-UNIVERSITY Ph.D. (WITH UNIVERSITY OF BARI "ALDO MORO") IN INDUSTRY 4.0 – DRI4.0

Coordinator: Prof. Gennaro Boggia

Department of Electrical Engineering and Information Technology

National Centre (NC) "National Centre for Sustainable Mobility" (MOST)				
SPOKE	SCIENTIFIC SUPERVISOR	GRANT COORDINATOR	GRANTS AVAILABLE	TOPIC AREA
Spoke 14 "Hydrogen and New Fuels"	Prof. M. Torresi	Prof. U. Berardi	1	Impact and Life Cycle Assessment of Innovative Fuels. (see topic description in Attachment 7)

### Art. 3: ADMISSION REQUIREMENTS

Admission applications, with no age limit or nationality restrictions, may be submitted by all candidates who:

- by deadline date **hold one of the following degree qualifications** (second-level degrees);
  - degree awarded by an Italian university prior to Ministerial Decree 509 (1999);
  - Specialist degree as per Ministerial Decree 509 (1999);
  - Master's degree as per Ministerial Decree 270 (2004);
  - equivalent academic qualifications obtained abroad.

Applicants to the PhD programme in **Design for Heritage: Knowledge and Innovation (CTI)** must hold a **second level (specialized) degree** in one of the following disciplines:

- Degree diploma in Architecture awarded prior to Ministerial Decree 509/99
- LM-2 Archaeology
- LM-3 Landscape Architecture
- LM-4 Architecture and Building Engineering
- LM-4 Single Cycle 5-year degree in Architecture and Building Engineering
- LM-10 Architectural and Environmental Heritage Conservation
- LM-12 Design
- LM-23 Civil Engineering
- LM-24 Building Systems Engineering
- LM-35 Environmental and Land Engineering
- LM-48 Urban and Environmental Land Planning
- LM-89 History of Art
- 2/S Archaeology
- 3/S Landscape Architecture
- 4/S Architecture and Building Engineering
- 10/S Architectural and Environmental Heritage Conservation
- 28/S Civil Engineering
- 38/S Environmental and Land Engineering
- 54/S Urban and Environmental Land Planning

- 103/S Theories and Methods of Industrial Design
- 95/S Art History

- **obtain the qualification** required for admission by 31 December 2022;
- **hold a second-level degree awarded abroad** (as per the Bologna Process) or a Master's degree which enables the holder to enrol on a PhD programme in their country of origin. These qualifications must be awarded by an officially recognized academic institute.

Only for those candidates due to graduate from Politecnico di Bari, Ph.D. programme applications may only be submitted after an online request for second level qualification conferment has been made, as per administrative regulations and deadlines issued by the Politecnico *Centro Servizi per la Didattica*.

Candidates whose degree has **already been recognised as equivalent** by an Italian university must attach self-certification indicating all relevant details of this to their application.

Where a qualification awarded by a foreign university has **not yet been declared equivalent** to an Italian university degree, the Selection Committee will decide upon the eligibility of the foreign qualification in line with current Italian regulations and those of the country of origin, as well as any international treaties or agreements on qualification recognition for further study. In order to facilitate the recognition process, candidates must attach all documents pertinent to eligibility evaluation to their online applications. The compilation of online applications entails an implicit request for the verification of all degrees awarded abroad.

The evaluation of qualification eligibility is only possible if the documentation provided clearly shows all required information, including **specific details** (degree type; typical length of degree course; official title of academic institute awarding the degree; date qualification obtained; mark or grade achieved in relation to the scale used in the higher education system in question).

Candidates are accepted provisionally until the validation of all admission requirements. Politecnico di Bari may ascertain the fulfilment of these requirements at any time, also after programmes have commenced, as per art. 43 of Consolidation Act 445/2000. Candidates may be excluded at any time by substantiated decision.

## **Art. 4: APPLICATIONS**

Applications for admission to the Ph.D. programmes outlined above can be made exclusively online **up to 30 days from the publication date of this Call (10 Nov 2022)** using the procedures available on the Politecnico di Bari's website Esse3 portal ([poliba.esse3.cineca.it](http://poliba.esse3.cineca.it)).

**Instructions for the specific requirements for each PhD programme can be found in Art. 3 of this call document.**

Any applications that are presented in different formats will not be considered.

Candidates are responsible for correct adherence to online procedures.

Candidates are invited to apply for the selection procedure in advance of the final deadline date.

In order to access the application procedure, candidates must be **registered on the Esse3 platform**.

Applicants who have not yet registered can do so as follows:

- visit the webpage <https://poliba.esse3.cineca.it/Home.do>;
- **select MENU followed by REGISTRAZIONE;**
- **insert the required data.**

On completing registration, **the system will provide access credentials. It will now be possible to continue with the application as below.**

Applicants who are already registered with Politecnico di Bari should:

- visit the webpage <https://poliba.esse3.cineca.it/Home.do>;
- **select MENU followed by LOGIN;**
- **access the restricted area (Area Riservata)** using the credentials provided. Applicants are required to **update** any personal data by selecting HOME, in particular their e-mail address to which all information on the selection procedure will be sent;
- **select SEGRETERIA from the menu on the right, followed by TEST DI AMMISSIONE - ISCRIZIONI CONCORSO and the PhD programme of interest.**

During the compilation of the application form, candidates must :

- **select the PhD programme** they wish to apply for and the **language** (Italian or English) in which they intend to take the examination;
- **communicate any assistance required** (for disabled candidates);
- **enter their education data and follow the instructions provided by the system;**
  - **attach the following: all documents and self-certification following the model provided by Politecnico di Bari**, available on the *Dottorati di Ricerca* page of the Politecnico website. Candidates must also upload a **current identity document**. Each qualification certificate and document must be a .pdf file attachment no greater than **5 MB**. Each file attached must also be given a numerical code and document type, as indicated in art.5 of the current document.
  - **pay an administration fee of €30** by the deadline of 12:00 on 9 December 2022, using only the PagoPA method as set out in the payment page (*Pagamenti*) for each Esse3 profile. Missing registration of payment details on Esse3 will result in exclusion from the subsequent selection phase, except where candidates can provide a receipt for payment as per the terms outlined in this decree document. Please consult the PagoPA page (<https://www.poliba.it/it/didattica/bacheca/pagopa>) for instructions on how to carry out payment.

**The deadline for payment is irrevocably 12:00 on 9 December 2022.** The PagoPA certified payment date prevails. Any later date of payment will result in exclusion from the selection procedure. Given the time limits for applications, it is strongly recommended that candidates make payment immediately after completing their Esse3 registration and well before the deadline date.

**Only for candidates resident abroad:** if it is not possible for candidates to pay using the PagoPA system, payment will also be accepted by bank transfer payable to: Politecnico di Bari - via G. Amendola, 126/B - 70126 Bari. The bank details are: IBAN: IT59X0306904067100000300001 BIC: BCITITMM - description: "Application for PhD Programme in \_\_\_\_". Only those candidates making payment in this way are required to send an e-mail to [post-lauream@poliba.it](mailto:post-lauream@poliba.it), attaching a copy of the bank transfer payment and including a declaration of failed administration fee payment (*Dichiarazione di impossibilità al pagamento del contributo di partecipazione alla procedura concorsuale mediante PagoPA*), to be compiled using the form available on the Politecnico website ([www.poliba.it](http://www.poliba.it)).

**Under no circumstances can refunds be issued** (i.e. exclusion, withdrawal, absence, etc.).

The sole fee payment of €30 does not in itself constitute an application in the absence of an online application form. All conditions of the application procedure are obligatory and candidates who fail to comply will be excluded from the selection procedure.

As part of the online application, **candidates with a disability** (as per Laws 104 (5 Feb 1992) and 17 (28 Jan 1999) or specific learning disabilities (SLD / ASD as per Law 170 (8 Oct 2010) must clearly state any request for additional assistance or added time needed to complete the examination.

Applicants who intend to **apply for more than one PhD programme** must do so separately for each programme, providing the documents and qualification certificates required for each programme selection procedure. Each programme application requires a separate application procedure (including payment).

In accordance with Presidential Decree 445 (28 Dec 2000) and subsequent modifications and additions, Italian candidates may provide a self-declaration certificate attesting to the following criteria, as certified by public administrations:

- a) registration on official registers recognised by public administrations;
- b) memberships of professional associations;
- c) degrees held and examination results;
- d) professional titles held, specialisation qualifications, professional training, continuing education, technical certification;
- e) student status.

After all data has been confirmed and the application submitted online, no further changes will be allowed to the application form. Applicants may add, delete or modify document attachments provided this is before the deadline date, after which no further amendments will be permitted.

Verification of application validity, including receipt of all required documentation and compliance with self-certification requirements, will be carried out by the Administration Department after the deadline date.

## Art. 5: DOCUMENTS TO ATTACH TO APPLICATIONS

Application form compilation requires the **obligatory** upload of the following documents (**failure to comply will result in exclusion from the selection procedure**):

- A **CV** following the **example format** provided by Politecnico di Bari on the Politecnico website [www.poliba.it](http://www.poliba.it) in the *Ricerca/Dottorati di Ricerca* section.  
(This file should be named "01.CV").
- **A signed, valid identification document. Only the following documents will be considered;**
  - Only ID cards issued by an EU member state;
  - Only driving licences issued by an EU member state;
  - In all other cases, a fully valid passport (including non-EU citizens);(This file should be named "02.Documento riconoscimento").
- **Degree qualification certification for first (Bachelor) degrees and second (specialization/Master's) degrees (or 5-year Single Cycle degrees). Candidates with qualifications obtained in Italy must** attach the form provided by the Politecnico and available at the link <https://www.poliba.it/it/dottorati-di-ricerca> specifying the following information:
  - final degree marks;
  - list of exams taken during both degree courses (or single, 5-year course);
  - marks for exams taken.(This file should be named "03.Titoli di Laurea").

Candidates with a **degree qualification awarded by a non-Italian university**, in place of self-certification, must attach the following documents to their application, prepared by the academic institute which issued them:

- Degree certificate or diploma showing relative final mark;
- Official transcript of exams taken during all university study programmes, showing relative results;
- Any other type of document which demonstrates the equivalence of qualifications with those required in this application call (Supplementary Diploma, *Dichiarazione di Valore* (statement of value) issued locally).

*(This file should be named "03.Titoli di Laurea").*

- **An abstract/summary of the thesis topic for specialist/Master's degree (or five-year Single Cycle degree)**, stating the title and name of thesis supervisor(s) (max 3,000 characters)

*(This file should be named "04.Abstract Tesi").*

- **The candidate's thesis for specialist/Master's degree (or five-year Single Cycle degree)**; for graduating students whose thesis is not yet complete (see art.3), a draft version of the thesis which has been completed up to the time of application; (N.B. *draft version* implies a version of the thesis text written by the graduating candidate up to the date of application, which, in terms of chapters and pages, allows the Selection Committee to evaluate its relative content and subject area. The abstract is not considered as a draft version of the thesis under any circumstances.

*(This file should be named "05.Tesi").*

- **PhD research proposal** which the candidate intends to develop during the programme, stating the scientific basis of the proposal, its research objectives and the methods to be used. **Proposals must be based on the relevant topic areas outlined in this Call document.** Proposals are assessed purely as part of the selection procedure and are not necessarily those which candidates will develop during the programme.

*(This file should be named "06.Proposta di Ricerca").*

- **(only for CTI candidates) – A motivational letter** (max. 3,000 characters) outlining the candidate's research interests related to the programme selected and the research project which the candidate intends to propose during the doctorate programme.

*(This file should be named "07.Lettera di motivazione")*

Other **non-obligatory** attachments to the application to facilitate the selection process may include the following:

- **A self-certification declaration for any other qualification deemed** suitable for evaluation, which must be signed and dated (form available at the link <https://www.poliba.it/it/dottorati-di-ricerca>), in accordance with arts. 46 and 47 of Presidential Decree 445/2000.

*(This file should be named "08.Dichiarazione altri titoli").*

- **One (max. two) letters of presentation from teaching staff** who have supervised the candidate throughout their university studies.

*(This file should be named "09.Lettera presentazione 1", "09. Lettera presentazione 2").*

- **Language certification** demonstrating a knowledge of English which corresponds to at least B2 level. Only non-Italian citizens can attach certification which demonstrates knowledge of the Italian language..

*(This file should be named "10.Certificazione linguistica 1"; etc).*

- **Any publications** related to activity carried out and shown on the candidate's CV.

All of the aforementioned documents must be in either Italian or English or translated into Italian or English, under the responsibility of the candidate.

In cases of **large documents** unavailable as electronic files or which exceed the number of MB permitted for documents, applicants may submit these separately (in paper format or as a CD or DVD-ROM), accompanied by a detailed list of contents, by 12 p.m. of the deadline date for admission applications.

Any publications submitted on paper or digital support must be sent in a closed envelope, signed along the seal, to the following address:

Magnifico Rettore del Politecnico di Bari – Direzione Gestione Risorse e Servizi Istituzionali- Settore Ricerca, Relazioni Internazionali e Post-Lauream - Ufficio Protocollo – Via Amendola 126/B, 70126 BARI (Italy)

Envelopes must display the name and surname of the candidate together with the following text: “*Concorso di Ammissione al Corso di Dottorato in...* (name of the PhD programme)”. The delivery of the envelope containing publications to Politecnico di Bari - by postal service, private courier or shipping agency – is at the exclusive risk of the candidate.  
(*This file should be named “11.Pubblicazione 1”; etc).*)

## **Art. 6: GROUNDS FOR EXCLUSION**

The following are grounds for exclusion from the PhD programme selection procedure:

- a. any application which does not comply with the format set out under art. 4 of this call document;
- b. incomplete applications or those containing errors or missing documents which are obligatory for the selection procedure, as set out in art. 5, relative to each individual PhD programme;
- c. any false or mendacious self-declaration statements.
- d. missing application fee payment by the deadline date, as set out in the terms under art. 4.

Any candidates excluded from the selection procedure will be notified by the Postgraduate Department by email at the address provided on the Esse3 website. As such, candidates are asked to verify that the email address provided on the application form is current and correct. Alternative email addresses sent separately will not be taken into consideration.

## **Art. 7: PUBLIC EXAM PROCEDURE**

Admission to the PhD programmes is subject to a selection procedure designed to ascertain candidate preparation on general programme topics and their research aptitude and is aimed toward ensuring an accurate comparative evaluation of candidates.

Candidates will not receive direct notification of exam procedure results; these will be published in the private area of the Esse3 website portal.

**Selection examinations will start on 16 December 2022 and conclude on 19 December 2022.** Oral exams will be held in line with instructions provided to candidates prior to the test, published in the *Dottorati di Ricerca* page of the Politecnico di Bari website ([www.poliba.it](http://www.poliba.it)). Candidates will be excluded from the selection procedure if they are unable to provide identification or do not attend on the day of the selection examination.

All candidates must demonstrate a good knowledge of English. This can be certified with a recognised language qualification from an accredited examination board showing B2-level knowledge of the language, in line with the Common European Framework for the Knowledge of Languages. In the absence of certification, the candidate’s English language level will be assessed during the oral examination.

Non-Italian candidates must demonstrate a satisfactory knowledge of Italian. On submission of the application form, this can be certified with a qualification showing B1-level knowledge of Italian, in line with the Common European Framework for the Knowledge of Languages. In the absence of certification, the candidate’s Italian language level will be assessed during the oral examination.

Examinations can be taken either in Italian or in English for those candidates who request this option in the online application.

Any changes relating to the aforementioned dates or times **will be published** as an official notification on the *Albo Ufficiale* page, as well as on the Politecnico website.

**No other form of notification regarding oral examinations will be sent to candidates.**

Candidates who do not attend the examination will be considered as having withdrawn from the selection procedure.

## **Art. 8: EVALUATION OF QUALIFICATIONS AND INTERVIEW**

The Examination Board will assess candidates' qualifications and interview with a **mark out of 100**.

- a. For **DRIEI, DRDATE, CTI** and **DRI4.0** PhD programmes, this total mark is divided as follows:
- 40 marks for qualifications held (average exam marks, final degree mark, theses, Master's degrees, post-graduate courses, language certification, publications, etc.)
  - 60 marks for interview.

Candidates obtaining less than 10 marks in the **qualification evaluation** stage will not be admitted to the interview. The minimum pass mark for the **interview** stage is 15.

- b. For the **DRIMEG** PhD programme, the total mark is divided as follows:
- 20 for qualifications held (average exam marks, final degree mark, theses, Master's degrees, post-graduate courses, language certification, publications, etc.);
  - 20 for the research project proposal;
  - 60 for the interview (which provides a complete evaluation of the candidate and verification of the applicant's aptitude for research and willingness to undertake experience abroad, as well as areas of research interest.).

Candidates obtaining less than 10 marks for **qualification evaluation** will not be admitted to the research project evaluation stage. The minimum pass mark for the **research project evaluation** is 10. The minimum pass mark for the **interview** is 30.

The results of the Board's assessment for qualifications and project proposals will be published on the ESSE3 portal in the private area of each candidate. No other results notification will be sent to the candidates. At the end of the examination procedure, the Board will carry out an overall assessment and draw up an admission rankings list on the basis of the marks obtained by candidates in each part of the examination. The **assessment criteria for qualifications** will be established by each Examination Board.

## **Art 9. SELECTION BOARD AND GRANT ALLOCATION**

The Rector will appoint a Selection Board with a Rector's decree as per art. 15 of the Politecnico di Bari's PhD Programme Regulations (available on the Politecnico website).

Members of the Selection Board are required to provide self-certification under art. 46 of Presidential Decree 445/2000 attesting that:

- they will advise of any potential conflict of interest in the selection procedure and/or reasons for

abstention or incompatibility with regard to their appointment;

- they do not have a criminal record for acts which excludes them from holding public office, acts which influence professional moral standards or acts as set out in Legislative Decree no. 231/2001;
- they are not currently aware of being under criminal investigation;
- they will carry out their duties in an impartial and professional way, respecting confidentiality and adhering to the current regulations and founding principles of the Politecnico's Ethical and Behavioural Code.

The Selection Board will draft an examination report which will then be submitted to the Post-Lauream Office to provide admission rankings lists for each of the PhD programmes.

Grant allocation will be administered by the Board of each individual PhD programme.

## **ART. 10: ADMISSION RANKINGS AND ELIGIBILITY**

The Rector will issue a decree confirming his approval of the acts (*Decreto di Approvazione Atti* and *Assegnazione Borse*) and publish the names of successful candidates by confirming the ranking lists for admission.

Candidates are admitted to the courses in the order of admission rankings until all available positions have been assigned for each programme.

In cases where candidates have an identical result, gender balance will be considered, with preference given to the minority gender with higher ranked positions in the same list. If candidates are still level, the younger of the candidates will be selected as the beneficiary.

The general admission ranking list for successful candidates (*Decreto di Approvazione Atti* and *Assegnazione Borse*) will be published online as with an official notification on the Official Notifications (Albo Ufficiale) page of the Politecnico di Bari website, as well as in the specific section of [www.poliba.it](http://www.poliba.it).

## **ART. 11: ENROLMENT**

Candidates admitted to PhD programmes must enrol online on the Esse3 platform with the same credentials used for the application procedure.

The terms and regulations for enrolment will be published at the same time as the admission ranking list as an official notification on the Albo Ufficiale page of the Politecnico di Bari website, as well as in the Ricerca/Dottorati di Ricerca section of [www.poliba.it](http://www.poliba.it). This notification will also be attached to the *Decreto di Approvazione Atti* and *Assegnazione Borse* documents.

Candidates who fail to enrol as set out under these regulations for successful applicants will be considered as having waived their status as a successful candidate. This waiver will affect any subsequent entries on the admission ranking list and rulings which may arise as a result.

The notification attached to the *Decreto di Approvazione Atti* and *Assegnazione Borse* document will outline terms and conditions for any subsequent rulings.

Please note that candidates will be given a deadline to implement these procedures, after which failure to reply or comply with the terms will be considered as withdrawal from the rankings.

If a successful candidate waives their position or loses their right to admission before the beginning of the

PhD programme, a replacement participant will be admitted according to their position on the admission rankings list. If a candidate is deemed eligible for more than one programme, they must opt for only one of these.

Replacement admissions are allowed up to two months after the commencement of the programme.

**Please note that if a study grant is waived at any time during the programme, the participant's status as PhD student is annulled.**

If a place on the PhD programme is waived after completing the enrolment process, a stamp duty fee of €16 must be paid.

## **ART. 12: OBLIGATIONS AND RIGHTS OF DOCTORATE RESEARCH STUDENTS**

Participation in the PhD programme is a full-time commitment subject to a specific discipline, in accordance with art. 10 of the Doctorate Research Programme Regulations issued as part of Politecnico di Bari Rector's Decree no. 288 (11 Mar 2022).

Doctorate Research students are hereby notified of their obligation to respect:

- the rules and conditions set out in the Doctorate Research Programme Regulations, issued as part of Rector's Decree no. 288 (11 Mar 2022);
- the Politecnico di Bari's Ethical and Behavioural Code, issued as part of Rector's Decree no. 582 (28 Sept 2018);
- all applicable rules and Politecnico di Bari regulations, including those pertaining to student fees as stipulated by the Politecnico di Bari.

Doctorate students are required to provide documents as stipulated in "Guidelines for accountability for initiative implementors for Mission 4 Component 2":

- report on time schedules;
- periodic reports on principal activities carried out, counter-signed by the scientific supervisor;
- annual report;
- documentation of research activities carried out;
- all payment documentation.

## **ART. 13: GRANTS**

Grants are annual and are renewable on the provision that the student has completed the programme of activities for the previous study year. This is verified in accordance with procedures set out in the Regulations document, on the understanding that grants must be issued once verification has been successfully carried out. The full amount of the scholarship, paid in monthly instalments, is initially determined as no less than the figure of €16,243 outlined in Ministerial Decree no. 247 (23 Feb 2022), published in Official Gazette no. 80 (5 Apr 2022). This figure is gross and subject to social security contributions, which are to be paid by the beneficiary. This amount may be increased by up to 50%, allocated monthly for a period of 12 months if authorisation has been given by the programme Coordinator to carry out research activity abroad. This period may be extended to a maximum of 18 months for PhD students in joint co-ordination with external bodies or those established according to the Politecnico di Bari Regulations

for Doctorate Research Programmes.

All participating PhD students are ensured (as part of the financial resources of the Politecnico budget) a fund for research activity in Italy or abroad which is appropriate to their programme. This funding is no less than 10% of a total grant amount.

Doctorate Research grants may not be added to other types of funding (including research scholarships), except those granted by Italian or non-Italian institutes to provide support to PhD students abroad (with the exception of grants for further training abroad, as per Law 398).

## **ART. 14: FEES AND CONTRIBUTIONS**

Upon enrolment on the programme, PhD students are subject to the current Student Fees and Contributions Regulations. These are available for consultation on the Politecnico website [www.poliba.it](http://www.poliba.it).

PhD students are exempt from the all-inclusive contribution and are required to pay only the electronic revenue stamp and the ADISU Right to Higher Education fee, as well as adhering to the conditions set out in the Politecnico di Bari Fee Regulations.

Politecnico di Bari automatically acquires Equivalent Financial Situation Index certification (ISEE) from the National Social Insurance Agency (INPS) relative to subsidised benefits for higher education study in order to determine the total amount of Regional ADISU fees payable. All declarations should be completed in full on the INPS website by 31 December of the calendar year of enrolment (for Academic Year 2022/23 the deadline will be 31 Dec 2022). Failure to provide declarations by the deadline date will result in the application of the full fee rate.

The enrolment fee is €136, based on a stamp duty of €16 and the first instalment of Regional Tax (€120). ADISU fees are divided into three bands according to annual income, which are respectively €120, €140 and €160. Accordingly, based on the aforementioned ISEE figure, contributions will be invoiced in the private area of each PhD student. All payments must be made using the PagoPA electronic payment system. Payments made this way will be automatically recognised by the EssE3 system

The up-to-date financial contributions of Doctorate Research students are an obligatory condition in order to access Politecnico services and maintain PhD student status.

## **ART. 15: TREATMENT OF PERSONAL DATA**

In accordance with Law 675/96, the private nature of information provided by candidates will be guaranteed. All data provided will be used only for the purposes connected with selection procedures. For successful candidates, this data will also be used for purposes related to the PhD programme, in compliance with current regulations as per European General Data Protection Regulations EU2016/679.

Under arts.15-18 of the aforementioned Regulations, candidates have the right to access their personal data as well as request modifications, additions and cancellation. Candidates may also request limits for the treatment of their data by contacting the Politecnico di Bari at [rpdp@poliba.it](mailto:rpdp@poliba.it).

In all cases, by participating in the selection process applicants give their implied consent for the publication of their data, including examination results, on the Politecnico di Bari website, in line with the abovementioned Law.

In accordance with Law 241 (7 Aug 1990) and Presidential Decree 184 (12 Apr 2006) and subsequent modifications and additions, any party with a related legal interest may have access to the selection procedure documentation, in line with guidelines set out under current legal rules. Accordingly, any documentation provided by applicants may be made available to other candidates.

### **ART. 16: PROCEDURAL SUPERVISOR**

The Procedural Supervisor for selection proceedings is Ms. Anna Flora, Politecnico di Bari Research, International Relationships and Post-Lauream Office, whose contact details are: [post-lauream@poliba.it](mailto:post-lauream@poliba.it), telephone (+39) 080 596 followed by 2229 / 2201 / 2525 or 2068.

### **ART. 17: REFERENCE FOR REGULATIONS**

For any conditions not specified in this document, please refer to current regulations as well as those outlined in the Politecnico di Bari's Regulations for Doctorate Research programmes, issued as part of Rector's Decree 288 (11 Mar 2022).

This call for applications has been published on the website of the Italian Ministry of Universities and Research, Euraxess and the Official Notifications page of the Politecnico di Bari's website ([www.poliba.it](http://www.poliba.it)) and its *Ricerca/Dottorati di Ricerca* section.

Bari, 10th November 2022

The Rector  
Prof. Francesco CUPERTINO

## ATTACHMENT 1

### “SYSTEMS AND TECHNOLOGIES FOR FINAL USES”

#### “Network 4 Energy Sustainable Transition” (NEST)

#### Spoke 4 - “Clean Hydrogen and Final Uses”

*(Scientific Supervisor: Prof. Marco Torresi – Grant Coordinator: Prof. Marco Torresi)*

Recent EU policies and Italian PNRR identified hydrogen (H<sub>2</sub>) as key enabling energy vector for National/EU future. In this sense, Italy needs to promote a new economic paradigm, where H<sub>2</sub> will become one of the pillars of the next future decarbonized energy production. The use of H<sub>2</sub>, either directly or through derivatives such as ammonia (NH<sub>3</sub>), presents important technological problems, but in perspective, offers great margins for improvement in different industrial and energy applications.

Hydrogen addition (or complete substitution) to conventional fossil fuels increases the reactivity and the flame speed of the mixture, causing higher temperature in the combustion chamber and thus higher NO<sub>x</sub> emissions. In this context, a more detailed understanding of the effects of hydrogen addition to traditional fossil fuels on the mixture properties, and thus to the whole combustion process, is crucial.

The PhD student activity will be focused on the development of accurate numerical simulations of the combustion of hydrogen, ammonia and blends of conventional fossil fuel and hydrogen.

The research activities will take place within the Sustainable Mobility Research Lab of Polytechnic University of Bari with reference to the Spoke 14 facilities as well as in the laboratory of the Department of Mechanics, Mathematics, and Management (DMMM) of the Polytechnic University of Bari.

The ideal candidate for this position is an engineering with background in energy systems. It must also demonstrate an aptitude for teamwork and develop a critical and investigative spirit in the research topic.

## ATTACHMENT 2

### “IMPACTS AND LIFE CYCLE ASSESSMENT OF INNOVATIVE FUELS”

#### “National Centre for Sustainable Development” (MOST)

#### Spoke 14 - “Hydrogen and New Fuels”

*(Scientific Supervisor: Prof. Marco Torresi – Grant Coordinator: Prof. M. Dassisti)*

Fuel cells represent a potential solution to eliminate emissions from civil transport on land, sea and air using hydrogen produced from renewable sources as fuel. In this context, Proton Exchange Membrane Fuel Cell (PEMFC) is the most promising technological solution. The gap in the state of the art on PEMFC research is today mainly the sustainability of the component, with particular regard to life cycle durability and cost containment so that this technology can fully enter the market on a large scale to replace internal combustion engines and compete with rival batteries.

The PhD programme will therefore focus on improving the sustainability of PEM fuel cells.

One of the objectives of the research, beyond that to lengthen the useful life, is to think to a method of manufacturing of the fuel cell that returns the product producible in large scale, inexpensive and minimizing resources and production rejects.

The research activity that the PhD student will carry out is the following:

- State-of-the-art analysis of innovative methods to increase the performance and durability of PEMFC applied in transport;
- State-of-the-art analysis of sustainable manufacturing and possible reuse of PEMFC materials at the end of life;
- Characterization of a mathematical model that implements the changes on the components on which it was decided to act in order to optimize performance and durability;
- Performance comparison between original stack and modified stack after research, simulations and experimental tests;
- Planning the redesign and/or fabrication of the stack in a sustainable way.

The activities will take place at the Sustainable Mobility laboratory of the National Center of the Polytechnical University of Bari with specific reference to Spoke 14 and at the laboratories of the Department of Mechanics, Mathematics and Management (DMMM).

The ideal candidate for this position will have to have an engineering type training in the field of mechanical and energy engineering. It must also demonstrate an aptitude for teamwork and the development of a critical and investigative spirit in the field of research.

### ATTACHMENT 3

## **“ENHANCE THE WIRE-BASED ADDITIVE MANUFACTURING FOR LARGE STRUCTURAL MULTI-METAL COMPONENT PRODUCTION”**

### ***“National Centre for Sustainable Development” (MOST)***

#### **Spoke 11 - “Innovative Materials and Reduction”**

*(Scientific Supervisor: Prof. G. Palumbo – Grant Coordinators: Prof. G. Casalino; Prof.ssa C. Casavola)*

Nowadays, the use of innovative materials requires the enhancement of traditional manufacturing techniques and mechanical designing through advanced methodologies of experimental investigation with particular emphasis on the application of modern experimental mechanics and soft modelling for the optimization of the manufacturing process.

This is the case of Wire Additive Manufacturing (WAM), which is being increasingly recognized due to its fabrication of large-scale parts. An enabling technology characterized by integrating cyber and physical spaces, called Digital twin (DT) well-fits to WAM since it can benefit from digitalized assets and data analytics for the process optimization and control.

The Doctorate proposal is focused on studying and modelling WAM. During the activity, the doctorate will identify an appropriate DT implementation architecture to address integration and interoperability issues in WAM by gaining from advanced sensor technologies to respond to variabilities that impact process repeatability, part reproducibility, and quality assurance.

The model will include possibly the characterization of different domains of the material behavior (elastic domain, elastoplastic domain, phase domain, fracture behavior, etc.) and will allow to vary the properties obtained under different manufacturing conditions.

Mechanical properties of manufactured parts will be related to the mode of fabrication or to process parameters of manufacturing with the objective to allow the designing of the properties of products manufactured by high-productivity systems of additive manufacturing using metal filament as a stock material right from the processing phase.

The doctorate will take place in the Laboratory of Innovative Techniques for Advanced Materials Welding TISMA (<https://research.poliba.it/labs-networks/tisma>) and Experimental Mechanics Integrated Laboratory in Aerospace EMILIA (<https://research.poliba.it/labs-networks/emilia>) – Static and Dynamic Testing of DMMM of Polytechnic University of Bari.

The candidate for this position is preferably a mechanical engineer with interest in advanced manufacturing and materials characterization by numerical modelling. Moreover, he has a positive attitude to sensor and soft technologies and their exploitation in the frame of the proposed PhD program.

#### **ATTACHMENT 4**

### **“LOCATION-BASED RECOMMENDATION FOR MAAS”**

#### **“National Centre for Sustainable Development” (MOST)**

#### **Spoke 8 - “MaaS & Innovative Services”**

*(Scientific Supervisor: Prof. M. Ottomanelli – Grant Coordinator: Prof. T. Di Noia)*

Recommender Systems are intelligent software capable of learning user preferences and tastes and suggesting potentially interesting items. These systems are used in various fields and domains, and one of the most popular applications is in ecommerce websites.

Location-based recommender systems are a particular type of those systems whose characteristic is to take advantage of the user's position at a given time to provide suggestions. They are therefore used to recommend restaurants, attractions, museums, or points of interest in general (POIs) that are close to the user. The doctoral program will focus on the "study and design of location-based recommendation models capable of adapting suggestions to the user's position and having Points of Interest as the object of the recommendation". Particular attention will be devoted to the selection of transport mode shift points/nodes as well as to the choice set of possible single/multi modal solutions to be assumed as POIs withing the MaaS framework.

During the Ph.D. activities, the identification of appropriate models and architectures will allow to characterize different types of recommender systems with different paradigms of recommendation.

The general characteristics of the user, in terms of preferences and habits, will be modeled and adapted to the particular context where the user is, in order to receive suggestions that take into account both the long-term profile (generic preferences and constant over time) and contextual constraints of the particular place where the system is operating.

The research activities will take place within the SustainableMobility Research Lab of Polytechnic University of Bari with reference to the Spoke 8 facilities as well as in the SisInfLab laboratory of the Department of Electrical and Information Engineering (DEI) of the Polytechnic University of Bari.

The ideal candidate for this position is an engineering with background in computer science. He/she must also demonstrate an aptitude for teamwork and develop a critical and investigative spirit in the research topic.

## ATTACHMENT 5

### **“RESILIENCE OF NETWORKS, STRUCTURAL HEALTH MONITORING AND ASSET MANAGEMENT”**

***“National Centre for Sustainable Development” (MOST)***

**Spoke 7 - “CCAM & Smart Infrastructures”**

*(Scientific Supervisors: Prof. M. Ottomanelli; Prof. M. Binetti –*

*Grant Coordinators: Prof. M. Ottomanelli; Prof. M. Binetti)*

The PhD program will be focused on the study the viability referred to in the form of a digital twin and in particular on infrastructures such as bridges. Bridges are, in fact, strategic structures quite widespread also

in the city and metropolitan city, of critical importance for the impact on the transport sector in the region, for the economy and in some cases also for tourist reasons (many bridges can represent symbols of cities, such as the Brooklyn and Golden Gate bridges in the United States). The sources of risk are manifold and not completely predictable due to climate-related or human-origin reasons. Therefore, special attention is needed in the design process, accompanied by a continuous and systematic evaluation of the performance and maintenance procedures.

Resilience and reliability of transport networks is strictly related to the structural health condition of such infrastructures. The recent advances in techniques of monitoring, data collection, processing and interpretation are inevitably evident and promising, allowing to extend the modern trend technologies to the field of Structural and Health Monitoring (SHM), using it in the global scale of national urban development plans. The Digital Twin (DT) can be defined as virtual by means of a dynamic representation of a given phenomenon which can be built using the finite element model coupled with in situ measurements as an initial representative model, so it can be updated in near real time as new data are collected through long-term monitoring, providing feedback on the physical twin and running "what-if" scenarios to assess asset risks and predict asset performance.

The proposed research proposal suggests targeted approaches for the SHM of structures of strategic importance within the global scale of the DT of the metropolitan city and for infrastructures at a regional or national scale, exploiting the perceivable capacity of this technique in the management of big data. This objective will be achieved through the study of pilot cases that will be analyzed through monitoring systems based on the detection of environmental vibration data processed with Operational Modal Analysis (OMA) dynamic identification systems and through the implementation of numerical models calibrated on the experimental results. This approach makes it possible to surrogate the response of the

structures to external impulses by providing the managing bodies with suitable tools for the decision making and evaluation phase of the maintenance or safety of the asset. The PhD activities will be performed within the facilities of Polytechnic University of Bari and will be developed within the WP4 of the project of the spoke 7 of the National Centre for Sustainable Mobility.

The ideal candidate for this position will have an engineering background in the structural and/or construction field, with particular knowledge of structural modeling and analysis of experimental data.

Moreover, he/she must have a positive attitude to both qualitative and quantitative research methods in the frame of the content of this PhD scientific program.

## ATTACHMENT 6

### **“BUSINESS AND ORGANIZATIONAL MODELS FOR MOBILITY AS A SERVICE (MAAS)”**

#### **“National Centre for Sustainable Development” (MOST)**

#### **Spoke 8 - “MaaS & Innovative Services”**

*(Scientific Supervisor: Prof. M. Ottomanelli; Grant Coordinator: Prof. A. Messeni Petruzzelli)*

The PhD program will be focused on the study and development of innovative Business and Organizational models for MaaS. These models will be designed to create and exploit synergistic effects between TSPs (transport services providers), customers, local authorities, and environment. Specifically, it will analyze the mechanisms and activities required to create, deliver, and capture new value. More in details, specific tasks will be devoted to identify, for each type of services, the related value proposition, customer segments, customer channels and relationships, key activities and resources, partnerships, revenue streams and cost structure. Relevant MaaS case studies will be analysed. In particular, the research will focus on identifying relevant cases of organisations that supported the adoption and the diffusion of MaaS. An analysis of the academic literature on MaaS will support this activity by highlighting dimensions of interest that will be used to guide the search for relevant cases. Particular relevance will be given to those cases that show success and effectiveness in creating and exploiting synergistic collaborations involving different stakeholders. Data and information will be collected on the identified cases in order to define how they created, delivered, and captured new value by integrating MaaS within their business models. Actually, for each case, the related value proposition, customer segments, customer channels and relationships, key activities and resources, partnerships, revenue streams and cost structure will be identified to better understand how they create, deliver, and capture value. Furthermore, the analysis will also focus on mechanisms and strategies designed to favour synergistic collaborations between TSPs (transport services providers), customers, local authorities, and environment. Both within-case and cross-case analyses will be performed. As a main result a list of business model archetypes that could be used to valorise the adoption and diffusion of MaaS will be defined. On the demand side, in order to revise and refine the characteristic of the synergistic collaborative modes that can be adopted to foster the implementation of MaaS, a survey on potential users will be conducted to identify the critical success factors of integrated transport services. The PhD activities will be performed within the Sustainable Mobility Research Lab of Polytechnic University of Bari with reference to the Spoke 8 facilities as well as in other linked labs. The ideal candidate for this position must have a management engineering background with focus on business and organization models for innovative integrated services providers. Moreover, he/she must have a positive attitude to both qualitative and quantitative research methods in the frame of the content of this PhD scientific program.

## ATTACHMENT 7

### **“IMPACTS AND LIFE CYCLE ASSESSMENT OF INNOVATIVE FUELS”**

#### ***“National Centre for Sustainable Development” (MOST)***

#### **Spoke 14 - “Hydrogen and New Fuels”**

*(Scientific Supervisor: Prof. M. Torresi; Grant Coordinator: Prof. U. Berardi)*

The doctoral program will focus on assessing the sustainability of energy storage in order to promote the penetration of more sustainable options for substituting traditional fuels in thermal engines.

During the PhD activities, hydrogen and lithium battery storage will be evaluated from both an energy and environmental point of view, also using LCA methodologies.

The activities will take place at the Sustainable Mobility laboratory of the National Center of the Polytechnic of Bari with specific reference to Spoke 14 and at the LabZero laboratories - Technical Physics section, of the Polytechnic of Bari.

The ideal candidate for this position will have an engineering background in the mechanical, environmental and/or industrial fields. They must also demonstrate an aptitude for teamwork and the development of a critical and investigative spirit in the research topic.