PROCEDURA DI GARA N° 2/2023 – Partenariato pubblico-privato istituzionalizzato ex art. 17 del decreto legislativo 19 agosto 2016 n. 175 per la realizzazione, gestione ed utilizzo di una infrastruttura tecnologica di innovazione per la mobilità sostenibile in Italia nell'ambito del Progetto ISM4Italy: CIG 96360239BA - CUI F00518460019202300122 – CUP E17G22000600001

PROGETTO APPROVATO DAL MUR

Finanziato dall'Unione europea
NextGenerationEU

MUR

Ministero dell'Università e della Ricerca
Direzione generale dell'internazionalizzazione e della comunicazione

Avviso per la *"Concessione di finanziamenti destinati alla realizzazione o ammodernamento di Infrastrutture Tecnologiche di Innovazione"* da finanziare nell'ambito del PNRR

Piano Nazionale di Ripresa e Resilienza, Missione 4, *"Istruzione e Ricerca"* - Componente 2, *"Dalla ricerca all'impresa"* - Linea di investimento 3.1, *"Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione"*, finanziato dall'Unione europea - NextGenerationEU

Proposta definitiva

Intervention field 6: Investment in digital capacities and deployment of advanced technologies
DESI dimension 4: Integration of digital technologies + ad hoc data collections
055 - Other types of ICT infrastructure(including large - scale computer resources / equipment, data centres, sensors and other wireless equipment)

Finanziato dall'Unione europea
NextGenerationEU

MUR

Spett.le
Ministero dell'università e della ricerca
Direzione Generale dell'internazionalizzazione e della comunicazione
Via Michele Carcani, 61 – 00153 ROMA

OGGETTO: Proposta definitiva in esito alla fase negoziale per l'accesso alle agevolazioni previste dall'Avviso per la concessione di finanziamenti destinati alla realizzazione o ammodernamento di Infrastrutture Tecnologiche di Innovazione, da finanziare nell'ambito del PNRR – Progetto identificato con il codice F7C6728E – ISM4Italy

Il sottoscritto Guido Saracco, nato a TORINO il 24/11/1965, nella sua qualità di legale rappresentante (ovvero, procuratore speciale, in forza di idonea e adeguata procura speciale) del Soggetto Proponente Politecnico di Torino, con sede legale in TORINO, alla via Corso Duca degli Abruzzi , 24,

DICHIARA

- che la proposta definitiva è coerente con gli esiti della fase negoziale espletata a norma dell'art. 11 dell'Avviso in parola;

DICHIARA, altresì

- di confermare tutto quanto già dichiarato in sede di presentazione della Domanda recante Codice F7C6728E
- di essere consapevole che, in caso di dichiarazioni mendaci, ovunque rilasciate nel contesto della presente proposta e nei documenti ad essa allegati, potrà incorrere nelle sanzioni penali richiamate dall'art. 76 del D.P.R. 445/2000, oltre alla decadenza dai benefici, come previsto dall'art. 75 del D.P.R. in parola, conseguenti il provvedimento emanato in base alle dichiarazioni non veritiere;
- di consentire al trattamento dei dati personali per le finalità e con le modalità di cui al decreto legislativo 30 giugno 2003, n. 196, e successive modifiche ed integrazioni.

PRESENTA

la proposta progettuale identificata nella piattaforma GEA con il codice ITEC0000020, di cui alla presente. Costituiscono parte integrante e sostanziale della proposta tutti gli allegati indicati nella Sezione Allegati, che si intendono sottoscritti in uno alla presente, nonché gli Allegati trasmessi in sede di presentazione della domanda, come modificati in questa sede.

Firmato digitalmente

Finanziato dall'Unione europea
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Proposta definitiva

Avviso per la "Concessione di finanziamenti destinati alla realizzazione o ammodernamento di Infrastrutture Tecnologiche di Innovazione" da finanziare nell'ambito del PNRR – Proposta progettuale definitiva in esito alla fase negoziale – Codice F7C6728E

Soggetto proponente

- **Anagrafica Soggetto Proponente**
  - Denominazione: Politecnico di Torino
  - Codice CAR: 000182_UNIV
  - CF: 00518460019
  - Pec: politecnicoditorino@pec.polito.it
  - Tipologia soggetto: Enti e Istituzioni di Ricerca del conto economico consolidato dello Stato
  - Sede legale:
    - CAP: 10129
    - Via/Piazza: Corso Duca degli Abruzzi
    - Civico: 24
    - Comune: TORINO
    - Provincia: TORINO
    - Regione: Piemonte
- **Anagrafica Rappresentante Legale**
  - Nome: Guido
  - Cognome: Saracco
  - Codice fiscale: SRCGDU65S24L219S
  - E-mail: rettore@polito.it
  - Data di nascita: 24/11/1965
  - Comune di nascita: TORINO
  - Sesso: Maschio
- **Anagrafica Referente del progetto**
  - Nome: Giorgio
  - Cognome: Guglieri
  - Telefono: 00390110906860
  - Cellulare: 00393316795997
  - E-mail: infra.mobilitasostenibile@polito.it

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Dati di sintesi della proposta progettuale

Titolo del Progetto: INFRASTRUCTURE FOR SUSTAINABLE MOBILITY

Acronimo del Progetto: ISM4Italy

Settori e ambiti prevalenti dell'iniziativa:

- Digitale, industria, aerospazio:

  - Robotica
  - Innovazione per l'industria manifatturiera
  - Aerospazio

- Clima, energia, mobilità sostenibile:

  - Mobilità sostenibile

Keywords:

Green Aviation; Urban Air Mobility; Digital Twin; Adv Training Method; Electric powertrain; Hydrogen Powertrain; Green Hydrogen prod; Automated driving; Rail system inspect;

Livelli di maturità tecnologica prevalente (TLR): 5; 6; 7; 8;

Data di avvio del progetto: 01/01/2023

Durata del progetto (in mesi): 36

Costo complessivo del progetto: 39.994.192,00 €

Tipologia intervento: Realizzazione/Creazione

Localizzazione

Infrastruttura distribuita: Si

Numero sedi: 12

Sede 1

- CAP: 10129
- Via/Piazza: Corso Castelfidardo
- Civico: 36
- Comune: TORINO
- Provincia: TORINO
- Regione: Piemonte

Sede 2

- CAP: 70026
- Via/Piazza: Via delle Ortensie
- Civico: 19
- Comune: MODUGNO
- Provincia: BARI
- Regione: Puglia

Sede 3

- CAP: 42124
- Via/Piazza: Piazzale Europa
- Civico: 1
- Comune: REGGIO NELL'EMILIA
- Provincia: REGGIO EMILIA
- Regione: Emilia Romagna

Sede 4

- CAP: 80125
- Via/Piazza: Viale G. Marconi
- Civico: 4
- Comune: NAPOLI
- Provincia: NAPOLI
- Regione: Campania

Sede 5

- CAP: 70042
- Via/Piazza: Via S. Sabino
- Civico: 21
- Comune: MOLA DI BARI
- Provincia: BARI
- Regione: Puglia

Sede 6

- CAP: 80146
- Via/Piazza: Corso Nicolangelo Protopisani
- Civico: 70
- Comune: NAPOLI
- Provincia: NAPOLI
- Regione: Campania

Sede 7

- CAP: 10146
- Via/Piazza: Strada Vicinale della Berlia
- Civico: 500
- Comune: COLLEGNO
- Provincia: TORINO
- Regione: Piemonte

Sede 8

- CAP: 81030
- Via/Piazza: Via Pietro Pagliuca - Località Mazzafarro
- Civico: snc
- Comune: CASTEL VOLTURNO
- Provincia: CASERTA
- Regione: Campania

Sede 9

- CAP: 20091
- Via/Piazza: Viale Antonio Gramsci
- Civico: 2
- Comune: BRESSO
- Provincia: MILANO
- Regione: Lombardia

Sede 10

- CAP: 20156
- Via/Piazza: Via La Masa
- Civico: 34
- Comune: MILANO
- Provincia: MILANO
- Regione: Lombardia

Sede 11

- CAP: 10146
- Via/Piazza: Strada Vicinale della Berlia
- Civico: 500
- Comune: COLLEGNO
- Provincia: TORINO
- Regione: Piemonte

Sede 12

- CAP: 47016
- Via/Piazza: Via Giorgio Zoli
- Civico: 56
- Comune: PREDAPPIO
- Provincia: FORLI' - CESENA
- Regione: Emilia Romagna

Piano economico

Costi complessivi di progetto

Spese ammissibili	Costi (€) (1)	IVA (€) (2)	Totale (€) (1+2)
a) Spese Manager Infrastruttura ed altre figure manageriali	900.000,00	0,00	900.000,00
b) Strumentazione scientifica, apparecchiature e macchinari	19.232.339,00	3.522.272,00	22.754.611,00
c) Impianti tecnici generici	6.068.920,00	1.446.482,00	7.515.402,00
d) Licenze software e brevetti	826.351,00	183.249,00	1.009.600,00
e) Fabbricati e terreni	737.869,00	162.331,00	900.200,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	2.606.803,00	543.497,00	3.150.300,00
g) Spese per progettazione e altre spese tecniche	1.013.302,00	226.798,00	1.240.100,00
h) Costi indiretti	2.523.979,00	0,00	2.523.979,00
Totale (€)	33.909.563,00	6.084.629,00	39.994.192,00

Articolazione costi di progetto per localizzazione

Sede/Sito 1			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	180.000,00	0,00	180.000,00
b) Strumentazione scientifica, apparecchiature e macchinari	1.655.738,00	364.262,00	2.020.000,00
c) Impianti tecnici generici	450.820,00	99.180,00	550.000,00
d) Licenze software e brevetti	122.951,00	27.049,00	150.000,00
e) Fabbricati e terreni	327.869,00	72.131,00	400.000,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	491.803,00	108.197,00	600.000,00
g) Spese per progettazione e altre spese tecniche	245.902,00	54.098,00	300.000,00
h) Costi indiretti	294.000,00	0,00	294.000,00
Totale (€)	3.769.083,00	724.917,00	4.494.000,00

Sede/Sito 2			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	0,00	0,00	0,00
b) Strumentazione scientifica, apparecchiature e macchinari	156.000,00	44.000,00	200.000,00
c) Impianti tecnici generici	1.794.000,00	506.000,00	2.300.000,00
d) Licenze software e brevetti	23.400,00	6.600,00	30.000,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	0,00	0,00	0,00
g) Spese per progettazione e altre spese tecniche	62.400,00	17.600,00	80.000,00
h) Costi indiretti	182.700,00	0,00	182.700,00
Totale (€)	2.218.500,00	574.200,00	2.792.700,00

Sede/Sito 3			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	0,00	0,00	0,00
b) Strumentazione scientifica, apparecchiature e macchinari	2.900.000,00	638.000,00	3.538.000,00
c) Impianti tecnici generici	0,00	0,00	0,00
d) Licenze software e brevetti	30.000,00	6.600,00	36.600,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	300.000,00	66.000,00	366.000,00
g) Spese per progettazione e altre spese tecniche	25.000,00	5.500,00	30.500,00
h) Costi indiretti	277.977,00	0,00	277.977,00
Totale (€)	3.532.977,00	716.100,00	4.249.077,00

Sede/Sito 4			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	0,00	0,00	0,00
b) Strumentazione scientifica, apparecchiature e macchinari	2.000.000,00	440.000,00	2.440.000,00
c) Impianti tecnici generici	3.054.100,00	671.902,00	3.726.002,00
d) Licenze software e brevetti	0,00	0,00	0,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	0,00	0,00	0,00
g) Spese per progettazione e altre spese tecniche	20.000,00	4.400,00	24.400,00
h) Costi indiretti	309.520,00	0,00	309.520,00
Totale (€)	5.383.620,00	1.116.302,00	6.499.922,00

Sede/Sito 5			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	0,00	0,00	0,00
b) Strumentazione scientifica, apparecchiature e macchinari	4.964.526,00	373.674,00	5.338.200,00
c) Impianti tecnici generici	0,00	0,00	0,00
d) Licenze software e brevetti	0,00	0,00	0,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	0,00	0,00	0,00
g) Spese per progettazione e altre spese tecniche	0,00	0,00	0,00
h) Costi indiretti	401.800,00	0,00	401.800,00
Totale (€)	5.366.326,00	373.674,00	5.740.000,00

Sede/Sito 6			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	0,00	0,00	0,00
b) Strumentazione scientifica, apparecchiature e macchinari	1.956.075,00	430.336,00	2.386.411,00
c) Impianti tecnici generici	100.000,00	22.000,00	122.000,00
d) Licenze software e brevetti	0,00	0,00	0,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	0,00	0,00	0,00
g) Spese per progettazione e altre spese tecniche	0,00	0,00	0,00
h) Costi indiretti	175.589,00	0,00	175.589,00
Totale (€)	2.231.664,00	452.336,00	2.684.000,00

Sede/Sito 7			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	240.000,00	0,00	240.000,00
b) Strumentazione scientifica, apparecchiature e macchinari	500.000,00	110.000,00	610.000,00
c) Impianti tecnici generici	50.000,00	11.000,00	61.000,00
d) Licenze software e brevetti	150.000,00	33.000,00	183.000,00
e) Fabbricati e terreni	125.000,00	27.500,00	152.500,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	50.000,00	11.000,00	61.000,00
g) Spese per progettazione e altre spese tecniche	100.000,00	22.000,00	122.000,00
h) Costi indiretti	96.811,00	0,00	96.811,00
Totale (€)	1.311.811,00	214.500,00	1.526.311,00

Sede/Sito 8			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	0,00	0,00	0,00
b) Strumentazione scientifica, apparecchiature e macchinari	1.250.000,00	275.000,00	1.525.000,00
c) Impianti tecnici generici	80.000,00	17.600,00	97.600,00
d) Licenze software e brevetti	150.000,00	33.000,00	183.000,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	1.050.000,00	231.000,00	1.281.000,00
g) Spese per progettazione e altre spese tecniche	150.000,00	33.000,00	183.000,00
h) Costi indiretti	228.872,00	0,00	228.872,00
Totale (€)	2.908.872,00	589.600,00	3.498.472,00

Sede/Sito 9			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	120.000,00	0,00	120.000,00
b) Strumentazione scientifica, apparecchiature e macchinari	550.000,00	121.000,00	671.000,00
c) Impianti tecnici generici	70.000,00	15.400,00	85.400,00
d) Licenze software e brevetti	75.000,00	16.500,00	91.500,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	150.000,00	33.000,00	183.000,00
g) Spese per progettazione e altre spese tecniche	80.000,00	17.600,00	97.600,00
h) Costi indiretti	87.395,00	0,00	87.395,00
Totale (€)	1.132.395,00	203.500,00	1.335.895,00

Sede/Sito 10			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	120.000,00	0,00	120.000,00
b) Strumentazione scientifica, apparecchiature e macchinari	1.250.000,00	275.000,00	1.525.000,00
c) Impianti tecnici generici	70.000,00	15.400,00	85.400,00
d) Licenze software e brevetti	75.000,00	16.500,00	91.500,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	150.000,00	33.000,00	183.000,00
g) Spese per progettazione e altre spese tecniche	80.000,00	17.600,00	97.600,00
h) Costi indiretti	147.175,00	0,00	147.175,00
Totale (€)	1.892.175,00	357.500,00	2.249.675,00

Sede/Sito 11			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	240.000,00	0,00	240.000,00
b) Strumentazione scientifica, apparecchiature e macchinari	1.700.000,00	374.000,00	2.074.000,00
c) Impianti tecnici generici	100.000,00	22.000,00	122.000,00
d) Licenze software e brevetti	150.000,00	33.000,00	183.000,00
e) Fabbricati e terreni	285.000,00	62.700,00	347.700,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	115.000,00	25.300,00	140.300,00
g) Spese per progettazione e altre spese tecniche	150.000,00	33.000,00	183.000,00
h) Costi indiretti	230.300,00	0,00	230.300,00
Totale (€)	2.970.300,00	550.000,00	3.520.300,00

Sede/Sito 12			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	0,00	0,00	0,00
b) Strumentazione scientifica, apparecchiature e macchinari	350.000,00	77.000,00	427.000,00
c) Impianti tecnici generici	300.000,00	66.000,00	366.000,00
d) Licenze software e brevetti	50.000,00	11.000,00	61.000,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	300.000,00	36.000,00	336.000,00
g) Spese per progettazione e altre spese tecniche	100.000,00	22.000,00	122.000,00
h) Costi indiretti	91.840,00	0,00	91.840,00
Totale (€)	1.191.840,00	212.000,00	1.403.840,00

Cronoprogramma di attuazione

Obiettivi intermedi: una sintesi

Codice identificativo	Mese di avvio (dalla data di avvio progetto)	Durata (in mesi)	Stima dei costi (€)
1	01/01/2023	4	3.999.419,20
2	01/05/2023	8	18.000.000,00
3	01/01/2024	13	11.000.000,00
4	01/02/2025	7	2.994.772,80
5	01/09/2025	4	4.000.000,00
		Totale (€)	39.994.192,00

Obiettivo intermedo: 1

• Descrizione

Start up activities - The main objective is to establish an effective management of the ISM4Italy project. The first step will be to recruit the personnel, including the Infrastructure Manager (IM), local infrastructure coordinators and research managers. The second step of the IO1 will define the continuous monitoring procedures, the risk analysis and contingency plan and foster its long-term sustainability according to the strategies and roadmap defined. Finally, preliminary activities to initiate the design of the infrastructure will be conducted. The following Actions and timespan are foreseen:
Task 1.1 Recruitment (M1-M4)
Task 1.2 Definition of the continuous monitoring procedures (M2-M4)
Task 1.3 Definition of the risk analysis and contingency plan (M2-M4)
Task 1.4 Definition of the models for long-term sustainability (M2-M4)

• Mese di Avvio

1

• Durata in Mesi

4

• Deliverables

D. 1.1 – Report with profiles for the IM and other staff recruitment plus recruited personnel
D. 1.2 – Report including the procedures for: continuous monitoring and risk analysis, contingency plan, and long term sustainability

Obiettivo intermedo: 2

• Descrizione

Design of the infrastructure up to supplier selection and purchase of equipment. Construction work plan - The main goal of IO 2 consists in completing the design phase, defining the technical specifications for all the laboratories making up the infrastructure ISM4Italy. Detailed definition of the infrastructure requirements and of the following aspects is expected: buildings refurbishing, design of new facilities and adaptation of specific sites. After the completion of all the technical requirements, is envisaged the supplier inquiry, selection, agreements set up and procurement/order placement of all hardware and sourcing of all external services. Definition of the construction work plan and refinement of business plan will take place as well. The design of each laboratory is represented as a stand-alone task. Detailed description of the tasks and related KPIs and deliverables can be found in Annex 1 section B point 4.

- Mese di Avvio

  5

- Durata in Mesi

  8

- Deliverables

  D. 2.1 – Design report including the output at month 12

Obiettivo intermedo: 3

- Descrizione

Construction - After the conclusion of design phase (IO2), the construction phase of all the laboratories part of ISM4Italy will take place. The expected goals for this IO, within 25 month since the project start is the completion of the technical installations, along with building/land purchases, renovation, refurbishment and extension where necessary. Construction of each laboratory is represented as a stand-alone task. Detailed description of the tasks and related KPIs and deliverables can be found in Annex 1 section B point 4.

- Mese di Avvio

  13

- Durata in Mesi

  13

- Deliverables

  D. 3.1 – Midterm review report at month 19
D. 3.2 – Final detailed report at month 25

Obiettivo intermedo: 4

- Descrizione

Commissioning - After the conclusion of construction phase (IO3), the commissioning phase of all the laboratories part of ISM4Italy will take place. The expected goals for this IO, within 32 month since the project start are:
•performance verification and validation tests of the infrastructure will be carried out to activate more than 70% of the facilities. Thus, the infrastructure commissioning will be completed, and the experimental facilities enabled
•performance tests of all parts and software, both as standalone system and as in network co-operation.
Commissioning of each laboratory is represented as a stand-alone task.

• Mese di Avvio

26

• Durata in Mesi

7

• Deliverables

D. 4.1 – Commissioning report for all laboratories of the ISM4Italy at month 32

Obiettivo intermedo: 5

• Descrizione

Outreach and opening to the market - After the conclusion of commissioning phase (IO4), the outreach and opening to market phase of all the laboratories part of ISM4Italy will take place. The expected goals for this IO, within 36 month since the project start are:
•Opening to market
•Monitoring of multi-site laboratories status synchronization
•Dissemination
Each of them is detailed as a task with is own specific timeframe as follows.
Task 5.1 Opening to the market (M33-M34)
Task 5.2 Dissemination (M33-M36)

• Mese di Avvio

33

• Durata in Mesi

4

• Deliverables

D. 5.1 – Website creation, LinkedIn, and other social media profile creation at month 34
Outreach and opening to the market (report) at month 36

Allegati

Allegato 1 - Proposal template

Allegato 1: ***Proposal template***

Ministero dell'Università e della Ricerca
Direzione generale dell'internazionalizzazione e della comunicazione

Avviso per la *"Concessione di finanziamenti destinati alla realizzazione o ammodernamento di Infrastrutture Tecnologiche di Innovazione"* da finanziare nell'ambito del PNRR

Missione 4, "*Istruzione e Ricerca*" - Componente 2, "*Dalla ricerca all'impresa*" - Linea di investimento 3.1, "*Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione",* finanziato dall'Unione europea - NextGenerationEU

REFORMS AND INVESTMENTS UNDER THE RECOVERY AND RESILIENCE PLAN

NextGenerationEU

Call for proposals

Intervention field 6: Investment in digital capacities and deployment of advanced technologies
DESI dimension 4: Integration of digital technologies + ad hoc data collections
055 - Other types of ICT infrastructure (including large-scale computer resources/equipment, data centres, sensors and other wireless equipment)

Mission 4 – "Education and Research"
Component 2: from research to business
Investment 3.1: "Fund for the realization of an integrated system of research and innovation infrastructures

Annex 1 (technical annex)

Proposal template, pursuant to Article 8 of the call for proposals

(To be provided in English only)

DISCLAIMER: This document is aimed at informing potential applicants for call-PNRR funding. It serves only as an example. The actual Web forms and templates, provided in the online proposal submission system under the online proposal submission system, might differ from this example. Proposals must be prepared and submitted only via the online proposal submission system.

Part A – Strategic framework of the initiative *(max. 12,000 characters)*

A.1. Objectives of the initiative

The primary purpose of ISM4Italy is the creation of a bridge between research and industrial application, accelerating the transition from TRL 3-5 to TRL 5-8, strengthening the partnership between universities and smart companies, implementing a novel business model in which the academic research is the driver of industrial activities, enhancing the competence of industrial staff and extending the competitiveness of the Italian industrial environment. The national network of facilities of ISM4Italy will also enforce the interregional cooperation, breaking the local paradigms which may preclude a national vision for industrial development. The implementation of open laboratories is expected to revive the connection between industries and companies, universities and research centres in the country, to respond to high TRL European calls for research and challenges.

The Italian Aerospace sector ranks fourth in Europe and seventh in the world. The overall revenue is of nearly 13,5 billion Euro, which accounts for 0,65% of the GDP; the added value is of about 12 billion Euro. Key aspects are the innovation and research, which accounts for about 10% of the revenue, in good agreement with the EU average. Nearly 50.000 specialized employees and more than 200.000 overall in the sector are distributed across 4.000 companies. The vast majority, nearly 90%, are SMEs, although there are world leading companies (e.g., Leonardo, Avio Aero and Thales Alenia Space Italia).
Looking at the entire Automotive European sector, the number of employees is 14,6 million (6,7% of the entire workforce) and generates a turnover of 1,280 billion euros, with total investments of approximately 70 billion euros per year in research and development. In Italy, the sector involves 15.000 companies, about 2% of the total of Italian companies, of which 92% classified as SMEs, with revenues of 155 billion euros (7,1% of GDP). These companies employ 283.000 workers, 3% of the total Italian workforce, which corresponds to 7% of employees in the manufacturing industry, and SMEs absorb 82% of this workforce. Five regions collect 80% of the total turnover: Piemonte (28%), Lombardia (21%), Lazio (11%), EmiliaRomagna and Veneto (9% each).
The Railway sector in Italy includes the three main pillars of the railway systems: infrastructures, technological systems and rolling stock. The overall revenue of the entire railway sector is 4.5 billion euros (in 2020), with 1,1 billion of export. The direct number of employees is around 15.000, with an estimated number of 30.000 employees including the supply sector. About 130 companies have their site and operate both in Italy that abroad, with a notably prevalence in North-Center Italy, but also in Campania.
The activities of ISM4Italy will focus on multidisciplinary technologies for Aeronautics, Automotive and Railway systems, addressing the integration of design concepts and propulsion systems for sustainable mobility.
In Aeronautics, the activities of ISM4Italy will focus on the cooperation between systems with different levels of autonomy, combined with infrastructures and novel air traffic frameworks. Primary targets of the research are also the creation of simulation platforms based on virtual, mixed and augmented reality, aimed at the design (digital twin), certification, training and maintenance in aeronautics. The activities will also deal with advanced human-centred design methodologies to increase comfort, improve risk and safety management, and foster the introduction of the circular economy concepts.
In Automotive, the activities of ISM4Italy will build a network of testing facilities to support the development of innovative solutions for electrified and hydrogen powertrains. The facilities will be focused on: hydrogen propulsion systems based on fuel cells and internal combustion engines; green hydrogen generation systems and vehicle refuelling stations; electric powertrains automated vehicles.

In Rail systems the activities of ISM4 Italy will focus on the application of novel technologies, such as Artificial Intelligence (AI), in connection to testing equipment, to monitor the infrastructure to improve the safety of the rail transport system.
This aim of the project is to develop the following technologies supported by dedicated testing infrastructures interconnected together:

- Experimental equipment and methodologies aspects for autonomous and connected transport platforms (both terrestrial and fixed and rotary wing aircraft), in software, hardware, and man-inthe-loop environments.
- Methods for testing, support certification and training of autonomous and connected vehicle operators in a laboratory environment (indoor and outdoor).
- Verification methodologies in operating conditions close to real operations for the development of electrified powertrains and their components, increasing their efficiency and sustainability.
- Experimental methods for the development of hydrogen propelled systems, aiming to increase their efficiency and sustainability.
- Methods to support the transition and conversion to semi-autonomous and autonomous vehicle/aircraft through virtual and physical experimentation.
- Methods based on new technologies such as AI and sensor fusion for the monitoring of rail infrastructure to improve the safety and availability.

A.2. Geographical area of interest

ISM4Italy is a distributed network of experimental facilities involving the following regions, from North to South in the following regions: Piemonte, Lombardia, Emilia Romagna, Campania, Puglia.

A.3. Sectors/domains

ISM4Italy is aiming at developing the Automotive, Rail Systems and Aviation sectors (Aviation is part of the Aerospace environment), enforcing the industrial targets coherent with Sustainable Mobility European SRIAs. These sectors are beneficially transferring solutions and methods from Robotics, as a driver for the implementation of autonomous vehicles and aircraft.

A.4. Keywords

• Green Aviation,
• Advanced Air Mobility,
• Urban Air Mobility,
• Digital Twin,
• Advanced Training Methodologies,
• Zero-emission mobility,
• Electric powertrain,
• Hydrogen Powertrain,
• Green Hydrogen production,
• Automated driving.
• Rail System inspection.

A.5. Prevailing levels of TRLs

ISM4Italy is supporting the transition of TRLS from 5 to 8.
ISM4Italy is the step forward for research outputs of regional clusters and national centres, that typically focus on lower research levels (TRL 3-5), enforcing a strong technology transfer action and supporting the readiness/competitiveness for the market for commercial and industrial purposes.

A.6. Coherence with the priorities set in the European, National and Regional strategic agendas

The Technological Innovation Infrastructure of ISM4Italy is consistent with the programme objectives stated in the proposed framework programme (Article 3) of *Horizon Europe and Work Programme 20212022 Climate, Energy and Mobility* Key Strategic Orientations of making Europe the first digitally led circular, climate-neutral and sustainable economy, through the transformation of its mobility, energy, construction and production systems. With reference to 2Zero General Objectives, ISM4Italy will contribute to Europe having the first carbon-neutral road transport by 2050 and with the specific objective of developing zero tailpipe emission, affordable, user-centric solutions for road-based mobility across Europe. Additionally, ISM4Italy will support the 2Zero operational objective of developing affordable BEV and FCEV concepts and technologies. At National level ISM4Italy is consistent with "*Missione 2: rivoluzione verde e transizione ecologica*" which aims at supporting "renewable energy, hydrogen, power grid and sustainable mobility". At regional level the *Smart Specialization Strategy of Piedmont Region* indicates electrification, connected, digital and integrated mobility as main challenges.
The key challenge facing the Aviation sector in the next decades is to develop and introduce safe, reliable, and affordable Low-to-Zero-Emission air transport for citizens, and to concurrently ensure Europe's industrial leadership is maintained and strengthened throughout the transition to a climate-neutral continent. As a remarkable note, EU plans to reduce aviation emissions by at least 55% by 2030, to reach climate neutrality by 2050 (The European Green Deal, COM-2019, 640). Transforming aviation towards climate neutrality will require an integrated approach. Within this line of action, three key thrusts have been identified by the *Clean Aviation Programme* (Strategic Research and Innovation Agenda, 2020): hybrid electric and full electric architectures, ultra-efficient aircraft architectures, and disruptive technologies to enable hydrogen-powered aircraft. Advanced and Urban Air Mobility is also expected to become a reality in Europe within next years. New technologies such as aerial robotics, electric propulsion, and enhanced battery capacity, applied to hybrid and vertical take-off and landing systems, make this potentially possible. Several pilot projects are under way and some European manufacturers have already applied for certification, including piloted vehicles for passenger transport. EASA is working with these stakeholders on the airworthiness of the vehicles. The insertion in airspace of these unconventional aerial vehicles will also reset the current implementation of air traffic control (U-space concept of operations) and the take-off and landing infrastructures, as demonstrated by the relevant activities endorsed within SESAR JU Consortium.

A.7. Synergies with other initiatives envisaged within Mission 4 ("Education and research"), Component 2 ("From research to enterprise"), with particular, but not exclusive, reference to Investment 3.1 ("Fund for the creation of an integrated system of research and innovation infrastructures")

Nowadays, global climate challenges need to be assessed to guarantee a proper management of resources available on our planet, through the implementation of more sustainable models. Given that 23% of Europe's GHG emissions are produced by transport, an acceleration of sustainability of the transportation systems is required, and it is a crucial point for the NRRP initiatives. Additionally, road accidents are one of the main causes of deaths. Indeed, the target set at European level is to reduce the transport's sector emission by 60% within 2050 and to reduce the road traffic deaths and injuries by 50% by 2030. All this requires the adoption of the newest technologies and the usage of the most efficient systems.
ISM4Italy is expected to act in full synergy with the other projects that are programmed and will be funded within the NRRP Mission 4, Component 2, through the commitment of the members.
It is important to mention the expected synergies with the National Centre for Sustainable Mobility (CNMS), whose primary mission is to build a competent Italian leadership, consistent with territory's needs and companies' excellence, and capable of supporting the future development towards an inclusive and sustainable mobility. Particularly, CNMS aims at implementing a real change in the transportation systems, for instance to enable zero-emission vehicles, and it is fully aligned with the Flagship actions of the EU and Italian mobility and strategy plan. Furthermore, other synergies are expected with the National Centre for HPC, Big Data, with the Extended Partnership (PE) on Artificial Intelligence (PE11).
Moreover, expected synergies will come from the Research Infrastructures, Technological Innovation Infrastructures, and Innovation Ecosystems in which POLITO will be involved.
According to Mission 4 "Education and research", ISM4Italy can play an important role in strengthening the R&D system by improving higher education including bachelor, master, and PhD. The state-of-the-art infrastructure will allow strengthening a hands-on learning approach based on multidisciplinary projects and Challenges in cooperation with the partner companies that has already proven effective to link education and industry.
The innovation infrastructure will give more opportunities to test new solutions proposed by students and young researchers, with an important impact in terms of intellectual property generation and new start-ups.

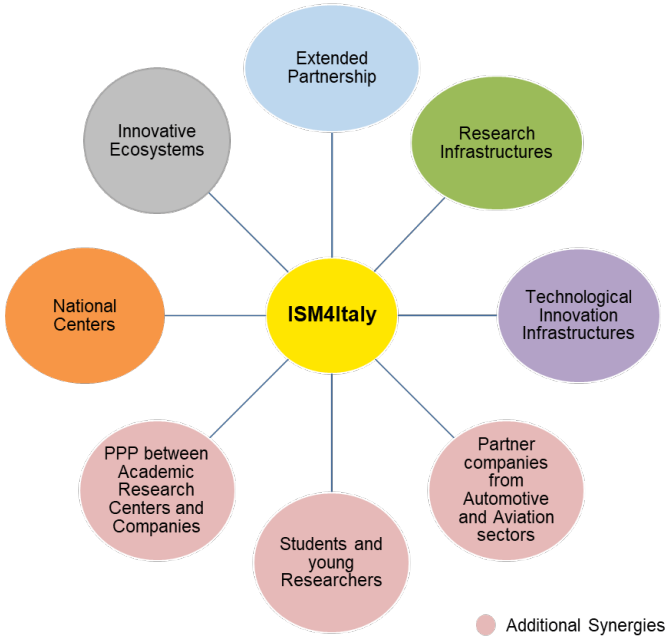

Figure A.1. – Synergies of ISM4Italy (II) with other NRRP Investments.

A.8. International profile and reach of potential users (with particular reference to SMEs)

The uniqueness of the ISM4Italy infrastructure and presence of high national and international recognized universities guarantee a high potential for leading global innovation in the sector, with consequential benefits both from the social, environmental, and future generations point of view. With a tradition of expertise and talent attraction in the background, these territories are the perfect places to lower the existing barriers to innovation, especially for SMEs. Smart mobility involves a complex technological network including vehicle manufacturers, suppliers, and universities, that need valuable scientific results, innovative technologies, and multidisciplinary methodologies to insure their competitiveness. Keeping or increasing the competitiveness is a matter of death or life for a company in a sector characterized in these years by one of the most radical transformations of its history. Companies clearly understand that adapting to and leading the new technologies will decide their existence. There is also a clear understanding that finding ways for small Italian companies to scale up, to form networks and clusters, and to become part of global value chains is critical to the sector's continued success.
ISM4Italy represents an opportunity for the automotive sector to lead the way in guaranteeing Italy with a research infrastructure dedicated to smart and zero emission mobility systems enabling to develop globally innovative products and services which will lead to high value jobs and a positive and long-lasting effect on the middle-class.
Enhancing competitiveness has the indirect positive effects of pushing competitors to increase innovation and quality level of their offers, with advantages also for users that can rely on safer and trustworthy mobility solutions. The development of a toolchain dedicated to smart and sustainable mobility is fundamental to obtain the levels of efficiency, reliability, safety, and performance requested by the Society. ISM4Italy will therefore answer to the need of making available a toolchain going from laboratory testing to track testing of automated and zero emission vehicles as well as smart road infrastructures, that is today unavailable not only in Italy but also in Europe. This can boost competitiveness of Italy worldwide, allowing for higher quality and safety of the mobility services for all the international users.

A.9. Start date of the initiative

1st January 2023

A.10. Please choose one of the following options below:

☐ Single-Site Infrastructure
☑ Multi-Site Infrastructure

Part B – Initiative features *(max 40,000 characters)*

B.1. Activities

(Describe the initiative, highlighting and motivating its innovative profile. This section should also include evidence of compliance with constraint 055 - Other types of ICT infrastructure (including

large-scale IT resources/facilities, data centres, sensors and other wireless devices)" in Annex VII of Reg. (EU) 2021/241)

Ground and air transportation systems, and in particular Automotive, Aviation and Railway sectors are characterized by very complex technological environments that involve a vast network of counterparties not only including the manufacturers of vehicles (road and rail) and aircraft, but also companies, universities and research institutes. This network can develop scientific results, innovative technologies, and multidisciplinary methodologies of fundamental importance for the sustainability and the competitive growth, within green objectives. The development of the industry related to Automotive, Railway and Aviation is stimulated by an incessant technological race. High competitiveness leads companies in these sectors to focus more on innovation, with the aim of proposing products and services with a better market value. On the other hand, high investment cost in infrastructure characterizes railway transportation, requires suitable monitoring devices for ensuring the safety and the availability of the infrastructure. The Automotive, Aviation and Railways industries have developed very quickly in recent years, thanks also to projects with a high technological content, such as those relating to intelligent and electric mobility, autonomous flight, and thanks to the synergies between universities, research institutions and companies that allow proper development and positioning within a real National and European technological ecosystem. Also, railways, with the development of high-speed networks, made a significant step forward for what concern the vehicle and the necessary technological infrastructure. The Infrastructure for Sustainable Mobility (ISM4Italy) will therefore integrate the experimental and technological demonstration capabilities of the reference sectors, currently still territorial, extending their domain towards an integrated National system, capable of responding to the needs of companies, especially in terms of enhanced Sustainable Mobility.
This challenging goal will be based on the exploitation of the following assets:

- Equipment and methodologies to characterize electrified powertrains and their components (engine, propeller where present, inverter, drive train and battery pack) in operating conditions close to real for increasing their efficiency and sustainability (economic and environmental).
- Equipment and methodologies to characterize hydrogen propelled systems, with the goal of increasing their efficiency and sustainability (economic and environmental).
- Equipment and methodologies to test green hydrogen production systems for increasing their efficiency, safety, and sustainability.
- Equipment and methodologies to monitor the rail infrastructure for increasing their safety, reliability, and availability.
- Equipment and scientific/methodological aspects for the development of autonomous and connected transport platforms (both terrestrial and fixed and rotary wing aircraft), through virtual simulation, experimentation in software, hardware, and man-in-the-loop environments.
- Equipment and scientific/methodological aspects for system level testing of vehicles for improving their energy efficiency and safety.
- Design and construction of cooling systems that guarantee high performance of the engines.
- Design aimed at improving the efficiency of cooling systems to preserve the integrity of the protective coatings, while minimizing the flow of cooling air.

H2 Powertrain

As a pillar of their position in the field of sustainable and low-emission powertrains, Politecnico di Torino and leading industry partners foresee the development of their capacity for development, calibration, and validation of H2 powertrains, based on both fuel cells and on internal combustion engines.

Within this frame, is proposed the conversion of an existing internal combustion engine test bench to H2. This test bench shall be made capable to execute testing activities on fuel cells and ICEs fuelled by H2 and, in general, e-fuels. For completely representative operation of both kinds of powertrains, the test facility shall be equipped with a safe H2 supply system as well as with a high-voltage battery emulator and the capability to install and operate e-motors.
Moreover two standard ICE engine test cells will be converted in:

1. Hydrogen Fuel cell test focused on the entire BoP, High voltage, H2 consumption, controller algorithm development, chemical processes on the fuel stacks. The equipment will be comprehensive of the key capabilities:
    - H2 supply (storage, distribution, and measurement)
    - Dynamic electric brake for electric motor testing
    - Battery emulator
    - Thermal energy management systems
    - Automation system
2. Hydrogen and e-fuels ICE test cell environment focused on engine development, controller algorithm development for the combustion optimization, certification, and homologation. The test setup will include the following capabilities:
    - H2 and e-fuels supply (storage, distribution and measurement)
    - Dynamic electric brake for ICE Heavy duty testing
    - Emission analyzers for near-zero measurements
    - ISO/IEC 17025 compliant
    - Automation system

As far as the fuel cells systems are concerned, the innovative target will be to carry out the validation at system level and to develop and optimize the control system for the final vehicle application.
The innovative aspect of the H2 ICEs, test benches is that they will allow developing and validating the hardware-related solutions and to optimize the control system to minimize H2 consumption and pollutant emissions. The test bench will maintain the capability to operate on liquid fuels in perspective of carbon-neutral e-fuels.
As the complexity of powertrain systems is growing, the need for granting the operability of this powertrain test facility in real-time synchronization with other HiL laboratories arises. Another innovative aspect of the H2 Powertrain infrastructure is that it will allow the simulation of complex electrified powertrain architectures can be carried on by the implementation of a virtual mechanical connection to other remote powertrain components. This requires the upgrade of the test bench automation and supervision system, to implement complex model-based DoE test management and remote Cloud connection.

Production of green H2 for engine and vehicle test

The core business of many powertrain companies is focused in the calibration of Diesel engines. Recently the trend leads to a diversification strategy towards alternative engines, such as petrol, gas, hybrid and electric vehicles. Moreover the combustion of hydrogen in internal combustion engines is gaining attention. The development includes CFD simulation to first understand the phenomena of mixing and ignition of hydrogen and then to adapt the engine test-cells to test the engine powered by hydrogen.
Within the infrastructure Politecnico di Bari and partner companies Within the Infrastructure plan to produce 100% green hydrogen by means of production, storage and exploitation of hydrogen from a photovoltaic plant connected with a centralized electrolyser. The hydrogen will be used to power supply the engine test benches (by updating the existing diesel ones) and the engine cells will be available to the partners for calibration and testing of components by optimizing the combustion parameters.

Test e-Drive

UniMoRe and partner companies will design and deploy a laboratory (Test e-Drive) for the testing of electric motors and electric axles for automotive applications. The laboratory will include three state-of-the-art test benches.

1) Testbench for electric motors (with and without inverter), for efficiency analysis and validation of Noise-Vibration-Harshness (NVH) performance and battery management system. The bench will be able to reach rotational speeds of up to 20000 rpm, with 500 Nm of torque (600 Nm overload) and 250 kW of power (350 kW overload). Integrated in the bench there will be a battery simulator with 310 kW of power (370 kW overload) and a dynamometer brake for road profile simulation.

2) Testbench for integrated electric axle, in climatic cell, able to carry out functional, NVH, efficiency, and environmental simulation checks. The bench includes a 350kW battery simulator and two dynamometer brakes each with 150 kW of power (240 kW overload) and 2500 Nm (5000 Nm total) of torque.

3) Testbench for durability tests of the integrated electric axle with continuous power of 250kW and peak power of 350 kW per wheel and consequently with a battery simulator characterized by a power of 750 kW.

Powertrain test bench for Heavy Duty and Off-Road Vehicles

The importance of powertrain testing reproducing any on-road/off-road driving condition is rapidly increasing in the development process of sustainable vehicle. The different available power sources in the modern vehicles (e.g., combustion engine/battery/fuel cell) require more and more efforts for component integration, energy management optimization and so on. This has a direct impact on the time-to-market of the product, the product cost and reliability, as well as the sustainability of the commercial and off-road vehicle. The development process can much faster and efficient reducing effort, cost and the related environmental impact.

The infrastructure includes the setup of a full-flexible test bench for powertrains up to 900 kW capable to test a complete 2-wheel powertrain as well as single power unit of different type: only combustion engine, hybrid, full electric and fuel cell. This type of facility isn't available in Italy, neither at the industrial partner, neither at the public centres. Its availability will represent a very powerful facility in service for Italian Companies and Academic/Scientific Institutions.

Diagnostica Infrastruttura Ferroviaria

Monitoring of infrastructure is a key issue to increase the safety of the infrastructure at lowest life cycle cost. A large part of railway LCC depends on Tracks and S&C monitoring.

The aim of the railway laboratory is to realize a mobile monitoring system that is described through three main components:

- Rail inspection vehicle which supports the measurement devices.
- Devices used to perform the measurements.
- Post-processing method for rail and overhead line defect detection.

The monitoring system includes innovative technologies for three main activities:

- Measurement and inspection of the overhead line.
- Track inspection.
- Ultrasonic rail inspection.

The innovation aspect of the Mobile Monitoring System is characterized as follows:

- The majority of monitoring and measuring systems are designed as independent tools thus making difficult the fusion of information and its integration in the maintenance process: the present

initiative aims to equip a rail diagnostic vehicle with synergic devices to cover the main issue of rail maintenance.

- Maintenance is currently based on periodic preventive maintenance based on good practices: the present initiative exploits the predictive maintenance principles for early failure detection.
- Rail asset is complex environment including several actors - often with conflicting priorities - involved in infrastructure operation and maintenance: the Mobile laboratory brings a collaborative approach in the maintenance organization.
- The installed technologies are able to check the compliance with the novel track geometry European standards.

Micro-Hole Cooling Lab

Within this infrastructure infrastructure, Università di Napoli "Federico II" and partner companies will study and develop innovative cooling systems for hot surfaces using micro holes. Such cooling technologies are also called "micro hole cooling" and these are particularly used in the cooling, for example, of the combustion chambers of aircraft engines and other propulsion systems. The idea is to create a specific laboratory able to design, build and test innovative cooling systems through the following activities:

- Use of innovative Laser Sources (UltrashortPulseLaser) for the creation of micro holes.
- Advanced in process inspection methods.
- Process Monitoring and Control.
- Extension to the manufacturing.
- Performance verification test.
- Validation using Computational Fluid Dynamics and Lumped Element numerical modeling.

Campus del Volo

With the establishment in the neighbouring Città dell'Aerospazio of the functional activities for the MS Degree Course in Aerospace Engineering of Politecnico di Torino and of the facilities for Air Mobility Spoke (National Centre for Sustainable Mobility - Centro Nazionale Mobilità Sostenibile), the use of the Torino Aeritalia International Airport (I-LIMA) is envisaged to host activities related to research and training for the aeronautical supply chain, such as a flight simulation laboratory (SimLab), a laboratory for aircraft maintenance technologies (EASA Part66) with a vocation for experimenting methodologies based on Augmented/Virtual Reality, and finally a laboratory dedicated to autonomous flight, including the experimentation of H2 propulsion (DroneLab). This initiative therefore supports the construction of a new multifunctional experimental center managed by POLITO and by the partner companies, also hosting the activities of PIC4Ser Interdepartmental Center - POLITO Interdepartmental Center for Service Robotics (https://pic4ser.polito.it/) and some student teams linked with aviation and autonomous flight (https://www.draftpolito.it). Appropriate synergies will be established with other neighbouring academic and industrial laboratories. Thanks to its airport headquarters, a strong link will be established for the training of professional pilots (https://www.aeroclubtorino.it/it/) for ATPLA courses and with the key companies of the Piedmont Aerospace District. The construction of the host building (Campus Building - 300 sqm – 2 levels), including urbanization and refurbishment of the area, will be in charge to Aero Club Torino. The financial management for the construction of the building and systems, and the management method of the area (technical and economic) will be defined by an agreement between the POLITO and (plausibly) Aero Club Torino, in addition to the existing agreement between the parties, and will have a suitable duration to guarantee the sustainability of the investment (at least 15 years).

Laboratorio Aeronautico Distribuito
This infrastructure is part of the ISM4Italy Distributed Laboratory for Aeronautics (LAD – Laboratorio Aeronautico Distribuito), gathering test sites and experimental facilities in Milan, Turin and Naples. The testing and experimental activities are oriented to technical solutions for Urban Air Mobility (rotary wing), Advanced Air Mobility (fixed wing), Optionally/Remotely Piloted Aerial Vehicles and Innovation for General Aviation.

Laboratorio Aeronautico Distribuito – Napoli
The purpose of the project located in Naples is the establishment of an outdoor test area with specific takeoff / landing areas with a corresponding airspace bubble, a series of ground equipment for test support (e.g., communications systems, GNSS ground stations, point surveillance systems, fixed and mobile control stations), a hangar area with laboratories and computing centers in which to operate on the flight platforms and efficiently carry out planning and analysis relating to tests. Urban scenarios and simulated infrastructures will also be included.
The area should allow experiments with small UAS platforms and possibly with larger aircraft such as helicopters and electric Urban Air Mobility vehicles, relating to issues such as resilient navigation and autonomous flight, technologies for airspace integration and traffic management, applications for delivery, inspection and surveillance, multi-drone systems. Also, General Aviation aircraft will benefit from this facility that can support testing their avionics equipment. Such an infrastructure would make it possible to schedule outdoor tests for an extended period, taking advantage of the climatic and wind conditions typical of southern latitudes. It would take advantage of nearby aerospace infrastructures, such as those of CIRA and the Italian Air Force and several General Aviation manufacturers. In this context it is conceivable to be attractive also for industrial and research realities located outside the Italian territory.
It would be possible to create operational setups of even complex test scenarios. This situation would follow that already present in important international experiences such as that of the MITRE center in the USA, the University of Cranfield (UK) and the Royal Melbourne Institute of Technology (RMIT), integrating solutions tested also within the main European programs, such as Clean Sky, SESAR and Galileo. The infrastructure will synergize with other facilities already available at UNINA such as the LIFT laboratory with its netted area, at the CeSMA Center and the Aerospace Guidance, Navigation and Control laboratory. In this context, the facilities of the aforementioned laboratories will be able to support the implementation of specific specimen tests to be used in the context of research and technology transfer projects. The infrastructure will also support the training phase of the operators of the developed systems, allowing the end-to-end development of Air Mobility services. In this context, the experience of the LIFT laboratory which is already an operator of RPAS systems registered in the ENAC register can be used.

Laboratorio Aeronautico Distribuito – Milano 1
Specifically, the proposed infrastructure (Milano 1) aims at supporting innovation in the field of Advanced Air Mobility with specific reference to in-flight testing activities for verification and validation of rotarywing technologies. The proposed location is within the premises of Milano's Bresso airport. The airport has a very favorable location as far as the testing of AAM technologies in a urban environment, given the close proximity to the city center. In greater detail, the objectives of the proposed Bresso rotary-wing laboratories can be summarized as follows:

- Support to outdoor flight testing for VTOL AAM aircraft, in a safe and controlled environment.
- Development of training programs for VTOL AAM in urban environments.

Laboratorio Aeronautico Distribuito – Milano 2

Specifically, the infrastructure (Milano 2) described in the following aims at supporting innovation in the field of Advanced Air Mobility with reference to rotary-wing technologies, which play a crucial role in enabling Vertical Take-Off and Landing (VTOL) capabilities in the framework of AAM. The infrastructures described below, to be located at the Politecnico di Milano Bovisa Campus shall partially rely on existing facilities for aeronautical research, which will be further developed and expanded to improve the present capabilities and meet the specific requirements of advanced air mobility technologies. In greater detail, the objectives of the proposed rotary-wing laboratories can be summarized as follows:
Development of rotary-wing technologies for VTOL aircraft with emphasis on safety, automation and reduced environmental impact (e.g., electric o hydrogen propulsion).
Simulation of eVTOL air mobility scenarios in urban environments.
Development of certification methodologies for automatic and autonomous eVTOL aircraft.

Laboratorio Aeronautico Distribuito – Torino

The purpose of the project located in Turin (Torino Aeritalia International Airport I-LIMA) is the establishment of an experimental center for sustainable Advanced Air Mobility (service center - indoor / outdoor laboratory - for aircraft flight testing and ground experimentation based on an international airport). The experimental center aims to define the operational concepts, the regulatory issues (EASA) and the relevant technologies for the development of innovative and sustainable air transport systems, both autonomous and non-autonomous, for both freight and passengers (AAM Advanced Air Mobility - Specialization: "innovative" fixed-wing and hybrid configurations).
The following laboratories/services will be established in collaboration with Politecnico di Torino and industrial partners: *1)* Experimentation center for electric air mobility: laboratory for the experimentation of HW and SW technologies to be applied on prototypes, implementing more/all electric aircraft concept. *2)* Center for the development of regulations and procedures (involving EASA, ENAC and ENAV) for the integration of aircraft in the airspace, equipped with simulators dedicated to the aforementioned development activities; infrastructures for U-Space coordination experimentation - ATM connected to the airport control tower. *3)* Training center for AAM fixed wing aircraft operators and flight controllers, equipped with dedicated simulators for this purpose. *4)* Flight experimentation center equipped with premises to house the experimental aircraft and all the equipment necessary to set them up for experimental flight activities and maintenance (it is assumed that the aircraft will be built in another industrial site). *5)* Service Hub, where to develop the functions to guarantee the operational use of AAM aircraft. Once the experimentation is complete, the Hub can be completed for public use, completing the necessary infrastructures for intermodal exchange with surface transport (public and private).
The construction of the host building (LAD Building – 300 sqm – 2 levels), including urbanization and refurbishment of the area, will be in charge to the project. The financial management for the construction of the building and systems, and the management method of the area (technical and economic) will be defined by an agreement between the Politecnico di Torino and (plausibly) Aero Club Torino, in addition to the existing agreement between the parties, and will have a suitable duration to guarantee the sustainability of the investment (at least 15 years).

Large scale «Flying Tunnel»

Drone testing is challenging as outdoor conditions are not controllable nor repeatable. This is why a real wind and weather indoor simulator for testing flying vehicles in various controllable atmospheric conditions represents a key factor. The new infrastructure built inside a mounted, inside a large excavated tunnel, will allow the worldwide best analysis of aerodynamics and flight mechanics effects on drones under the presence of lateral gusts. The gusts, programmable in space and in time, are obtained by means of multiple

fan systems designed and produced ad hoc for this purpose. The very large dimension of the infrastructure allows large models to be tested. The presence of a rail will provide the possibility to extend the analysis to ground vehicles. Stable ambient conditions and low noise guarantee a high signal to noise ratio.
The infrastructure will benefit from the presence of the existing infrastructure CICLoPE which will provide:

- Main system for power supply (1 Megawatt), ventilation and conditioning.
- External and internal offices for researchers.

The «Flying Tunnel» is designed to provide a test rig for at least twenty years of basic and applied research in this field. It will also offer the external users the possibility to test dynamical behaviour of ground vehicles subjected to lateral gusts, such as models of high-speed trains or trucks.

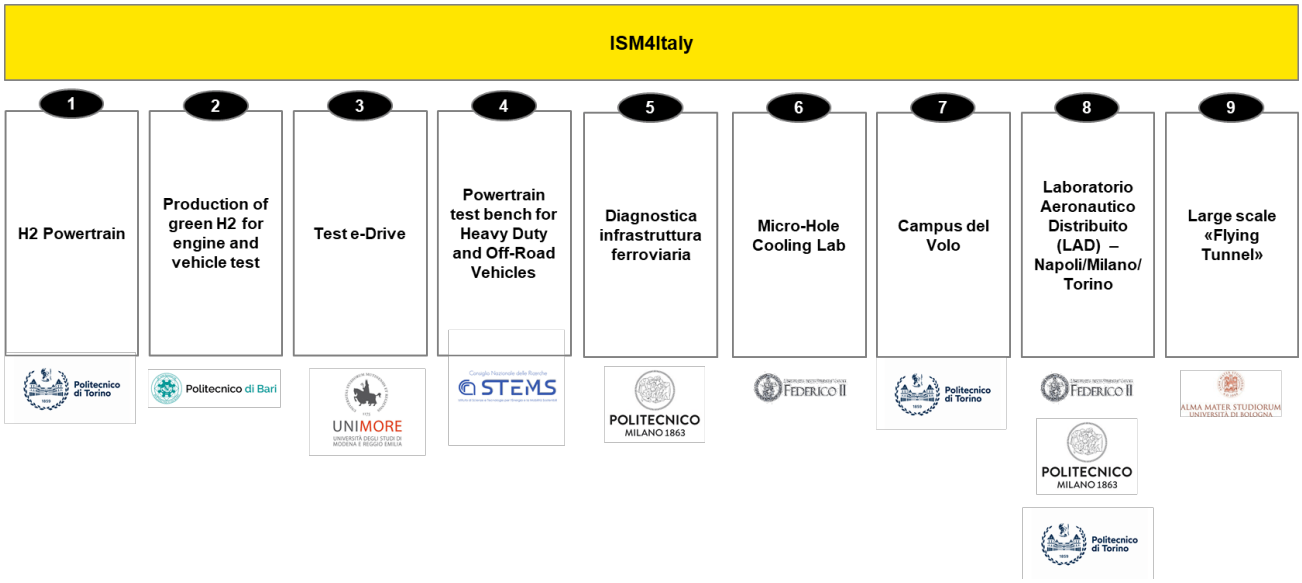

Figure B.1. – The Composition of the Technological Innovative Infrastructure, ISM4Italy, for a Sustainable Mobility in Italy.

B.2. Governance model B.2.1. Infrastructure and operational management

(Describe the operational management, also highlighting the profile and the role of the "infrastructure manager")

Politecnico di Torino (POLITO), which is the technical and operational proposer, has historical and strong worldwide cooperation with industrial and academic partners. The participation in many national and international projects allows POLITO to accrue a great experience in the coordination and management of complex projects funded by public and private bodies, ranging from projects funded by EU to projects funded by National and local governments or for those in cooperation with companies. Technology transfer is one of Politecnico di Torino excellences, with 307 inventions protected by 712 patents filed (2012-2021), of which 441 are active. Since 2017 POLITO has invested about 45M€ in Open Access research infrastructures enabling technological innovations and new business development. POLITO is founding member of the national competence center CIM4.0 (Competence Industry Manufacturing 4.0) SCARL, which is a PPP that carries out orientation and training activities for companies on Industry 4.0.

The Legal Entity undertaking to implement and manage the Infrastructure (*see paragraph B.2.2*), through the Manager of the Technological Innovation Infrastructure, will be the point of contact with the MUR.
The Special Purpose Vehicle (SPV) involves different kinds of members and its Governance is based on:

- **General Assembly:** it will be composed by members representing collectively all the interests of ISM4Italy and they are appointed by the partners. It is the body with full decision-making power, and it will meet at least once a year. Within its functions, it will approve the ISM4Italy's annual reports, accounts, and annual budget, and it will appoint and dismiss Board members.
- **Board of Directors** (BoD): it will be appointed by the General Assembly and it has full powers for ordinary and extraordinary management. The BoD will appoint the Manager of the Technological Innovation Infrastructure of ISM4Italy. It will take the final decision about strategic and operational elements.
- **Advisory Board:** it will be an external independent Committee composed of internationally renowned experts and other stakeholders that provides non-binding strategic advice on the infrastructure's activities.

The Manager of the II named ISM4Italy is expected to implement the strategy, control, and oversee all management operations, to manage people and organization. Very strong leadership skills will be essential since the Manager of the II is the one expected to interact with clients, researchers, technical staff, and report to the BoD. The duties will be to:

- Develop the Infrastructure's strategies.
- Prepare and implement comprehensive business plans.
- Define, set-up and manage the overall organization needed to provide the infrastructure services
- Plan, manage and control the set-up of the overall infrastructure with the support of the local infrastructure coordinators
- Develop the marketing strategy defined to reach the business targets and support the development of new service opportunities.
- Communicate and maintain trust relationships with stakeholders, science professionals, business partners, and funders.
- Control financial performance of the infrastructure
- Coordinate activities ensuring that timelines and expected results are met
- Coordinate local infrastructure coordinators and infrastructure research managers

The specific requirements are:

- Proven experience in management of science, innovation or R&D based organizations in the domains covered by ISM4Italy; previous experience in managing Technological Infrastructures and core facilities will be preferred.
- Proven experience in developing strategic and business plans.
- Thorough knowledge of the Technological Innovation ecosystem.
- Strong understanding of financials and performance indicators.
- Excellent organizational and leadership skills.
- Excellent communication, interpersonal and presentation skills.
- Outstanding analytical and problem-solving abilities.

- MSc/MA in technical/economic subjects.

In order to guarantee a smooth management of ISM4Italy and assure the long-term sustainability of the innovation infrastructure, the following roles are provided to support the Infrastructure Manager:

1. Local infrastructure coordinator: is envisaged one local infrastructure coordinator for each laboratory (or geographical area), with the tasks of:
   - Manage and control the phases that lead to the full operativity of the laboratory, producing periodical reports
   - Locally execute the infrastructure strategies
   - Implement the marketing strategy defined to reach the business targets and support the development of new service opportunities
   - Communicate and maintain trust relationships with local communities in which the laboratories are located
   - Monitor and mitigate risks
   - Support the IM in onsite management (relations with contractors, materials provision, etc..)
   - Manage laboratory access and maintenance
   - Monitor achievement of financial target goals and infrastructure income statement

2. Infrastructure research manager: is envisaged one infrastructure research manager for each laboratory (or geographical area), with the tasks of:
   - Coordinate with universities and research centres to define and implement the research program, assuring the respect of the strategic direction of the overall research program
   - Communicate and maintain trust relationships with science professionals
   - Relate with science professionals in determining technological innovation and priorities
   - Monitor progress and timing of the research activity through the production of periodic reports
   - Align IM on the laboratory research activities

These staff units will be recruited by the public-private company. Eventually these roles could be envisaged not by single infrastructure, but by geographical area.

B.2.2. PPP operation

(Describe the PPP expected modality as to the involvement of private partners: companies, specialized private infrastructure developers, investors, etc. In case of a PPP operation launched as a private initiative, the section should also indicate the private partner)

ISM4Italy will be defined as a Public-Private Partnership which satisfies the principles and the legal form of the "Partenariato Pubblico-Privato Istituzionalizzato" (Institutional Public-Private Partnership). The Public-Private Partnership (PPP) is a form of cooperation between public bodies and private entities that aims to ensure the planning, financing, construction and management of an infrastructure or the provision of a service. In particular, the Institutional PPP will imply the cooperation between the public and private actors within a separate entity, such as a joint enterprise, jointly owned by the public and private partner, whose mission is to ensure the provision of a work or service for the benefit of the public. At European level, PPPs are characterized by the following elements:

- The relatively long duration of the collaboration.
- The method of financing the project, guaranteed in whole or in large part by the private partner.
- The operational role of the economic operator, who participates in various phases of the project (planning, creation, implementation, financing).
- The role of the public partner, of defining the objectives to be achieved in terms of public interest, quality of the services offered, pricing policy, and monitoring compliance with these objectives.
- The sharing of risks between the public partner and the private partner, to whom risks are transferred, which, in traditional contractual forms (contract, loan, etc.) are usually borne by the public sector.

ISM4Italy will be established as a PPP in the form of an Institutional PPP with the establishment of a Special Purpose Vehicle (SPV).

In particular, for the implementation of the infrastructure, the Politecnico di Torino will rely on the contribution of private entities to co-finance the initiative through an institutionalized public-private partnership operation, pursuant to Art. 17 of the Legislative Decree 175/2016.

The reasons for this choice are linked to the Politecnico's intent to ensure an adequate scientific involvement in the partnership governance, aiming for constant equipment upgrade and innovation and to safeguard the open access.

To this end, a joint public-private company will be established, with predominantly private capital (51 percent), where the resources to be contributed by the private party(ies) may be financial and in kind, the latter to a maximum extent of 20 percent of the total eligible investments of the project.

Private contribution to PPP activities consists, apart from the contribution of capital or other assets, in active participation in the execution of the tasks assigned to the joint venture and/or in the management of that entity.

The private partner will be selected through a public bidding process that will have as its object, at the same time, the subscription or purchase of the company's shareholding by the private partner and the entrustment of the management of the infrastructure that is the exclusive object of the joint company's activity (so-called "dual-object" tender).

In the case of awarding the tender to multi-subjective competitors, they shall establish a new joint stock company with shareholdings corresponding to their share in the grouping or other form of collective participation.

The private partner, possessing the qualification requirements stipulated by legal and regulatory standards in relation to the services for which the company was established, will manage the infrastructure so that it will deliver services placed on the free market in favor of public and private stakeholders in the national and international territory operating in the infrastructure technology sectors.

The most suitable method to allow public entities, which have expressed interest in relation to the infrastructure when submitting the proposal, to participate in the joint public-private company is being evaluated.

There will be the participation to this PPP of both private and public partners. In addition to Politecnico di Torino (POLITO), the following public entities have already declared their interest to participate in the PPP operations: Politecnico di Milano (POLIMI), Università di Università Federico II di Napoli (UNINA), Università di Modena e Reggio Emilia (UNIMORE), Consiglio Nazionale delle Ricerche (CNR), La Sapienza (UNIROMA1), Politecnico di Bari (POLIBA), Università di Bologna (UNIBO).

POLITO carried out a preliminary market consultation, through the publication of a call for expression interest for the design, implementation, management, and co-financing of ISM4Italy addressed to private entities. The following private companies have submitted their expression of interest as partners (Comoli Ferrari, Gruppo FOS, TXT e-Solutions, LMA, FEV Italia, IVECO Group, Leonardo, Estra, Silk-FAW, GE Avio Aero, MerMec, Bosch, Punch) and as users (Blue Engineering, Civitanavi, Estra, GE Avio Aero). For the received expression of interest look at Annex 8.

POLITO will oversee the creation and implementation of the II. Indeed, POLITO will have the coordinator role until the establishment of the SPV and its complete operational independence.

B.3. Budget plan

Eligible cost (Art. 7 of the call for proposal)	**Costs (€)**		
	Not to be located in Mezzogiorno Regions	To be located in Mezzogiorno Regions	**Total**
a. Expenses, even if not accounted for as tangible and intangible investments, related to one highly qualified infrastructure manager and other executive personnel (managers) in charge of the services offered by the Infrastructure	900.000	0	900.000
b. Scientific instrumentation, research equipment and machinery and relative accessories, turnkey	10.865.000	11.889.611	22.754.611
c. Technical installations strictly connected to the functionality of equipment and machinery	1.269.800	6.245.602	7.515.402
d. Software licences and patents	796.600	213.300	1.009.600
e. Buildings and land (including built land) not exceeding 10% of the total cost of the project. For sites in a state of decay and for those previously used for industrial purposes that include buildings, this limit is increased to 15%	900.200	0	900.200
f. Rehabilitation, renovation, redevelopment and expansion of buildings if strictly necessary as to the functionality of the Infrastructure	1.869.300	1.281.000	3.150.300
g. Design cost and other related technical expenses	952.700	287.400	1.240.100
h. Indirect costs, forfeit (up to a maximum of 7% of the other project costs)	1.225.498	1.298.481	2.523.979
Total	**18.779.098**	**21.215.094**	**39.994.192**

B.4. Project time schedule

(In addiction to sections B.4.1 and B.4.2, please provide a general description as to the execution of the interventions)

The project time schedule of ISM4Italy is structured in multiple intermediate objectives that lead to the full functionality of the different laboratories which will constitute the final II of ISM4Italy.
The first intermediate objective is dedicated to the recruitment of infrastructure management and in general to the set up of operations and to guaranteeing the continuation of infrastructure monitoring and sustainability activities.
Intermediate objectives number 2, 3 and 4 correspond respectively to the phases of design, construction and implementation of the laboratories that make up the infrastructure. Each phase is declined in laboratories as multiple tasks, each of which is expected to take place within a determined timeframe.
Then, in order to monitor the actual achievement of the final objectives, specific deliverables and KPIs have been outlined for each task and have to be checked in a specific timeframe.
As last, an intermediate objective on infrastructure outreach and opening to the market has been defined.

B.4.1. Intermediate objectives

(For each intermediate objective, using the below template. Please notice that the aforementioned objectives must be scheduled in a time period of at least four months and will be defined according to the specific nature of the intervention)

<table>
<tr><td colspan="4">Intermediate Objective title: IO1 – Start up activities (e.g., IM Recruitment, Staff profiles Management Plan; Risk Management Plan)</td></tr>
<tr><td>Start month</td><td>1</td><td>Duration (min 4 months)</td><td>4</td></tr>
<tr><td colspan="4">Summary of the activities:

The main objective is to establish an effective management of the ISM4Italy project. The first step will be to recruit the personnel, including the Infrastructure Manager (IM), local infrastructure coordinators and research managers.

The IM will be hired with a fixed-term position, he will be in charge of: (i) developing and executing the II's strategies, (ii) preparing and implementing the business plans, (iii) managing the interactions with academic and industrial partners and stakeholders, (iv) monitoring and supervising the financial development of the project, (v) supporting the development of new opportunities and (vi) establishing and coordinating the priorities of the II.

The IM will put a significant effort into promoting and facilitating digitalization of the services provided, referring to best practices available worldwide, in ensuring the principles of FAIR data and Open Science and to this end, a Data Management Plan will be defined. Moreover, the IM will also be in charge for the implementation of the Guidelines for gender equality, junior researcher attraction and inclusion practices.

IM, with the collaboration of the research managers, will provide coordination with National Centers (in particular with National Center for Sustainable Mobility), private/public Italian and European Research Institutions and clusters (addressing also the joint participation to funded research calls). The connection with certification authorities will also be part of the assignments.

IM will define a proper Communication Plan, also organizing specific workshops and dissemination events (including onsite demonstrations).</td></tr>
</table>

The IM, with the collaboration of Local Infrastructure coordinators, will also deal with the risk management and contingency plans. Indeed, a careful risk analysis will be conducted, for possible political, financial, technical, technological, scientific, legal, and human resources related issues, and suitable contingency plans will be discussed, proposed, and implemented (eventually involving strategic consultants).

The second step of the IO1 will define the governance structure of the Infrastructure, the continuous monitoring procedures, the risk analysis and contingency plan and foster its long-term sustainability according to the strategies and roadmap defined by the Governing Board.

Finally, preliminary activities to initiate the design of the infrastructure will be conducted.

The following Actions and timespan are foreseen:

Task 1.1 – Recruitment (M1-M4)

The IM will be recruited. The profiles and requirements of Local infrastructure coordinators and research managers will be defined and recruitment started. Definition of the II management plan.

Task 1.2 - Definition of the continuous monitoring procedures (M2-M4)

Continuous monitoring will be a fundamental aspect of the ISM4Italy project. The main aim will be to define the procedures for an effective management and implementation of the infrastructure, along the Design, Construction, Installation, and outreach phases.

Continuous monitoring will be implemented through periodic meetings among the governance bodies of ISM4Italy. Moreover, the IM together with the local infrastructure coordinators will monitor and supervise the financial development of the project, and it will ensure the submission to the MUR of the periodic reports on the performance indicators associated with the project and on the expenses effectively incurred.

Task 1.3 – Definition of the risk analysis and contingency plan (M2-M4)

The methodology for the risk analysis and contingency plan will be set according to the Open PM v0.9, built on the following four-step approach: Risk Identification, Risk Assessment, Risk Response Development, Risk Control.

Task 1.4 – Definition of the models for long-term sustainability (M2-M4)

ISM4Italy will operate for at least 15 years after the completion. A scheme of a long-lasting functionality of the project will be elaborated, with the aim to establish a robust government and management structure ensuring the continuous and smooth functionality of the infrastructure. Sustainability will be carefully addressed, in terms of operational costs (e.g., running costs, maintenance, user support) as well as the necessary continuous upgrade of the instrumentations deriving from the scientific advances that may arise. Furthermore, the following implementation documents will be produced: Regulation governing Intellectual property generated by the research and innovation activities, Regulation of Access Mechanism, Tariffs and Quotation Spreadsheets, updated version of Data Management Plan, Communication Plan.

Activity KPI/Deliverable	**Target Value (KPI) / Completion Month (milestone and deliverable)**

Deliverable 1.1 – Report with profiles for the IM and other staff recruitment	KPI: 1 report / M1
Recruited personnel	KPI: recruited IM / M2
Deliverable 1.2 – Report including the procedures for: • Continuous monitoring and risk analysis; • Contingency plan. • Long-term sustainability	1 report / M4
Milestone 1 – Recruited personnel and procedures for management and sustainability	KPI: recruited IM and >50% staff and D1.2 report / M4

Intermediate Objective title: IO2 – Design of the infrastructure up to supplier selection and purchase of equipment. Construction work plan

Start month	5	**Duration (min 4 months)**	8

Summary of the activities:

The main goal of this IO consists in completing the design phase, defining the technical specifications for all the laboratories making up the infrastructure ISM4Italy.
Detailed definition of the infrastructure requirements and of the following aspects is expected: buildings refurbishing, design of new facilities and adaptation of specific sites.
After the completion of all the technical requirements, is envisaged the supplier inquiry, selection, agreements set up and procurement of all hardware and sourcing of all external services.
Definition of the construction work plan and refinement of business plan will take place as well.
The design of each laboratory is represented as a stand alone task, as follows.

Task 2.1: H2 Powertrain Design

Laboratory design end executive project; supplier inquiry and selection.
Procurement of all hardware and sourcing of all external services.

Task 2.2: Production of green H2 for engine and vehicle test

In collaboration with POLIBA, it will be defined the ideal configuration of the infrastructure (like analysis of the energy balance of the hydrogen self-production system and cost benefit evaluation) and the proper components will be selected from the market.

Task 2.3: Test e-Drive (M4 – M12)

Planning and selection of the instrumentation. Plant design (including electrical system).

Task 2.4: Powertrain test bench for Heavy Duty and Off-Road Vehicles (M4 – M12)

This task concerns the detailed definition of the laboratory considering the existing building and technical equipment already available at CNR STEMS, the executive design of all component of the infrastructure, the preparation and launch of the orders. The refining of the business plan is also part of this phase. Is possible, the installation of the first components of the infrastructure can be start in this phase.

Task 2.5: Diagnostica Ferroviaria (M4 – M12)

The aim of this task is to provide technical specifications for the system as a whole, the system design, preliminary integration approaches and related interfaces

Task 2.6: Micro-Hole Cooling Lab (M4 – M12)

The laboratory will be designed with specific reference to the definition of the specific characteristics of the machines and / or equipment that must be acquired for the establishment of the laboratory and the layout will be studied.
A preliminary study has already identified the types of machines and equipment that could be of interest to the new laboratory, and in particular: Laser Machine Unit, CT Scanner, Automatic visual gauge, Digital Microscope, Pneumatic Gage.

Task 2.7: Campus del Volo (M4 – M12)

Designing the infrastructure is central to spatial mapping and project planning.
Infrastructure encompasses many integral elements: selection/design of experimental facilities and laboratories, definition of layout, adaptation to host building (under construction and funded by TNE/Aero Club Torino during M4-M12
period), contacts with suppliers and orders. Definition of a detailed business plan is also part of this activity.

Task 2.8: Laboratorio Aeronautico Distribuito - Napoli (M4 – M12)

This task includes the design of the infrastructure, i.e. selection/design of experimental facilities, adaptation/recovery of host buildings, contacts with suppliers and orders. Definition of a detailed business plan is also part of this activity.

Task 2.9: Laboratorio Aeronautico Distribuito - Milano 1 (M4 – M12)

Designing the infrastructure is central to spatial mapping and project
planning. Infrastructure encompasses many integral elements: selection/design of experimental facilities and laboratories, definition of layout, adaptation to host building (under construction and funded by the project during M4-M12 period), contacts with suppliers and orders. Definition of a detailed business plan is also part of this activity

Task 2.10: Laboratorio Aeronautico Distribuito - Milano 2 (M4 – M12)

Designing the infrastructure is central to spatial mapping and project
planning. Infrastructure encompasses many integral elements: selection/design of experimental facilities and laboratories, definition of layout, adaptation to host building (under construction and funded by the project during M4-M12 period), contacts with suppliers and orders. Definition of a detailed business plan is also part of this activity

Task 2.11: Laboratorio Aeronautico Distribuito - Torino (M4 – M12)

Designing the infrastructure is central to spatial mapping and project
planning. Infrastructure encompasses many integral elements: selection/design of experimental facilities and laboratories, definition of layout, adaptation to host building (under construction and funded by the project during M4-M12 period), contacts with suppliers and orders. Definition of a detailed business plan is also part of this activity

Task 2.12: Flying Tunnel (M4 – M12)

Design of the rehabilitation, renovation of the tunnel, which will host the infrastructure. The tunnel must be cleaned and adapted to create an environment suited for the experiments.
Design of the main systems and technical installations. This design process will involve fundamental systems that will serve the apparatus (e.g. electrical and ventilation systems) and the characteristics element of the infrastructure, i.e. rail and slid and gusts generator.
Definition of a business plan.

Activity KPI/Deliverable	**Target Value (KPI) / Completion Month (milestone and deliverable)**

Deliverable 2: Design report including the output from tasks 2.1 to 2.12	**M12** KPI: design report and placement of purchase orders **>75%**
Milestone 2 – design documentation of the laboratories and placement of purchase orders,	Detailed design and executive documentation of laboratory infrastructures: 100%. Placed orders > 75%

Intermediate Objective title: IO3 – Construction: Building/land purchases and renovation, refurbishment and extension of buildings. Technical installation			
Start month	13	**Duration (min 4 months)**	13

Summary of the activities:

After the conclusion of design phase (IO2), the construction phase of all the laboratories part of ISM4Italy will take place.
The expected goals for this IO, within 25 month since the project start is the completion of the technical installations, along with building/land purchases, renovation, refurbishment and extension where necessary.
Construction of each laboratory is represented as a stand alone task as follows.

Task 3.1: H2 Powertrain (M13 – M25)

Setup of H2 supply system and upgrade of emission measurement devices.
Setup of test systems for high-voltage electrified powertrain components.
Upgrade of test bench automation system for control of the novel components.
Implementation of virtual shaft with conjunction to other FEV and Università di Bologna laboratories.
Implementation of cloud model-based DoE test management.

Task 3.2: Production of green H2 for engine and vehicle test (M13– M25)

The "designed" infrastructure will be realized starting from the procurements of the components up to the realization of the systems.

Task 3.3: Test e-Drive (M13– M25)

Realization of the laboratory. Purchase/installation of the instrumentation.

Task 3.4: Powertrain test bench for Heavy Duty and Off-Road Vehicles (M13 – M25)

This task concerns the realization of the infrastructure. More in details the building preparation for the test bench installation, the construction of the climate chamber, the installation of the powertrain test bench, the installation of the control system and the instrumentation for emission, fuel consumption and thermodynamic parameters.

Task 3.5: Diagnostica Ferroviaria (M13 – M25)

The proper integration of three device modules will be implemented in this task.
First prototype is realized by installing the developed technologies and software on an inspection car.
System interfaces will be verified and consolidated.

Task 3.6: Micro-Hole Cooling Lab (M13 – M25)

We will proceed to the acquisition of the machines, their installation and testing. The personnel who will be assigned to use it will be trained.

Task 3.7: Campus del Volo (M13 – M25)

As the host building (Campus Building) will be available, the experimental facilities will be set up and tested for functional validation. The experimental areas will be fully equipped. A preliminary use for industrial purposes, also open to other partners, customers and users, will be tested. The industrial staff will install (supported by suppliers) all the required technical rigs and simulators.

Task 3.8: Laboratorio Aeronautico Distribuito - Napoli (M13 – M25)

During this task, in cooperation with the industrial staff, and with the support of suppliers, the experimental areas will be completed and fully equipped with the experimental facilities. In view of functional performance verification, preliminary tests will be performed also open to other partners, customers and users.

Task 3.9: Laboratorio Aeronautico Distribuito - Milano 1 (M13 – M25)

The experimental facilities will be set up and tested for functional validation. The experimental areas will be fully equipped. A preliminary use for industrial purposes, also open to other partners, customers and users, will be tested. The industrial staff will install (supported by suppliers) all the required technical rigs and simulators.

Task 3.10: Laboratorio Aeronautico Distribuito - Milano 2 (M13 – M25)

The experimental facilities will be set up and tested for functional validation. The experimental areas will be fully equipped. A preliminary use for industrial purposes, also open to other partners, customers and users, will be tested. The industrial staff will install (supported by suppliers) all the required technical rigs and simulators.

Task 3.11: Laboratorio Aeronautico Distribuito - Torino (M13 – M25)

As the host building (LAD Building) will be available, the experimental facilities will be set up and tested for functional validation. The experimental areas will be fully equipped. A preliminary use for industrial purposes, also open to other partners, customers and users, will be tested. The industrial staff will install (supported by suppliers) all the required technical rigs, test areas and simulators.

Task 3.12: Flying Tunnel (M13 – M25)

Commercial negotiation and procurement. This phase is of fundamental importance to select those parties that will be able to build or provide the elements of the infrastructure.
Rehabilitation, renovation of the tunnel and system installation. All systems (i.e. electrical, ventilation) will be installed and set-up.
Technical installation of the apparatus. The elements of the slid and the gust generator will be installed and set-up-
Preliminary test will be accomplished to check the feasibility of the test-rig.

Activity KPI/Deliverable	**Target Value (KPI) / Completion Month (milestone and deliverable)**
Deliverable 3.1: Midterm review report	**M19** KPI: >30% work progress
Deliverable 3.2: Final detailed report	**M25** KPI: >90% work progress

Milestone 3 – functional assessment of the ISM4Italy testing capabilities	KPI: assessment of > 70% of functional testing capabilities of the ISM4Italy laboratories documented by a functional test report.

Intermediate Objective title: IO4 – Commissioning			
Start month	26	**Duration (min 4 months)**	7

Summary of the activities:

After the conclusion of construction phase (IO3), the installation and commissioning phase of all the laboratories part of ISM4Italy will take place.
The expected goals for this IO, within 32 month since the project start are:

- Performance verification and validation tests of the infrastructure will be carried out to activate more than 70% of the facilities. Thus, the infrastructure commissioning will be completed, and the experimental facilities enabled
- Performance tests of all parts and software, both as standalone system and as in network co-operation.

Installation and commissioning of each laboratory is represented as a stand-alone task as follows.

Task 4.1: H2 Powertrain (M26 – M32)

Commissioning of fuel cell and ICE test systems.

Task 4.2: Production of green H2 for engine and vehicle test (M26 – M32)

The start up of the infrastructure will be tested not only in terms of functionality expected but also from the documentation point of view.

Task 4.3: Test e-Drive (M26 – M32)

Functional test of the instrumentation. Laboratory commissioning.

Task 4.4: Powertrain test bench for Heavy Duty and Off-Road Vehicles (M26 – M32)

The Task includes all activities related to the final debug of the powertrain test bench: climate chamber, on-road driving simulation, emissions and other parameter measurements etc., until to the 100% operativity at M32

Task 4.5: Diagnostica Ferroviaria (M26 – M32)

Full scale testing of the Mobile Monitoring system on a test site is performed
Measurements, evaluation and validation activities are carried out in this task:
Advanced data analysis will be performed.

Task 4.6: Micro-Hole Cooling Lab (M26 – M32)

After the final checks, the laboratory will be ready for use.

Task 4.7: Campus del Volo (M26 – M32)

After the final checks, the laboratory will be ready for use.

Task 4.8: Laboratorio Aeronautico Distribuito – Napoli (M26 – M32)

In this last task, performance verification and validation tests of the infrastructure will be performed so to take the ongoing rate of activation of the facilities up to 100%. Thus, the infrastructure commissioning will be realized

Task 4.9: Laboratorio Aeronautico Distribuito - Milano 1 (M26 – M32)

During this last phase the ongoing rate of activation of the facilities will be taken up to 100%.

Task 4.10: Laboratorio Aeronautico Distribuito - Milano 2 (M26 – M32)

During this last phase the ongoing rate of activation of the facilities will be taken up to 100%.

Task 4.11: Laboratorio Aeronautico Distribuito - Torino (M26 – M32)

During this last phase the ongoing rate of activation of the facilities will be taken up to 100%.

Task 4.12: Flying Tunnel (M26 – M32)

Testing and validation. In this phase the different elements will be tested in-site. Preliminary test will be conducted until the facility will reach 100% of its capabilities.

Activity KPI/Deliverable	**Target Value (KPI) / Completion Month (milestone and deliverable)**
Deliverable 4: Commissioning report for all laboratories of the ISM4Italy infrastructure	**M32**
Milestone 4 – performance tests of the ISM4Italy Lab capabilities	KPI1: assessment of > 70% of performance testing capabilities of the ISM4Italy laboratories documented by a commissioning test report.

Intermediate Objective title: IO5 – Outreach and opening to the market			
Start month	33	**Duration (min 4 months)**	36

Summary of the activities:

After the conclusion of commissioning phase (IO4), the outreach and opening to market phase of all the laboratories part of ISM4Italy will take place.
The expected goals for this IO, within 36 month since the project start are:

- Opening to market
- Monitoring of multi-site laboratories status synchronization
- Dissemination

Each of them is detailed as a task with is own specific timeframe as follows.

Task 5.1 – Opening to the market (M33-M34)

Definition of the service catalogue and pricing. Preliminary online visibility and websites.

Task 5.2 – Dissemination (M33-M36)	
The activity will be devoted to the dissemination of the availability of ISM4Italy to the potential market through dedicated seminars, interviews to specialized magazines, participation to B2B events, organization of dedicated events on the infrastructure, definition of structured webpage and social media.	
Activity KPI/Deliverable	**Target Value (KPI) / Completion Month (milestone and deliverable)**
Deliverable 5: Web site creation, LinkedIn and other social media profile creation Outreach and opening to the market (report)	**M34** **M36** KPI: > 1 dissemination event (M36)

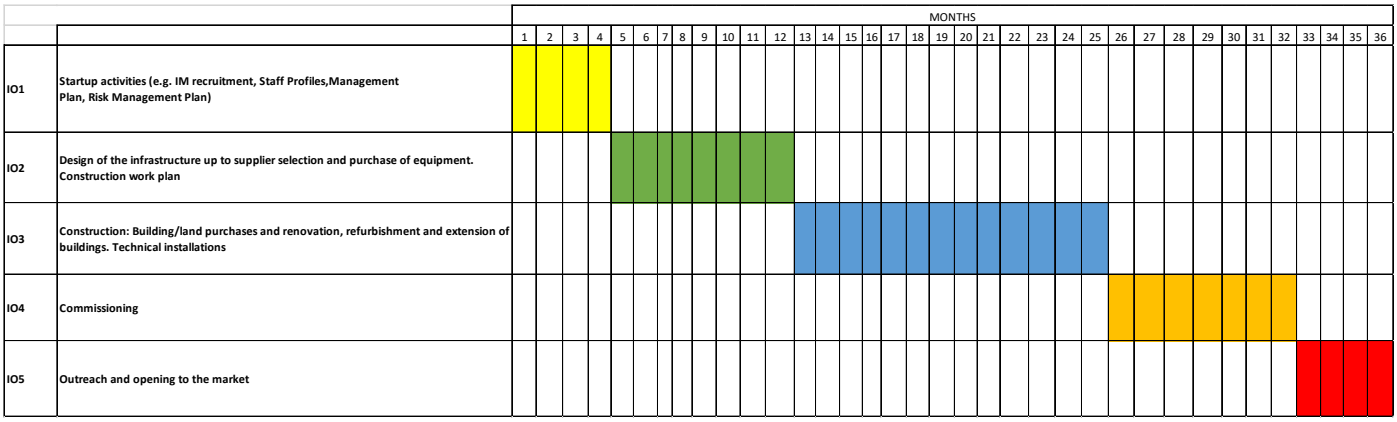

Figure B.2. – Gantt Chart of Intermediate Objectives and Tasks.

B.4.2. Timeframe envisaged for the implementation of the procedure aimed at setting up a PPP

The setting up of the PPP is intended as a preliminary activity to the start of the project, which will last 6 months, from July to December 2022.
The project start date will therefore be 1st January 2023.

For the establishment of the PPP, the following activities will be completed by 1 January 2023:

1. Institution and publication of the call (3 months)
2. Collection of application and selection of the private partners (2 months)
3. Constitution of the joint public-private company (1 months)

PHASE	MONTH					
	1	2	3	4	5	6
Institution and publication of the call (3 months)						
Collection of application and selection of the private partners (2 months)						
Constitution of the joint public-private company (1 months)						

Figure B.3. – Gantt Chart about the implementation of the procedure aimed at setting up the Institutionalized PPP.

B.5. Promotion of knowledge transfer and business creation activities

(Describe the activities envisaged or the expected impact of the Infrastructure in terms of knowledge transfer and settingup new businesses)

ISM4Italy's knowledge transfer activity is based on two main drivers:

- **Direct**: in the case of direct knowledge transfer, the user of the result of the research activity conducted at ISM4Italy is one of the private shareholders of the company that manages ISM4Italy. The partner is responsible for bringing the industrial application based on the research outcome to the market. This process is substantially accelerated by the fact that the industrial application is built with the use of the same enabling technologies and methodologies developed in the laboratory. More specifically the laboratories will be used to test prototypes and validate the detailed digital models that will then be the base for the development of new products of the private shareholders. Moreover, digital twins and Hardware/Software-In-the-Loop will be made available by ISM4Italy to the partners to allow integrating the physical testing of a novel subsystem, with the virtual simulation of the other subsystems to verify their behavior at system level.
- **To third parties**: in this case the result of the research project is entrusted to the management of the ISM4Italy infrastructure in charge of the promotion of intellectual property (technology transfer).

If in the first instance the marketplace organizes research projects conducted directly in the ISM4Italy laboratory, its application can subsequently be extended to research projects carried out outside ISM4Italy. This goes in the direction of simplifying the dialogue and interaction between academia and the market: ISM4Italy does not represent exclusively a technological platform to accelerate research programs that lead to industrial applications, but a catalyst for technology transfer that is addressing the intrinsic weaknesses of the Italian technology transfer between academia and market.

As a matter of fact, Knowledge Transfer (KT) for ISM4Italy focuses on the formation of spin-out business, or the licensing of intellectual property (IP), based on the outputs of science and technology-related research. Although these are vitally important areas, KT guidelines for ISM4Italy encompass a much broader range of activities and is not limited to the science and technology disciplines:

- People: When students and graduate from university join the workforce, they bring with them new knowledge and are effectively helping to ‘regenerate the gene pool’ of industry.
- Publication and events: Knowledge is transferred through publication of research outputs, and through events and networking.

- Collaborative research: This is a powerful means of creating opportunities for innovative knowledge exchange.
- Consultancy: The provision of domain-specific expert advice and training to external clients by ISM4Italy research and innovation staff can be a very effective KT mechanism – it can provide a platform for the exchange of both explicit and more tacit knowledge, and a window on areas of possible collaboration.
- Licensing: Licensing the right to use specific research outputs (IP such as patentable ideas) is another important KT mechanism.
- New businesses: Bringing research outputs to market through the formation of a new business can be particularly appropriate when the application represents a 'disruption' to the current market or sector, or where there isn't any obvious external partner to whom the idea could be licensed.

The activities carried out in ISM4Italy are projected towards a long-term strategy for further expansion of the concepts beyond the research and academic world, to boost the advantages of the concepts developed within their own sector of utilization and beyond, by seeking for technology transfer to enable commercial exploitation. In this context, key actions will be put in place to ensure:

- Sustainability of the concepts developed, with a thorough market analysis and the deployment of measures (as IPR) already to be put in place during the project to ensure continuation of the activities beyond the research environment (further advancements in TRL).
- Technology transfer enabling exploitation and valorization of project outcomes, thanks to the engagement with private stakeholders to create a common ecosystem and cross link the objectives of the concepts developed with sector industrial and commercial strategies.

This will be done by implementing the following actions:

- ***Stakeholders' engagement and networking***

That will accelerate the acceptation of the innovative developed concepts from private stakeholders along the value chain and engage with them in order to advance in terms of TRL (demonstration and validation activities) and achieve commercial roll-out. This will be achieved thanks to the creation of an ecosystem where researchers from universities and private actors will have the chance to:

i) Establish a feedback loop: Researchers will have the chance to receive feedback directly from End users on the marketability of the concept.
ii) Engage with end-users to further advance research through demonstration and validation activities: project activities will benefit from a strong contribution of private entities, representing the excellence in automotive, aviation and railway industry and allows the completion of the value chain of each project.
iii) Improve education: the laboratories will be a powerful tool for improving education at all University levels as well as upskilling and reskilling company personnel with the latest technological development. The laboratories will make possible an extensive Hands-on teaching approach. The companies themselves will be proactively involved in the process by proposing Challenges to multidisciplinary groups of students. All this will be a powerful tool for stimulating the introduction of new technologies in the sector.

- ***Promoting an entrepreneurial mindset among researchers.***

Within the scope ISM4Italy, the open science principle will be followed wherever possible. Nonetheless, protection of key research results will be one of the priorities of the exploitation and valorization strategy. Sessions will be organized to provide participants with entrepreneurship education, more specifically on how to manage intellectual property, interact with industry and understand go-to-market related activities. More specifically, this action will focus on:

i) Identification of background and foreground IP. ii)
First thoughts on the exploitation of project results.
iii) Define a roadmap for valorization and exploitation of the research outcomes and identification of the most suitable protection means (IPR). A specific IPR management plan will be defined with the contribution of all the members.

Moreover, ISM4Italy will promote a series of B2B events dedicated to technology transfer such as, indicatively, Innovation Days dedicated to specific industrial partners and investors and Call for ideas dedicated to researchers inspired by needs identified by industrial partners.

Part C – Expected impact *(max. 8,000 characters)*

C.1. Expected outcomes of the intervention

(Describe the impact in terms of a) employment and research spin-off, b) synergy with other productive and research domains)

The aim of ISM4Italy is to stimulate the implementation of breakthrough innovation by addressing the technological challenges identifiable in the mega-trends of the sector, i.e., electrification, hydrogen, connectivity, autonomous vehicle, and aircraft.
Powerful numerical simulation tools allows to develop new products mostly in a virtual environment. Nevertheless, physical physical testing becomes even more important to help researchers ad companies to bridge the gap between research demonstrators, proof of concepts and products ready for the market. ISM4Italy is an aggregator of Universities and companies of different sizes to support the development of innovative tool at the pre-competitive stage and for the optimization of new products at TRL 7-8.
The methodological development and test tools made available by ISM4Italy will be accessible to innovative start-ups and micro-enterprises, guaranteeing the possibility of tests that cannot be reached independently by the companies themselves, due to the required investment.
ISM4Italy will improve the quality of teaching and in setting up dedicated tracks for upskilling and reskilling of technical staff, and the generation of IP (national and international patents), and know-how in the sectors.
In 2020 the Automotive sector counted more than 160k employees (3,1% reduction to 2019),6,6% of reduction in low added value production. In producers of special parts and in engineering and design services, there was an increment of employees larger than 5%. In 2021 the number of employees decreased in all supply chain segments: modest reduction in turnover in Engineering&Design companies (-6,8%), aftermarket specialists (-7,0%) and subcontractors (-9,6%), while the decline is more evident for specialists, including those in motorsport (respectively -12,1% and -11,3%), systems engineers and subcontractors (-13,6%).
Aerospace and Aviation are drivers of one of the main industrial sectors in terms of size and intensity. In Italy it is made up of about 500 players distributed as follows: 54% in NorthernItaly, 23,4% inCenter, 19,5% in the South and the remaining 3,1% in Islands. Lombardy is the first region in terms of number of companies with 18,7% of the total. The following are Lazio, Campania, Piemonte, Emilia-Romagna, Veneto, Liguria, Toscana, Puglia and Friuli. In terms of employment, two-thirds of companies have fewer than 5 employees, while only 5,6% employ more than 100. The situation highlights the need to face the effects of the COVID19

pandemics on employment levels, estimating the time span required to restore the pre-crisis situation no less than 3-5 years.
ISM4Italy sectors are supported by a long tradition of researchers distributed in the national territory. Among them, POLITO, POLIMI, POLIBA, UNIBO, UNIROMA1 and UNINA. Most of them in the last years have invested considerable resources in experimental facilities to support the applied research in the sector. CNR, CIRA, ASI, JRC have a long tradition in the field of powertrain research, aerospace, and clean aviation, and more recently, in automated driving and flight.
In 2020, the level of employed graduates after one year from their bachelor's degree in both Automotive Engineering and Aerospace Engineering consists to a 21,9% for North-West regions, and for a 19% at National level.
The level of employed graduates after three years from their master's degree is particularly high, in the case of former Aerospace engineering students, the percentage in the North-West regions is equal to the number of cases at National level (95,7%). While for the Automotive Engineering master's degree, the range is slightly higher, 96,6% for the NorthWest regions and a 96,8% for the National territory.
The level of unemployment, especially within the young NEET and in the Southern regions, are expected to decrease thanks to the ISM4Italy.
ISM4Italy improve the employment indices in the Automotive sector, which currently has about 15.000 companies, distributed in Large (10%), SME (77%) and Micro Enterprises (13%), with a turnover of 2M € in 25% of the cases, between 2M € and 10M € in the 60% and over 50M € in the 15%. In the North-West, Piemonte represents the 33,5% of the Italian total (737 companies), although in the last five years its incidence has decreased by more than 2%. Lombardia, with over 600 companies, represents 27,4%. In the North-East, Emilia Romagna has kept constant the share of companies belonging to components (10.2%), while Veneto has increased its weight today to 8.6% (7,2% in 2016).
The Aerospace sector ranks 4° in Europe and 7° in the world. The overall revenue is of nearly 13.5 bln€, which accounts for 0,65% of the GDP; the added value is of about 12 bln€. Nearly 50k specialized employees and more than 200k overall in the sector are distributed across 4k companies. The vast majority, nearly 90%, are SMEs, although there are world leading companies (Leonardo, Avio Aero and Thales Alenia Space Italia).
In the average 36% of the companies declares to invest less than 3% of the revenue in R&D, and just 15% invests less than 5%. Nearly 71% of the product R&D is inhouse 18% with other companies, and less than 7% in cooperation with other institutions or outsourced. The factors that limit the R&D are the cost and availability of resources, the lack of R&D personnel and the difficulty to find partners to support this activity. The limited investments in R&D justifies an approach to the innovation limited to the continuous improvement of existing products. This approach is inadequate for addressing the current technological challenges, i.e., electrification, hydrogen, connectivity, autonomous vehicle.

ISM4Italy indicators along with the expected percentage improvement:

- Efficiency improvement due to energy management in BEV (2 ÷ 5) % and FCV (2 ÷ 5) %
- Increase of power grid storage capacity from electric vehicle integration (5 ÷ 10) %
- Reduction of raw materials through e-drive components recycling (5 ÷ 15) %
- Battery life cycle extension through improved diagnostics (5 ÷ 10) %
- Cost reduction due to modularity and powertrain integration in the vehicle structure (2 ÷ 5) %
- Increase of shared mobility through zero-time setup of shared vehicle (10 ÷ 20) %
- Mass reduction due to modularity and powertrain integration in the vehicle structure (10 ÷ 15) %
- Improvement of battery monitoring through local and cloud techniques (5 ÷ 10) %
- Improved safety due to driver health and attention monitoring (10 ÷ 15) %
- Improved efficiency and vehicle reliability through vehicle in the cloud data analytics (10 ÷ 15) %

- Reduction of non-exhaust emissions (15 ÷ 20) %
- Introduction of Hybrid-electric, distributed, propulsion, ultra-efficient gas turbine engines, coupled with highly efficient aircraft configuration (Fuel burn reduction: -30/50%/Emissions reduction: 85/90%)
- Use of SAF Fuels, improved propulsion efficiency (Emissions reduction: -40%)
- Revision of ATC and operations (Emissions reduction: -10%)
- Efficient Wing, Airframe design, advanced material (Fuel burn: -15%)
- Air traffic control and system integration (Risk mitigation:10-15%)
- Systems, Connectivity, Maintenance and Services (Travel Time reduction: -35%)
- No Waste production and circular economy (Re-usability of the components: 30%)
- Optimized and sustainable infrastructures for Advanced Air Mobility in urban environment (Noise reduction: 10%)
- Advanced and reliable digital technologies (Cost reduction: 20-30%/Lead time reduction: 20-30%).

C.2. Long-term sustainability profile

(*Provide a detailed description of the profitability of the intervention, including and adequately motivating the expected revenues per year over a period of at least 15 years)*

Together with environmental and social aspects, as mentioned in the previous section, a key pillar for the ISM4Italy budget will be the financial sustainability in the long term that will be ensured also by the contribution of private clients, exploiting of intellectual properties and the attraction of additional funding from Italian and EU public and private calls where the unparalleled depth of ISM4Italy research infrastructure skills and private companies (cofounders) network will play a crucial role. The infrastructure operating revenues and costs over a period of 15 years

(2026-2040) after the "in itinere" phase have been assessed to highlight the overall sustainability.

Project's financial sustainability is mainly supported by 3 different kind of revenue streams: 1) revenues from infrastructure access 2) revenues from research including EU and Italian Grants and exploiting of intellectual property

3) revenues from offering to the market the infrastructure "as a service" (IaaS) in a "pay per use" route to market. For the particular kind of laboratories – very focused on the various player in the market of the sustainable mobility - the first revenue stream, which represent the most important one, accounting for about 46% of the income, comes from the fees per access paid by users that utilize the infrastructure. Since the ISM4Italy living labs will offer the state of the arts technologies for sustainable mobility that will interest player in different sectors for training and research project purposes. Three main clusters of users are expected to pay 3 different levels of fees: a) consortium member that are involved in the PPP pay a reduced fee; b) users from universities and other kind of research and educational institutions are allowed to access at a subsidized price; c) private users that pay a market price in order to access and utilize the infrastructure. The second revenue stream is related to research activities, like the participation to international calls (jointly with the university consortium) and to the infrastructures of European or national research programs. This flow is expected to amount for about 33% of the total income. The third expected source of income (22% of the total) can be summarized into "IaaS" (Infrastructure as a Service) which means, for example, the pay per use of each laboratory for training activities or simulations. The 3 levels of fees mentioned above remain valid for this revenue stream.

ISM4Italy, as a multisite infrastructure, is composed by 12 different laboratories, each of them is expected to be economically sustainable over 15 years long period, as represented in the following table in terms of initial investment and future revenues

	Revenues K€														
Laboratories	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Powertrain test bench for Heavy Duty and Off-Road Vehicles	1.805	1.808	1.811	1.814	1.817	1.820	1.824	1.869	1.892	1.895	1.899	1.902	1.905	1.909	1.912
Production of green H2 for engine and vehicle test	775	779	781	784	786	1.577	1.580	1.582	1.585	1.588	1.590	1.593	1.596	1.598	1.601
Laboratorio Aeronautico Distribuito - Milano 2	662	667	672	676	680	776	780	878	882	887	892	896	901	906	911
Laboratorio Aeronautico Distribuito - Milano 1	514	518	521	524	527	622	625	706	709	712	716	719	723	726	730
Diagnostica infrastruttura ferroviaria	1.163	1.167	1.250	1.272	1.355	1.426	1.508	1.531	1.613	1.616	1.699	1.701	1.784	1.787	1.870
Campus volo	742	748	751	754	757	852	855	954	957	961	964	967	971	974	978
Laboratorio Aeronautico Distribuito - Torino	1.242	1.254	1.263	1.273	1.282	1.382	1.392	1.498	1.507	1.517	1.527	1.537	1.548	1.558	1.569
h2 Powertrain	1.771	1.775	1.778	1.782	1.786	1.790	1.793	1.797	1.801	1.805	1.809	1.813	1.817	1.821	1.826
Large scale «Flying Tunnel»	492	496	497	499	501	603	605	607	609	611	713	715	717	719	721
Test e-drive	1.300	1.307	1.310	1.314	1.318	1.390	1.394	1.713	1.717	1.721	1.725	1.729	1.733	1.737	1.741
Laboratorio Aeronautico Distribuito - Napoli	1.095	1.104	1.110	1.116	1.122	1.204	1.211	1.377	1.384	1.390	1.397	1.404	1.411	1.417	1.424
Micro-Hole Cooling Lab	412	437	462	462	462	462	462	529	529	529	529	529	529	529	529
TOTAL	11.972	12.060	12.207	12.270	12.394	13.903	14.027	15.040	15.186	15.232	15.458	15.506	15.634	15.682	15.811

Figure C.1. – Single laboratories expected revenues over 15 years period after commissioning (data in thousands of euro)

In order to evaluate the sustainability, we decided to use as indicators the NPV (Net Present Value) of each laboratory and of the overall infrastructure. In order to evaluate the NPV we used a WACC (Weighted Average Cost of Capital) of 4,6% as an average between 1,642% (Italian BTP % calculated at 9/3/2022) and 7,2% (estimation of average WACC on the reference sustainable mobility infrastructure sector). Taxes has been evaluated at 28,82% (IRES and IRAP).

Laboratories	Investments (K€)	Positive Net cash flows (K€ in 15 yrs)	NPV at 2022 (K€)	IRR %
Powertrain test bench for Heavy Duty and Off-Road Vehicles	6.499	13.754	2.359,38 €	8,6%
Production of green H2 for engine and vehicle test	2.809	9.505	2.844,59 €	12,4%
Laboratorio Aeronautico Distribuito - Milano 2	1.867	4.321	812,34 €	8,8%
Laboratorio Aeronautico Distribuito - Milano 1	1.118	3.420	972,64 €	12,1%
Diagnostica infrastruttura ferroviaria	5.000	9.632	996,32 €	6,7%
Campus volo	1.530	4.573	1.293,50 €	12,1%
Laboratorio Aeronautico Distribuito - Torino	3.521	7.821	1.397,53 €	8,7%
h2 Powertrain	4.494	10.069	2.003,60 €	9,4%
Large scale «Flying Tunnel»	1.434	3.256	565,97 €	8,4%
Test e-drive	4.249	10.905	2.535,17 €	10,3%
Laboratorio Aeronautico Distribuito - Napoli	3.499	7.224	1.016,14 €	7,6%
Micro-Hole Cooling Lab	2.684	2.662	-943,16 €	-0,1%
TOTAL	**38.703**	**87.142**	**15.854**	**8,7%**

Figure C.2. – Single laboratories expected NPV over 15 years period after commissioning (data in thousands of euro)

With this assumption the total IRR of the whole infrastructure is therefore 8,7% while the NPV in 18 years (i.e., 3 years in itinere and 15 years in production from 2023 to 2040) will be 15.854K€. The slightly negative NPV for micro-hole cooling lab is largely compensated by the rest of the whole infrastructure.