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XIV Forum

Expo PNRR
26/27 OTTOBRE
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MOST - Centro Nazionale per la Mobilità Sostenibile

Prof. Rosario Miceli
Dipartimento di Ingegneria
Università degli studi di Palermo

CN 00000023 – PNRR – M4C2 Inv. 1.4

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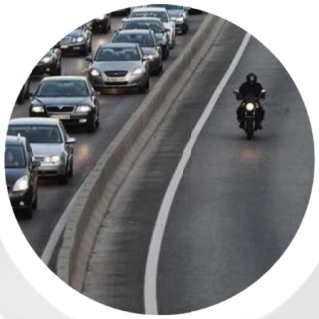
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
MOST CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

Il mondo sta evolvendo verso una **mobilità** sempre **più attenta a nuove necessità e ambizioni**

DECARBONIZZAZIONE

Il **mondo industriale** e il **consumatore** appaiono oggi sempre più sensibili al tema della **sostenibilità** e della **transizione energetica** stimolando iniziative in grado di garantire una **mobilità** sempre più **green**

DECONGESTIONE



Popolazione urbana in continua crescita, **congestione stradale** ed **emissioni** sono solo alcuni degli enabler che stanno portando alla creazione di tecnologie che permettano di creare una **rete di trasporto efficace e smart**

ACCESSIBILITÀ

Le **tecnologie emergenti** e le **startup** dirompenti stanno trasformando il mondo della mobilità rendendola sempre più **connessa, intermodale, as a service** ma soprattutto garantendone **l'accessibilità a tutti i livelli della comunità**

SICUREZZA

Il grande periodo di incertezza generato dalla **pandemia** e il crescente **livello tecnologico** legato al trasporto mette un **accento ancora più marcato sul tema sicurezza,** andando a richiedere garanzie e standard sempre più elevati

TRANSIZIONE E LAVORO

Il settore della mobilità e del trasporto diventa sempre più **strategico per il Paese**, continuando ad evolvere e cambiare forma rendendo necessaria l'**introduzione** di **nuove professionalità e la creazione di nuovi ruoli**

Prof. Rosario Miceli, Università di Palermo

Il Centro Nazionale per la Mobilità Sostenibile nasce con l'ambizione e con l'obiettivo di contribuire alla creazione di una domanda e di un'offerta di mobilità sostenibile

Una mobilità...

...Più «green»
Soluzioni leggere, nuovi sistemi di propulsione, combustibili H2 ed elettrico

...Più sicura
Soluzioni digitali per favorire strategie predittive per ridurre gli incidenti

...Più resiliente
Trasformazione digitale sistemica nel trasporto pubblico e privato

...Più accessibile
Integrazione tecnologica e inclusione attraverso l'innovazione digitale

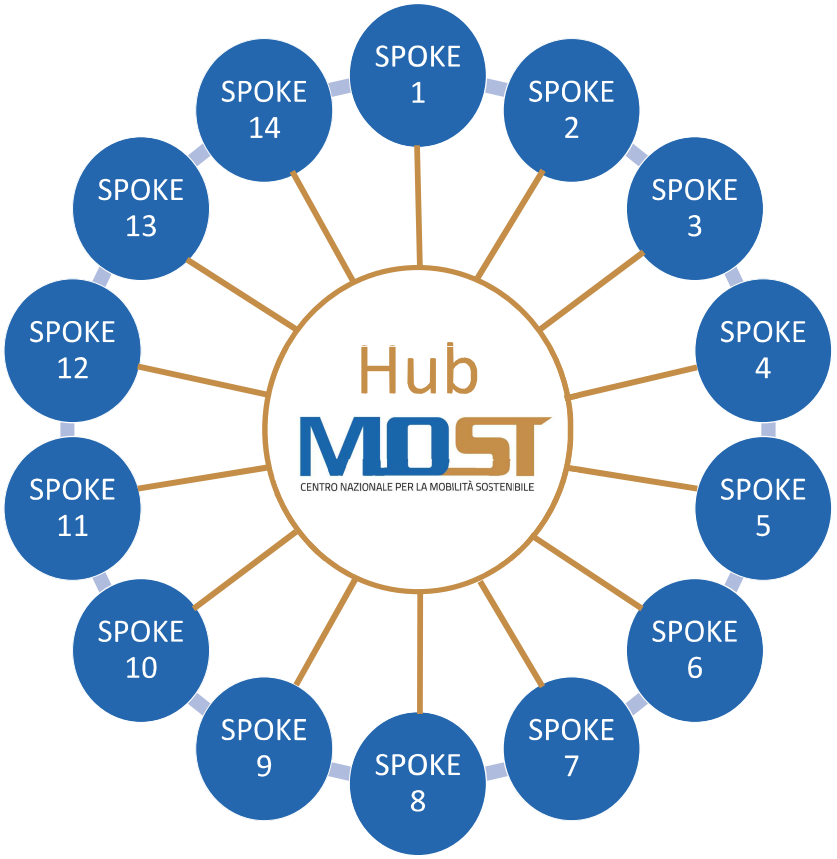
...Più competitiva
Aumentare le sinergie tra università, aziende e istituzioni

...Più collaborativa
Individuazione delle priorità e delle strategie per lo sviluppo della ricerca e dell'applicazione industriale

Il PNRR nella missione 4.2 del Mur, «from research to business», ha previsto 5 Centri Nazionali, di cui fa parte il Centro Nazionale MOST.

Il modello "Hub&Spoke" è un **sistema dinamico**, con un perno al centro l'Hub MOST e attorno i **14 Spoke Leader** che, nella loro interazione, favoriscono la cooperazione con l'ecosistema nazionale e locale.

L'**Hub**, svolge funzioni di **coordinamento**, definisce le linee strategiche, promuove iniziative trasversali, raccoglie input dal mercato, orienta le progettualità e promuove iniziative di startup intelligence.



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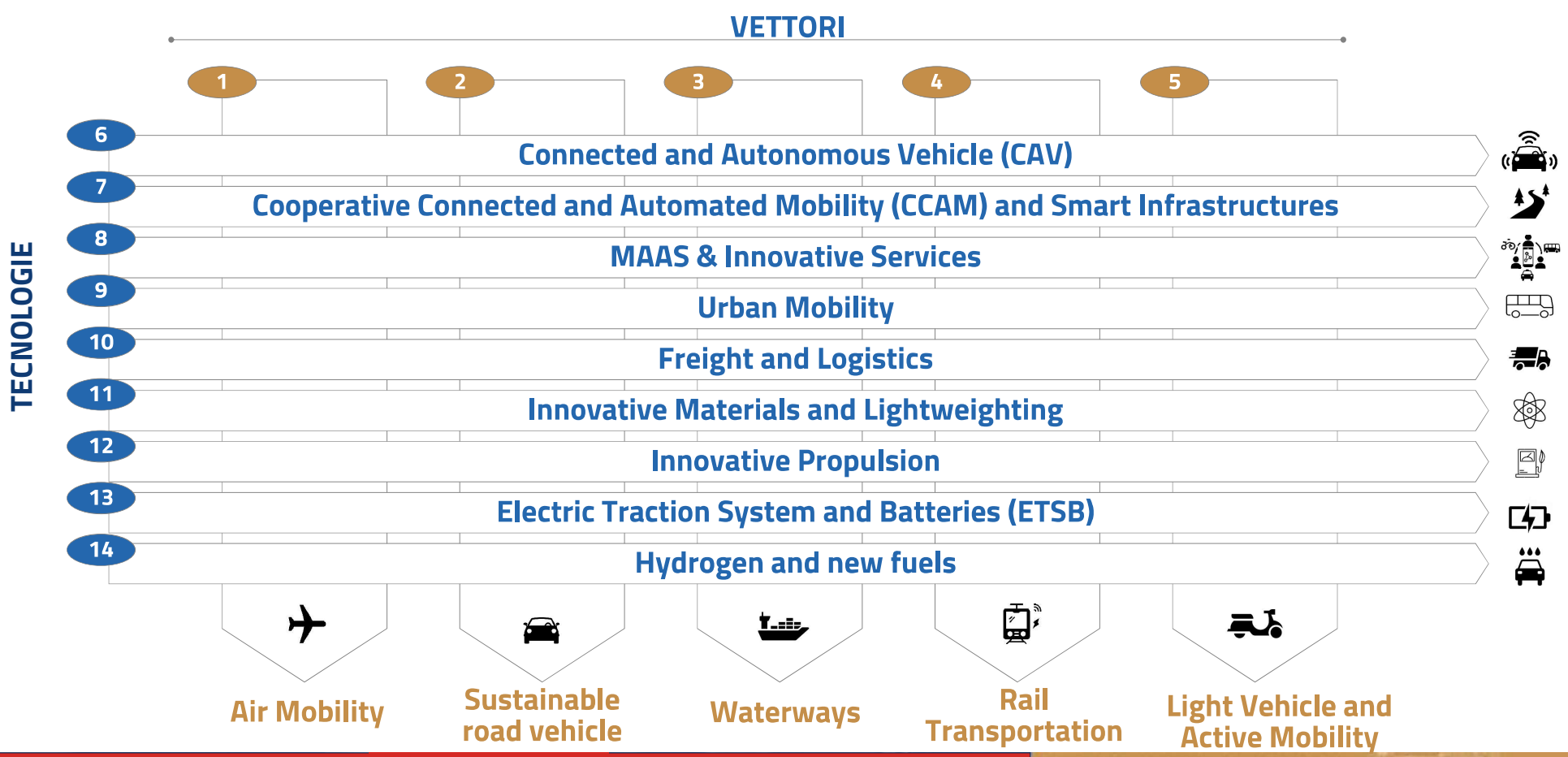

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Gli **Spoke** sviluppano programmi di ricerca a TRL (Technology Readiness Level) elevato con **soluzioni vicine alle esigenze del mercato**, tecnologie strategiche del settore a medio e a lungo termine, operano grazie a infrastrutture e a laboratori all'avanguardia.

SPOKE 1	SPOKE 2	SPOKE 3	SPOKE 4	SPOKE 5	SPOKE 6	SPOKE 7	SPOKE 8	SPOKE 9	SPOKE 10	SPOKE 11	SPOKE 12	SPOKE 13	SPOKE 14
POLITO	POLITO	CNR	POLIMI	UNIBG	UNIMORE	UNINA	POLIBA	UNIROMA	UNINA	UNIBO	CNR	POLIMI	POLIBA
ACCENTURE	BREMBO	FINCANTIERI	ACCENTURE	ANGEL	ACCENTURE	ALMAVIVA	A2A	A2A	ALMAVIVA	AVIO AERO	FERRARI	A2A	A2A
AVIO AERO	IVECO	UNICA	ALMAVIVA	BREMBO	ANGEL	AUTOSTRADE	ANGEL	ALMAVIVA	FNM GROUP	CNR	FINCANTIERI	ACCENTURE	AVIO AERO
LEONARDO	SNAM	UNIGE	ANGEL	PIRELLI	AUTOSTRADE	CNR	FNM GROUP	AUTOSTRADE	LUTECH	ENI	IVECO	AUTOSTRADE	CNR
POLIMI	STELLANTIS	UNIPA	CNR	POLIMI	CNR	FERROVIE DELLO STATO	HITACHI	FERROVIE DELLO STATO	POLIMI	LEONARDO	LEONARDO	FERRARI	ENI
POSTE ITALIANE	TEORESI	UNIPART	FERROVIE DELLO STATO	POSTE ITALIANE	FERRARI	FINCANTIERI	LUTECH	FNM GROUP	POSTEITALIANE	FERRARI	SNAM	HITACHI	FNM GROUP
TEORESI	UNIBO		FNM GROUP	UNIBS	FINCANTIERI	FNM GROUP	UNICA	LEONARDO	UNICA	PIRELLI	UNIFI	INTESA SANPAOLO	INTESA SANPAOLO
THALES ALENIA SPACE ITALIA	UNICAS		HITACHI	UNIFI	IVECO	HITACHI	UNIMIB	LUTECH	UNIGE	POLIBA	UNIMORE	IVECO	SALENTO
UNIBG	UNIPA		INTESA SANPAOLO		LEONARDO	INTESA SANPAOLO	UNINA	PIRELLI	UNIPART	STELLANTIS	UNIPA	POLITO	SNAM
UNIBO	UNISA		LUTECH		PIRELLI	POLIBA	UNIPD	POLIMI	UNIPI	THALES ALENIA SPACE ITALIA		STELLANTIS	UNIPD
UNINA			SNAM		POLIMI	POLITO	UNIPOL	THALES ALENIA SPACE ITALIA		UNIBS		UNIBO	UNITO
UNIROMA			UNIFT		POLITO	SALENTO		UNICA		UNIPD		UNICAS	
			UNINA		POSTEITALIANE	TEORESI		UNICAS		UNIPI		UNIMIB	
			UNIPR		STELLANTIS	UNIBO		UNIFI		UNIROMA		UNIMORE	
			UNIRC		UNIBO	UNIBS		UNIPA		UNIVPM		UNIPD	
			UNIROMA		UNINA	UNIPART		UNIPOL				UNIPI	
					UNIPOL	UNIPI		UNIPR				UNIROMA	
					UNIRC	UNIPOL							
						UNIROMA							
						UNISA							
						UNIVPM							

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La **collaborazione tra pubblico e privato, tra enti di ricerca e impresa,** garantirà una copertura nazionale, capillare ed efficace

24 Atenei e il CNR

Consiglio Nazionale delle Ricerche
Università degli Studi di Palermo
Università degli Studi di Salerno
Politecnico Milano 1863
Alma Mater Studiorum Università di Bologna
Università degli Studi Mediterranea di Reggio Calabria
Politecnico di Torino
Parthenope
Università degli Studi di Bergamo
UNIMORE Università degli Studi di Modena e Reggio Emilia
Università del Salento
Università degli Studi di Brescia
Università Politecnica delle Marche
Università degli Studi di Padova
Università di Parma
Università degli Studi di Cagliari
Università degli Studi di Cassino e del Lazio Meridionale
Università di Torino
Sapienza Università di Roma
Università di Pisa
Università di Genova
Politecnico di Bari
Università degli Studi di Firenze
Federico II
Università degli Studi di Milano Bicocca

13 Regioni coperte dagli Spoke

Spoke-Leader

24 Enti Privati

a2a Life Company
Pirelli
accenture
Ferrovie dello Stato Italiane
Posteitaliane
AlmavivA
Fincantieri
snam
Angel
FNM la vita in movimento
Stellantis
autostrade per l'italia
Hitachi
Avio Aero a GE Aerospace company
Intesa Sanpaolo
Teoresi group
brembo
Iveco
ThalesAlenia Space
Leonardo
eni
Lutech
UnipolSai Assicurazioni

Fatturato conglomerato di

290 miliardi di euro

580 mila dipendenti

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I **numeri** del Centro Nazionale per la Mobilità Sostenibile

PERSONALE STRUTTURATO
696
Ricercatori dedicati

INVESTIMENTO
378 M€
(2023-2025)

PERSONALE DA ASSUMERE
574
Nuovi ricercatori

PROGETTI INFRASTRUTTURALI
147 M€
progetti di ricerca

OPEN CALL
32 M€
partner esterni

PROGETTI FLAGSHIP
68 M€
progetti bandiera

Prof. Rosario Miceli, Università di Palermo

18 DICEMBRE 2021
PROGETTO APPROVATO

9 GIUGNO 2022
NASCITA FONDAZIONE

1 FEBBRAIO 2023
NASCITA STRUTTURA OPERATIVA

6 MARZO 2023
PRIMA REVISIONE SCIENTIFICA

21 APRILE 2023
PRIMA RENDICONTAZIONE

MOST: general outline

SPOKE

- **Permanent Staff / PhD & RTD Recruitement (→ internal)**
- **Infrastructures & Other Costs (→ internal)**
- Cascade / Open calls (→ external)

HUB

- Call for ideas and spin off calls / Startup Intelligence (→ internal/external)
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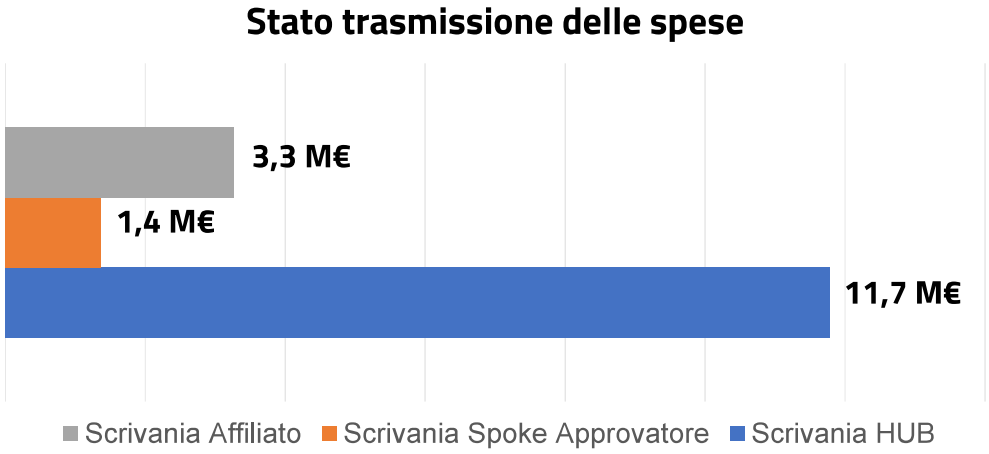
- MOOC (→ internal/external)
- Other projects / Tech Observers (→ external)

Dati di monitoraggio della spesa (al 08/09/2023)

In base ai dati estratti da At Work in data 08/09, allo stato attuale sono state caricate sul sistema spese complessive per **16,4 M€**.

Milestone	Valori
M1 - Massa critica fino a 05/23	10.175.169,30 €
M2 - Massa critica da 06/23	2.082.488,71 €
M5 - RTD/Primo ciclo	1.661.420,66 €
M7 - Phd/Primo ciclo	637.412,74 €
M10 - Infrastrutture pubbliche	1.315.131,19 €
M13 - Infrastrutture private	530.049,65 €
TOTALE	**16.401.672,25 €**



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Indice dei contenuti

1. Closed Call – Bandi PoC e Scalability – Progetti Ricevuti

Tipologia Progetto	N. Progetti Ricevuti	Contributo Richiesto	Milestone di riferimento
PoC – Proof of Concept	**23**	**3,8 M€**	Mls 22 – 2M€
Scalability	**12**	**4,5 M€**	Mls 28 – 4M€

1. Closed Call – Bandi PoC e Scalability – Progetti Ricevuti

	PoC	Scalability
Totale contributo richiesto	3.831.869 €	4.543.926 €
Di cui Quota SUD (fin. Richiesto)	624.274 €	1.356.418 €
Quota SUD %	16%	30%
Di cui Quota Privati	238.446 €	972.121 €
Quota Privati %	6%	21%

Sui **PoC** la **quota privati** (contributo richiesto) sono 238k suddivisi tra: Autostrade, CRF, Ferrari, Ferrovie dello Stato, Pirelli, UnipolSai(Unipoltech)

Sugli **Scalability** la quota privati sono (contributo richiesto) 972k suddivisi tra: Autostrade, CRF, Ferrari, Ferrovie, Hitachi, Pirelli, Poste)

La **quota SUD** è principalmente a carico delle Università-Sud per

quanto riguarda gli Scalability:
- Scalability Bat4Trains Polimi Spoke 2: Hitachi è quota SUD *367.250€*
- Scalability IsROad UniMORE Spoke 6: CNR e ASPI sono quota SUD *112.994+56497 =169.491€*

1. Closed Call – Bandi PoC e Scalability – Griglie di Valutazione

Ogni membro dello IAB riceverà 2 file excel - uno per i progetti PoC e uno per i progetti Scalability - nel quale riportare le proprie valutazioni dei progetti. (MOST Griglia Valutazione PoC e MOST Griglia Valutazione Scalability)

Foglio 1 – MOST Elenco PoC/Scalability. In questo foglio è riportato l'elenco dei progetti presentati e i dettagli di ciascuno (Spoke di riferimento - numero e nome, acronimo del progetto, capofila, partner(s) coinvolti, costo totale, finanziamento richiesto, quota Sud, quota cofinanziamento). Nella tabella è presente anche la colonna «punteggio» con compilazione automatica.

Foglio 2 – Griglie Punteggi. Sono riportate le metriche per la valutazione

Foglio 3,4,5…Griglia di Progetto. Sono riportate le griglie di valutazione per ciascun progetto

Sulla base del testo delle proposte progettuali, ciascun membro dello IAB compilerà i 2 file (MOST Griglia Valutazione PoC e MOST Griglia Valutazione Scalability) assegnando un punteggio per ogni sezione. Qualora lo riteniate necessario potete accompagnare il punteggio con un breve testo di supporto e motivazione (massimo 500 caratteri, spazi inclusi).
La valutazione dovrà **prevedere punteggi per punti interi**, all'interno dei range previsti nella griglia.
In caso di **conflitto di interesse,**il membro dello IAB soggetto a conflitto dovrà astenersi dal valutare la proposta in oggetto. (*es. progetto presentato dal proprio ente*). **Le griglie sono da riconsegnare all'HUB entro lunedì 18 settembre ore 10.00**

Lo IAB avrà autonomia decisionale nell'esaminare e valutare le proposte e qualora ritenuto necessario sarà possibile ipotizzare un ulteriore finanziamento a copertura della graduatoria a scorrimento.

2. Premio MOST StartUP – Caratteristiche

Obiettivo: il **Premio MOST** ha l'obiettivo di sostenere lo **sviluppo e il consolidamento di imprese innovative ad elevato contenuto tecnologico** e di conoscenza che operano sul territorio nazionale e che propongano sul mercato nuovi prodotti, nuovi servizi, processi innovativi e nuovi modelli di business nelle specifiche aree di intervento del Centro Nazionale per la Mobilità Sostenibile.

Destinatari: Configurandosi come una «finale delle finali» potranno partecipare le **startup innovative** che siano risultate **vincitrici di un contest per startup promosso e/o sostenuto da un Partner del MOST** negli ultimi 18 mesi; e startup innovative che siano risultate **vincitrici dei contest StartCup regionali italiani**

Dotazione finanziaria MLS 25 Call4Ideas: **4 milioni €**.

Importo Premio MOST: **50k€** per ciascuna startup. **(TBC)**

Target: **30-50 startup (TBC)**

Tempistiche: chiusura bando **31 dicembre 2023 (TBC)** erogazioni entro **aprile 2024 (TBC).**

2. Premio MOST StartUP – Funzionamento generale

Il CN MOST con il supporto operativo degli SPOKE erogherà il premio MOST, scaturito dalla finale delle finali (slide precedente).

Ruolo dello Spoke che agirà come:

- Membro del **Comitato Scientifico di valutazione (TBC)**
- **Erogazione del Premio** e gestione della pratica su AtWork

Comitato Scientifico di Valutazione: membri dell'I.A.B. + membri del Coordinamento degli Spoke + eventuale apertura ad expert. (se ritenuto necessario)

Possibilità di prevedere un media partner

3. Closed Call - Flagship proposta di Bando

I progetti Flagship sono progetti ad altissimo impatto caratterizzati da unicità, alto tasso di innovazione e sostenibilità nel tempo.

Anche questa azione rientra nelle Closed call e **sarà dedicata ai soli AFFILIATI del CN MOST**

Il bando Flagship del Centro Nazionale per la Mobilità Sostenibile (MOST) si pone attivare 2 macro categorie di intervento:

A. **Progetti divulgativi ad alto impatto mediatico** e innovativo che diano adeguata visibilità al MOST.
B. **Infrastrutture di ricerca e Iniziative disruptive suddivisi a loro volta in 4 filoni di intervento**.
    1. *Dimostratore di ricerca*
    2. *Laboratori di ricerca e innovazione outdoor e indoor*
    3. *Living Lab anche con la Pubblica Amministrazione*
    4. *Iniziative disruptive: progettualità che aprono nuove frontiere/aree di mercato*

3. Closed Call - Flagship proposta di Bando /2

Finanziamento max. per progetto	500.000 euro per i progetti divulgativi – budget disponibile per I^ Call 2,5 Ml€ 5.000.000 euro per i progetti di ricerca – budget disponibile per I^ Call 25 Ml€
TRL di arrivo o target da raggiungere	TBC
Descrizione del modello di business e sostenibilità finanziaria per MOST	Il piano di business dovrà contenere una stima delle misure di sostenibilità finanziaria previste per il Centro Nazionale per la Mobilità Sostenibile. Contributo stimato alla sostenibilità finanziaria MOST (min 10% dei ricavi a lungo termine con soglia minima dell'5% del finanziamento)
Partenariato	Minimo 3 partner di cui almeno 1 del settore privato. Ogni Affiliato MOST può presentare al massimo 2 proposte alla "Call for Flagship".
Finanziamento privato	25 % se SS o 50 % se RI
Finanziamento pubblico	100%
Co-finanziamento	Il/i partner dovranno garantire il 25% del cofinanziamento totale del progetto
Durata	Min 12 max 18 mesi
Spese di personale	Max 15% del valore del progetto
Premialità previste	Quota SUD e Cofinanziamento

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MOST
CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

OPEN CALLS

€ 32 MILIONI (2023-2025)

ANNO 2023 - € 10,6 MILIONI

€ 2 MILIONI

SPOKE 1
POLITECNICO DI TORINO
AIR MOBILITY

SPOKE 2
POLITECNICO DI TORINO
SUSTAINABLE ROAD VEHICLE

€ 1,3 MILIONI

Aggiornamento Unioncamere

OPEN CALLS

- **Total funding: € 1.998.714 (Spoke 1 - 2mln€) (Spoke 2 - 1,3mln€)**
- **Climate constraint >**36% of the action
- **Digital constraint** >15% of the action
- **Topics covered** in the open calls: **See *"Allegato 3"* of the call**

SAVE THE DATE!

Azione	Data
Apertura della Cascade Call	25 Luglio 2023
Cut off	31 Ottobre 2023
Valutazione delle proposte	26 Luglio - 30 Novembre 2023
Inizio delle attività finanziate	1 Gennaio 2024

Spoke activities description

Spoke 1 – Air Mobility

POLITECNICO DI TORINO

Spoke Coordinator: TORINO

Context

- The italian aerospace sector is solidly in fourth place in Europe and seventh in the world. It is able to generate a total turnover of 13.5 billion euros, equal to 0.65% of GDP; the overall added value is around 12 billion euros.
- A fundamental factor is innovation and research, for which the sector employs about 10% of its turnover, keeping within the European average.
- Approximately 50,000 of the more than 200,000 specialized workers in the sector are employed in the more than 4,000 companies that make up the supply chain. Most of them, about 90%, are SMEs, but the Italian aerospace sector can boast players of strategic importance and international reputation (Leonardo, Avio Aero and Thales Alenia Space Italia).

Project of the Spoke

- Study of the enabling aeronautical technologies of multidisciplinary conception
- Design of innovative air platforms with integration of new propulsion systems with low environmental impact
- Development of methodologies for the integration in the airspace of new autonomous and/or single-pilot means of air transport, and of the conception of cooperation logics between aeronautical systems with different levels of autonomy
- Design and deployment of simulation platforms based also on Virtual, Mixed and Augmented Reality tools for aeronautical design, training and maintenance
- Development of advanced design methods for aeronautics and introduction of circular economy concepts related to the complete life cycle of aeronautical products

Goals

- Develop new technologies and methodologies applicable to fixed-wing and rotary-wing civil aviation with innovative propulsion, high energy efficiency and low environmental impact, for short/medium range transportation, regional and utility services
- Identify operational and logistical alternatives based on transportation via high range aeronautical and multimodal systems and related supporting infrastructure
- Design guidelines for autonomous and/or single-pilot systems in the aeronautical domain (with particular emphasis on Advanced/Urban Air Mobility)

Key Enabling Technologies

- Autonomy and AI, Collaboration between autonomous and manned systems, Human Machine Interface, 5G and communications networks
- Digital Twin
- Model Based System Engineering
- Virtual, Mixed and Augmented Reality

Other Impacted Spoke

- Electric traction and batteries, Innovative propulsion, Hydrogen and new fuels, Autonomous driving and connected vehicle, Innovative materials and light weighting

Spoke 2 - Sustainable Road Vehicle

POLITECNICO DI TORINO

Spoke Coordinator: TORINO

Context

- In Italy, the automotive sector involves 15,000 companies, 3% of the workforce, corresponding to 7% of employees in the manufacturing industry, with revenues equal to 7.1% of GDP. The supply chain includes the whole chain from component and service suppliers to OEMs.
- The need to make the transport system more sustainable justifies regulations that impose a drastic reduction in emissions, achievable only through electrification, hydrogen and alternative fuels. Between 2030 and 2035, major manufacturers will no longer produce vehicles with ICEs.
- Communication and data processing systems make possible increasingly autonomous levels of vehicles with implications for sustainability and safety.
- The challenge for the Italian automotive industry is to adapt to these changes through the development of low-emission, autonomous and connected vehicles that are environmentally, socially and economically sustainable.

Project of the Spoke

- Development, testing and systemic/integrated validation of:
- New electric, autonomous and connected vehicle architectures.
- High efficiency electric and hydrogen powertrains through integration of all components: engine, transmission, power electronics, cooling.
- Energy management and vehicle control systems highly integrated with infrastructure and autonomous driving system.
- Chassis components for fuel efficiency, safety and comfort.
- Systems for diagnostics and management of the vehicle and its components.
- Autonomous vehicle homologation support through laboratory tests at vehicle system level.

Goals

- Rethink the architecture of zero emission (electric, hydrogen), autonomous and connected vehicles and their components, in order to make them environmentally, socially and economically sustainable.
- Define new methodologies for the integrated design and validation of zero emission vehicles for passenger and freight transport.
- Define new methodologies for the integrated design of vehicle-powertrain-autonomous driving system-connectivity.

Key Enabling Technologies

- 5G and communication networks
- Batteries and fuel cells
- AI for diagnostics, virtual sensing, and safety
- Cloud and IOT for diagnostics and processing

Other Impacted Spoke

- Electric Traction and batteries, Hydrogen and new fuels, Urban Mobility, Autonomous driving and connected vehicle, MAAS, Innovative materials, Networks and smart infrastructure.

Spoke 3 – Waterways

Spoke Coordinator: CNR

Context

- Maritime transport plays a fundamental role for the movement of people and goods and for the development of the economy, considering that 80% of world traffic is carried by sea. In this context, Europe, and in particular Italy, due to the high extension of its coasts, plays a fundamental role, destined to grow, with important repercussions on tourism in general and on the islands in particular.
- The freight and passenger transport sector in Italy generates an added value of approximately 8 billion, employs more than 100,000 people and has a multiplier effect of 2.8%;
- Given the size and power at stake, maritime transport, also following the recent introduction of regulatory constraints, will have to face a significant design and technological revolution for the substantial reduction of greenhouse gas emissions and other pollutants both during navigation and while in port;
- Although the path to decarbonization has been started with a major European investment program, zero emission solutions (e.g. electric, hydrogen) are not yet technologically mature for immediate use on large ships;
- Port infrastructures are not always adequately structured to allow the use of low-emission fuels or connection to the electricity grid;
- The transport of people and goods represents a fundamental pillar for the development of a sustainable and resilient Italy, which can be achieved by paying adequate attention to both the environmental aspects related to chemical and physical pollution and the safeguard of human life at sea, integrating the effective use of digital technologies for a continuous improvement of the performance of marine vehicles.
- Sea transport, similarly to other modes of transport, sees in the technological development towards an increasingly autonomous guidance, navigation and control of marine vehicles, an enabling path towards increasingly efficient and safe carriers.

Goals

- Increase marine vehicle efficiency and reduce emissions of GHGs and other pollutants from marine vehicles both while underway and while in port;
- Foster the transition to less polluting and, progressively, zero-emission fuels;
- Improve traffic management and navigation safety also through an increase in the level of automation;
- Mitigate the impact of shipping on the environment and marine life;
- Favor an increase in the intermodality of road/sea transport.

Project of the Spoke

- Development of innovative design systems able to take into account the entire life cycle and decommissioning of the vehicle in view of the circular economy;
- Study of technological and design solutions for energy efficiency and reduction of GHG emissions and other pollutants of marine vehicles and subsystems for different operational areas;
- Increasing the level of automation and management of vehicles through the implementation of new IoT solutions, new communication networks based on the use of sensor networks and AI techniques for real-time data analysis;
- Digitization of vehicles and on-board systems and implementation of decision support tools for optimal management of the vehicle and on-board systems and able to detect failure situations, predict maintenance interventions and provide decision support in emergency situations;
- Development of guidance, navigation and control systems for application to autonomous driving of marine vehicles;
- Characterization and mitigation of the impact of vehicles on the marine environment in terms of noise and pollutants at sea;
- Improvement of traffic management in open sea and port areas through port-ship interfacing;
- Optimization and simulation tools for cargo and passenger management, multimodal transport models, automation of passenger and cargo handling operations.

Key Enabling Technologies

- AI for systems digitization, autonomous driving, data analysis and Decision Support System
- Advanced sensing and IoT for situational awareness, continuous system and vehicle monitoring, optimal management and decision support;
- Advanced materials for energy efficiency;

Other Impacted Spoke

- Innovative Propulsion, Innovative Materials, Logistics, Autonomous Driving, Electric Traction, Hydrogen and New Fuels, Networks and Infrastructures

Spoke 4 - Rail transport

POLITECNICO MILANO 1863

Spoke Coordinator: MILANO

Context

- Railway based transport covers a wide range of scale dimension, from urban, to regional and national level, so that it can be integrated with long-range and short range and personal ways of transportation, both for passengers and goods, aiming at improving access and efficiency of overall mobility.
- Advanced signaling systems (like ERTMS) enable to operate safely a high level of traffic on the High-Speed network, that contribute to decrease the time distance among distant regions, and to improve the north-south access.
- Digital technologies and monitoring systems managed through data analytics, based also on structures modelling, enable to conceive to move to preventive maintenance in railway infrastructure, in order to increase safety level, to prevent disruption and improve economical sustainability. This can be applied both on the infrastructure directly, or through on-board monitoring systems
- Hydrogen powered FC trains are entering into service, offering a sound alternative to classical IC engine power for not-electrified lines, promoting the regional transportation, also from east-west sides coasts.

Goals

- In line with the Strategical Document for Railway Mobility of passenger s and goods delivered by MIMS, the spoke objectives:
  - Digitalization of railway transportation, with regards to predictive maintenance approach based on big data for safety and sustainable maintenance of infrastructure, both
  - Hydrogen powered trains with green hydrogen for clean railway transportation in non electrified lines
  - Effective, safe and efficient goods transportation on railways.
  - Infrastructure technologies and solutions for the sustainable development of Adriatic corridor, as well as strategic transversal connection for improvement of network in southern Italy, and connection to TEN-T corridors.
  - Development of resilience, economical and environmental sustainability effectiveness of mass transportation in the metropolitan areas.

Project of the Spoke

- Creation of a network of research labs and demonstrators
  - Ordinary passenger train suitably fitted with monitoring systems for daily inspection of the status of the infrastructure (line, IRJ, bridges, ...) to feed predictive maintenance programs. The same can be applied to improve the capabilities of current inspection trains. (Field demonstrator).
  - Dedicated sensor network for infrastructure monitoring (Switches, IRJ, bridges). (Field demonstrator)
  - Drone for railway line inspection and patrolling (vehicle demonstrator)
  - Flexible moving block signaling system (virtual lab)
  - Long freight train: optimal control of operation (Virtual lab, on board train diagnostics for running safety and train defects detection Demonstrator).
  - Fixed monitoring system (Demonstrator)

Key Enabling Technologies

- Digitalization of data and information flow
- Big data model-based analytics and data fusion for management finalized to infrastructure maintenance management
- Multiphysics modelling and simulation on shot and long-term time scale, for estimation of energy requirements
- Distributed sensors network

Other Impacted Spoke

- Urban mobility, MAAS and services for mobility, Connected networks and smart infrastructure, Logistics

Spoke 5 – Light Vehicle and Active Mobility (1/2)

UNIVERSITÀ DEGLI STUDI DI BERGAMO

Spoke Coordinator: BERGAMO

Context

- Active mobility and light vehicles represent one of the most fast growing sector in terms of units sold. Multimodal mobility is spreading thanks to the large availability of e-bikes and e-scooters (2-3-4 wheel) together with suitable APPs creating a virtuous and harmonious combination of connected vehicles, services, infrastructure, and people.
- Active mobility and light vehicles are the ones most promising solution thanks to their ability to be contemporaneously able to:
- Offer/be used in door to door services
- Sustainable and healthy alternative to single occupancy car issues, both in cities and rural scenarios
- Unbeatable low Energy requirements and consumption
- Higher social accessibility due to presence of several cheap solutions
- Space saving (e.g. traffic congestion, land consumption)
- Time to market (both infrastructures and vehicles)
- Active mobility is part of new and sustainable lifestyles and an alternative form of mobility. It aims at encouraging a new organization of activities. Moreover, outside metropolitan areas, must be seen as a new infrastructure.

Goals

- Vehicle: create new design paradigms and a new generation of flexible and modular 100% safe vehicles
- User: user-centric personalized mobility experience including health-improvement
- Environment: Demonstrate the ability of renewable-based charging stations to reduce their adverse impacts on power grids;
- Social and Economic: Demonstrate the ability to safely use L- vehicles in an extend range of scenarios
- Reduce Total cost of ownership
- Extend the use range
- Identify infrastructure solution suitable for a large number of cities (big and small-medium size)

Issues

- The challenging contribution of innovation that characterizes this sector raised several issues that need to be tackled
  - Need to further explore and demonstrate the ability to design efficient solutions that employ fully renewable sources (e.g., solar photovoltaic generators coupled with battery energy storage)
  - Risk assessment and proper solution given the higher natural direct human (body) exposure compared with other transport solution (i.e. accidents, exposure to fine particulate, etc..)
  - proper place and integration into the mobility system and development of appropriate/dedicated smart road infrastructure and ICT infrastructure in relations to different areas
  - Identify proper user centric designed solution that will favor modal switch
  - Provide inside and technological instruments that allow for a proper Market regulation and surveillance system

Key Enabling Technologies

- AI for the identification of the consumption patterns of electric vehicles based on the specific driver behavior and real-time/forecasted traffic congestion;
- IOT for smart infrastructure and digital twin
- Mathematical model and real data management for traffic management, safety solution and real time risk assessment

Other Impacted Spoke

- MAAS , Urban mobility, smart infrastructure, electric power train

Spoke 6 – Cooperative, Connected and Autonomous Mobility

UNIMORE

Spoke Coordinator: UNIMO-RE

Context

- Digital technologies and devices are one of the most important parts of current vehicles. Their rapid development is expected to lead in short to a complete autonomous mobility. Today single vehicles are already able to drive autonomously in specific contexts, but the challenge addressed by this project is to define a system where all, or almost all vehicles drive autonomously in no predefined environment.
- The exploitation of these technologies in real urban and extra-urban environments (with occlusions, variability, dynamicity and heterogeneity) requires future systems to have a robust and deep integration with infrastructure, vehicle architecture and control systems, a 360° vision of the surrounding environment, significantly reduced reaction times, improved performance predictability and to be able to control the vehicle for extended periods of time not relying on human back-up, user and social acceptance, and economic sustainability.
- Future scenarios will also require cross-sectors synergies with KETs that have different time scales for innovations and innovative business models
- The advent of automated vehicles also opens important new challenges in relation to cybersecurity, liability and privacy aspects.

Goals

- In line with the Strategic Research and Innovation Actions [1] developed by the CCAM Partnership [2], the spoke has the overarching objective of creating a network of research labs and a large-scale demonstration environment to achieve the following concrete yet ambitious Operational and Strategic objectives:
- Facilitate the creation of an eco-system to foster the deployment and adoption of future connected and automated vehicles (CAV)
- Define proper guidelines for connected infrastructures design
- Foster the integration of connected vehicles in the intelligent transport system to reduce accidents and minimize energy consumption and emission.
- Facilitate the wide public acceptance
- Address validation and certification approaches
- Coordination of local, national, and EU initiatives

Issues

- Creation of a network of research labs and large-scale demonstration environment
- To capitalize and implement CCAM technologies and innovations through Living Lab Pilots and Field Operational Tests (FOTs)
  - To support deployment readiness and the related impact assessment.
  - To facilitate the wide public acceptance through the collection of feedback on user needs and societal expectations (e.g. systematic survey campaign, also mining the mood from the social media, to find the barriers for the introduction of autonomous vehicles)
- Vehicular technologies development:
  - Study and development of next-generation platforms for future autonomous driving scenarios and their integration in vehicles (e.g. high-performance real-time architectures and technologies for low-power embedded systems)
  - Development of on-board and cooperative technologies of CAVs to perceive the environment, interact with their surrounding as well as with other road users, and make decisions, enabling safe and sustainable mobility, and providing protection in the case of emergency while reducing the system environmental footprint and ensuring the comfort and well-being of the vehicle occupants.
- Connected infrastructure design:
  - Definition of guidelines for the design of connected infrastructures that can properly interact with CAVs in real urban areas
- Deliver certificated and homologated in-vehicle and infrastructure technologies for demonstration on public roads, including functional safety, cybersecurity, and ethical and legal aspects.

Key Enabling Technologies

- High-performance real-time architectures and technologies for low-power embedded systems
- Cybersecurity building blocks, tools and methodologies (at vehicle and communication level)
- Trustworthy and reliable Artificial Intelligence and Decision Support framework
- Data fusion for high precision localization and mapping, accurate real-time road users and obstacles position, urban navigation and control.

Other Impacted Spoke

- Car and Tire, Urban mobility, MAAS and services for mobility, Connected networks and smart infrastructure, Logistics

Spoke 7 - Connected Networks and Smart Infrastructure

Spoke Coordinator: NAPOLI

Context

- Most of the countries with developed economies have large portions of road and highway networks in operation for over fifty years, with a disruptive potential for human safety and economic systems
- Mobility has reached a high level of interconnection among its constituent components, which is destined to increase with the emergence of Cooperative, Connected and Automated Mobility, the spread of innovative mobility models, the emergence of new energy carriers
- Efficiency and sustainability of transport, as well as ability to produce and sell technologically innovative means and services, pass through the integration and connection of physical and digital networks

Goals

- Improve the resilience of the transportation system with respect to point and network fragilities due to degradation, seismic and climatic events, and other natural, anthropogenic, and health susceptibility factors
- Achieve digital transformation of infrastructure networks for more integrated, smart, safe and secure mobility
- Prepare transportation networks for the advent of cooperative, connected and automated mobility
- Ensure the network elements for the use of new energy carriers alternative to fossil fuels

Project of the Spoke

- Develop technologies and models for monitoring, processing and intervention for the resilience of transport networks
- Develop technologies and platforms for transport nodes, terminals and networks, increasing their accessibility, effectiveness, efficiency and impact on territorial and economic systems
- Consolidate ITS technologies and develop the transition to C-ITS technologies, also developing the related services
- Develop technologies for the control of networks and traffic systems in conditions of increasing automation and connection
- Develop technologies and tools for the distribution and use of alternative energy carriers to fossil fuels in the network
- Support the validation of autonomous driving through the testing of Operational Design Domain in laboratory environment

Key Enabling Technologies

- Sustainable Mobility
- Advanced simulation and big data analysis and management
- Advanced technologies for environment and energy

Other Impacted Spoke

- Logistics and Freight; Waterways; Rail Transportation; Autonomous Driving and Connected Vehicles; MaaS and Services; Electric Traction; Hydrogen and New Fuels

Spoke 8 – MAAS & Innovative Services

Spoke Coordinator: BARI

Context

- The effects of the Pandemic Covid-19 have shown the poor resilience of the collective transport system
- Recent studies show a reduction in the use of collective transport and the increase in the use of private vehicles, in many cases, has grown to levels higher than pre-pandemic levels with consequent environmental, social and safety diseconomies.
- It is evident the emergence and growth of new behavioral and technological paradigms of mobility (e.g. micro-mobility, post-car city, 15min city) and the need to ensure innovative services and technologies to support multimodal transport, seamless, flexible, able to reduce the use of own means of transport that integrate new forms of mobility in respect of sustainability and livability of the city.

Goals

- Identify and integrate innovative services and technologies for mobility able to reduce the use of cars by promoting collective transport and other forms of sustainable mobility in an integrated and multimodal way.
- Realize technological platforms for the management of the optimal interaction between demand and supply through protocols and network architectures for the orchestration of flexible and secure services, even on a large scale.
- Identify business models to support collaborative solutions between operators, users and environment.
- Identify social, economic, environmental and behavioral aspects of the solutions
- Define guidelines for the design and real-time management of fair, safe and sustainable mobility solutions at the network level to support the 15min city and post car city paradigms for a more livable and sustainable city.

Project of the Spoke

- Study and determination of MaaS structures and innovative mobility services with related technologies, with particular reference to shared and multimodal micro-mobility, also for sustainable urban logistics (drones, crowdshipping, cargobikes etc).
- Definition of operational, technological, behavioral, infrastructural and policy drivers to maximize benefits and penetration of innovative mobility solutions
- Assessment models for social equity and safety, and Life Cycle Impact and environmental impact of innovative mobility solutions
- Innovative services of advanced sensors for monitoring and real-time control of gas emissions and traffic
- Realization of living labs
- Realization of an observatory / study center for mobility with reference to systematic mobility and micro-mobility

Key Enabling Technologies

- Artificial intelligence (for predicting system states)
- IoT (for real-time programming)
- B5G/6G architecture (for connectivity)
- Big data analytics
- Augmented and virtual reality (for understanding behaviors)
- Sensors

Other Impacted Spoke

- Urban Mobility, Logistics, Connected Networks and Smart Infra, Autonomous Driving, Light Vehicle & Active Mobility, ...

Spoke 9 - Urban Mobility

SAPIENZA UNIVERSITÀ DI ROMA

Spoke Coordinator: ROMA

Context

- The world of urban mobility is changing fast, and cities are grappling with the impact on safety. Growth in urban populations, combined with more cars, trucks and public transport vehicles sharing crowded streets with vulnerable road users (pedestrians, cyclists and motorcyclists), makes the task of providing safe mobility a complex challenge. The task is further complicated by unsafe driving behavior, demand for multimode transport options, the need for bicycle-friendly streets and the uncertain future of autonomous vehicles, the constraints related to public health in case of pandemic diseases (like COVID-19).
- Recent studies have highlighted that the main challenges in "Urban mobility" are related to the following topics: environment, safety, quality of life, traffic congestion, public health, accessibility and inclusivity and public space

Project of the Spoke

- To accelerate the transition to low- and zero-emission forms of transport
- To develop and implement a new model of urban transportation integrating human-driven or autonomous carriers, and different vectors (including bike and soft mobility)
- Active and passive technologies and monitoring network for improved experiences of urban mobility users and outdoor pollutant monitoring
- User-centric multi-point communication schemes for high rate, high reliability V2X communications at millimeter wave frequencies
- Methods and models for the improvement of Safety of Cycling and pedestrian Mobility in Urban environment, taking into account issue related to safety.
- Retrofitting and redesign of transport infrastructures for the new smart and sustainable urban mobility
- Management of intermodal hubs for travel from extra-urban to urban areas, which also includes the management of the integration between private mobility and public mobility, also linked to the development of intelligent infrastructures that facilitate the speed and efficiency of the exchange.

Goals

- Demonstrate how new technologies can work to solve real problems in real cities by transporting people, freight and waste in smarter ways, through the implementation of a new model of urban transport, which integrates multiple technologies (KETs) and different types of vectors (on road, on rail, on water and air), in an effective approach of smart and green city

Key Enabling Technologies

- Real time sensor networks for urban mobility
- Low latency and high reliability communication network
- Artificial intelligence and optimization methods
- New smart devices for the management of the urban mobility
- Full and hybrid electrical transport system

Other Impacted Spoke

Spoke 10 – Goods logistic

Spoke Coordinator: NAPOLI

Context

- The logistics and goods transport sector in Italy involves more than 15 thousand companies for a turnover of about 70 billion Euros; it is constantly growing, despite the difficulties due to the pandemic crisis.
- The sector is under pressure due to energy tensions, the e-commerce phenomenon, globalization vs. reshoring, the volatility/dynamicity of goods flows, an optimization of individual distribution chains with little attention to externalities and collective diseconomies
- In Europe, transport causes about 25% of CO2 emissions, 36% of which are due to goods, and the opportunities of circular economy and synchromodality are not yet fully exploited.

Project of the Spoke

- Modeling logistics nodes and networks, also with digital-twining tools, to predict/optimize planning and operations
- Develop logistics hub technologies towards synchromodality and system resilience
- Define operational models to exploit the innovation of cyber-physical systems, physical internet, IoT world, blockchain, automation and connection between vehicles and/or networks
- Develop the technologies and operational and business models for freight and logistics as a service and last-mile logistics
- Develop calculation models and system optimization of the environmental footprint of freight and logistics nodes and networks

Goals

- Equip it with increasingly advanced cognitive tools and system modelling, including forecasting methodologies
- To develop and promote technologies able to enable the innovation of organizational systems and operational approaches
- Technologically support synchromodality and rebalance road transport
- Design guidelines for infrastructural and legislative changes to encourage a positive impact on sustainability

Key Enabling Technologies

- Sustainable Mobility
- Advanced simulation and big data analysis and management
- Industry 4.0

Other Impacted Spoke

- Air Mobility; Car and Tire; Waterways; Hydrogen and new fuels; Urban Mobility; CCAM, connected networks and Smart infra

Spoke 11 - Innovative Materials and Light-weighting

Spoke Coordinator: BOLOGNA

Context

- Innovative materials for structural light weighting are essential for reducing vehicle fuel consumption and emissions while maintaining high safety standards and high performance.
- Replacing components made of conventional materials with innovative materials, such as high-strength steels, aluminum, magnesium and titanium alloys, polymeric materials, advanced ceramics and composites, micro- and nanostructured hybrid materials, and smart materials, enables a significant reduction in vehicle weight and an equally dramatic reduction in fuel consumption and emissions. For example, 100 kg of weight reduction in a car powered by a heat or electric engine leads to a reduction in emissions from about 6 to 11 g of CO2/km. The use of recycled materials further reduces environmental impact and carbon footprint.
- The use of lightweight materials is fundamental for all vehicles but particularly for hybrid, plug-in hybrid and electric vehicles, in order to compensate the weight of batteries and electric motors, improving efficiency and increasing range.
- The innovative techniques of surface modification of materials for lightening also make it possible to reduce energy dissipation, due to friction for example, and limit the phenomena of degradation in operation, to the benefit of efficiency, reliability and durability.
- The integration of components and joints in innovative lightweight, functional, smart materials in next-generation vehicles is essential to reduce costs, increase sustainability in raw material use, recovery and recycling, minimizing environmental impact and procurement risk. Achieving these goals requires a multidisciplinary approach that integrates specific skills on: materials, advanced design techniques, manufacturing processes, environmental sustainability.

Goals

- Identify alternatives to traditional materials with a view to lightening vehicles, ensuring high standards of safety and reliability, with attention to sustainability, recyclability and recovery.
- Define more efficient and sustainable production and transformation processes -including additive manufacturing technologies and new joining technologies- also through the use of digital twin process approaches to guarantee the final properties of manufactured goods, applying Eco-design and Life Cycle Analysis (LCA) principles.
- Define new heat treatment and surface modification strategies for increased mechanical, tribological, and durability performance.
- Develop design methodologies based on structural optimization aimed at lightweight design in the field of mobility with innovative materials and processes.
- Identify and promote the industrial realization of new recycling supply chains in cascade of innovative lightweight materials, in order to extend their life while promoting the integration and synergy with other strategic production chains.

Project of the Spoke

- Study of alternative solutions to conventional materials involving the production and use of innovative materials for the lightening of structural components and/or components for energy storage and conversion in new generation vehicles, ensuring high standards of safety, reliability, durability and reduced environmental impact.
- Development of manufacturing processes and cradle-to-grave design methodologies for efficient and sustainable integration of innovative vehicle light weighting materials.
- Development of computational methods for the simulation of mechanical behavior and for the estimation of in-service damage of lightened vehicle components, and of methodologies for the topological optimization of anisotropic materials.

Key Enabling Technologies

- Advanced and functionally graded materials
- Additive manufacturing
- Advanced manufacturing and joining systems
- Digital twin processes
- Multiscale and predictive models for materials service behavior
- Development of design methodologies for light weighting in complex assemblies and structural and topological optimization methods
- Limitation of the use of critical raw materials
- Renewable raw materials, Eco-design, recovery and recycling

Other Impacted Spoke

- Car and tire, Air mobility, Electric traction and batteries, Hydrogen and new fuels, Waterways, Mopeds and soft mobility

Implementazione

- The initiative will contribute to the implementation of a network of research laboratories, demonstration environments and Living Labs to achieve the goals of light weighting for sustainable mobility:
  - Creation of laboratories with large shared equipment for the production and integration of innovative materials in light weighted components for sustainable mobility and their validation
  - Prototypes/demonstrators of the technologies developed by Spoke
  - Coordination and collaboration with local, national and European institutions and industrial partners
  - Communication and dissemination of results and training of personnel with high skills and lifelong learning in the field of innovative materials for light weighting

Spoke 12 – Innovative propulsion

Spoke Coordinator: CNR

Context

- The evolution towards a sustainable transport system in environmental, social and economic terms is one of the pillars of the energy transition. Propulsion technology, energy carrier, conversion process and optimal use of energy are the key points that drive the research to identify solutions for the use of sustainable energy sources and propulsion systems with zero impact on pollution and climate.
- This requires the development of innovative methodologies and technologies for all types of propulsion systems used in different transport sectors (land, sea, air) and the gradual introduction of "environment-neutral" energy carriers (electric, H2, bio-CH4, e-fuels, NH3, etc.).
- There is no single technology solution and architectural model that covers all sectors. Rather, architectures and technologies must be chosen based on parameters related to the means of transport, whether land (road and off-road), naval or air, such as:
  - mission profile and/or work cycle;
  - working environment and type of energy carrier available;
  - dimensions and mass;
  - functional safety for the specific sector (aviation, military, etc.);
  - purpose (transportation of people, cargo, mixed) etc.;

Goals

- Development of innovative propulsion technologies for the short to medium term, powered by sustainable energy carriers for each sector of the transport system;
- Identification and prototype development of "disruptive" solutions for advanced and sustainable powertrains;
- Development and demonstration of energy conversion processes and technologies for "fuel flexible" (e-fuels/bio-fuels) powertrains;
- Identification of new materials for higher performance and more sustainable powertrain components;
- Development of control systems, through Cyber-Physical Systems architectures for powertrains;
- Identification of methodologies for the optimal management of energy flows on board vehicle/ship/ship;
- Implementation of control logics for the optimization of the interaction between powertrain and vehicle sensors in view of ADAS;
- Development of systems for the reduction of exhaust and non-exhaust emissions;

Project of the Spoke

- Optimization of existing thrusters with innovative architectures for the use of sustainable energy vectors (for land, sea and air transport).
- Development and prototyping of non-conventional thermal machines with very high efficiency and neutral environmental impact for the generation of mechanical and/or electrical energy.
- Development of innovative high efficiency propulsion systems based on different architectures for naval and aeronautical applications with different levels of hybridization (thermal, electric and fuel cell) depending on the mission;
- Development of "smart" power architectures for the naval sector with optimal integration between renewable energy production systems and on-board and/or in-port systems;
- Development of innovative sensors for thruster control and power transmission optimization;
- Development of specific methodologies for the evaluation and analysis of the environmental impact of thrusters during their life cycle;
- Use of new, more sustainable and high-performance materials and construction technologies for both engin and emission abatement systems;
- Implementation of intelligent controls for the optimal management of active, regenerative and passive power to reduce emissions.

Key Enabling Technologies

- Propulsion systems technology.
- Energy carrier thermo-conversion processes.
- Diagnostics and process control.
- Methodologies for integration of propulsion systems into cyber-physical systems.
- Power transmission and control systems.
- Energy storage devices and power flow optimization.
- Production and characterization of advanced materials for energy and transportation.
- Thermo-fluid-dynamic simulation models and platforms.
- Sustainability analysis of systems over the entire life cycle.
- Sensors and virtual sensors for thruster control.

Other Impacted Spoke

- Hydrogen and New Fuels, Electric Drive and Batteries, Innovative Materials, Autonomous Driving and Connected Vehicles, Waterways.

Spoke 13 – Electric Traction Systems and Batteries (ETSB)

POLITECNICO MILANO 1863

Spoke Coordinator: MILANO

Context

- Electric Traction Systems have traditionally evolved in the railway sector and are recently being developed in the different mobility sectors: road, naval and aerial applications.
- The development of road systems, in recent years, has led to many researches in the field of electric drives and electrochemical batteries, but without reaching yet a mature and proved technology.
- The development of power electronic converters to drive electric motors needs studies about Power Quality and electromagnetic compatibility with others apparatus and devices on board and infrastructures.
- In parallel, the generation of electricity from Renewable Energy Sources of different nature is developing, whose non-programmability will require new challenges to the electrical system that will increasingly need storage systems.
- It is possible to think about a medium-term future scenario characterized by a high presence of electrified transport systems and Renewable Energy generators that will have to interact with each other while maintaining the safety of the system.

Goals

- In line with the Next Generation EU (NGEU) program [1], this spoke has the overall goal of creating a network of research centers and laboratories, large-scale demonstration environments, full-scale prototypal applications and Living Labs to achieve the following challenging but feasible operational and strategic goals:
- Electrification of the traditional transport systems
- Development of equipment for Smart Electric Road Systems
- Development of devices and systems for fast and ultra-fast innovative transport infrastructures
- Development of chemical battery for on-board and stationary applications
- Control strategies and system interface between different mobility infrastructures with Renewable Energy Sources (RESs) and Battery Electric Storage Systems (BESSs)
- Coordination of local, national, and EU initiatives

Project of the Spoke

- Creation of a network among research centers and laboratories, large-scale demonstration environments, full-scale prototypal applications and Living Labs
  - To capitalize and implement ETSB technologies and innovations through Living Lab Pilots and Field Operational Tests (FOTs).
  - To support deployment readiness and the related impact assessment.
  - To study the harmonization and interaction among various systems and to verify the overall efficiency.
- Battery technologies development
  - Study and development of new sustainable chemistry for high performance batteries for on board and stationary applications.
  - Synergies between different traction electric systems, RESs and storage batteries.
- Impact of electric mobility on infrastructures and power grid
  - Electromagnetic compatibility on apparatus system on board.
  - Power Quality towards the supply electric infrastructures.
  - Control strategy on optimizing RESs and BEESs energy opportunity.

Key Enabling Technologies

- High performance electronic power converters
- Tools and methodologies for the energy efficiency of optimization
- Innovative smart component technologies
- Advanced materials for electrochemical batteries

Other Impacted Spoke

- Rail, air mobility, Car and tire, Urban mobility, MAAS and mobility services, Connected networks and smart infrastructure

Spoke 14 – Hydrogen and new fuels

Politecnico di Bari

Spoke Coordinator: BARI

Context

- Domestic and international transport is responsible for 29% of total greenhouse gas emissions in the EU.
- For Europe to achieve zero climate impact by 2050, the European Green Deal calls for a 90% reduction in greenhouse gas emissions from transport.
- Europe is focusing on the use of hydrogen as evidenced by the European Clean Hydrogen Partnership under the Horizon Europe project.

Project of the Spoke

- Identification of criticalities in the use of hydrogen, sustainable biofuels and ammonia in transport.
- Study and testing of components for collective transport systems and/or hydrogen powered goods (buses, trains, streetcars, ships, planes).
- Development of smart grids equipped with power to gas systems (production of green hydrogen).
- Management of the smart grid with the help of tools such as big data, advanced systems of artificial intelligence and neural networks to maximize the efficiency of the network and the reduction of costs of green hydrogen production.

Goals

- Develop new technologies for the use of hydrogen, sustainable biofuels, ammonia for mass and/or freight transportation.
- Develop smart grids and energy communities that make the production of green hydrogen immediately available at gas stations for low-impact transportation systems competitive.
- Evaluate the impact of large-scale deployment of hydrogen and innovative fuels for mobility (sustainability, carbon footprint and Life Cycle Assessment).

Key Enabling Technologies

- Artificial Intelligence for the management of smart grids
- Advanced Materials for obtaining innovative fuels intrinsically sustainable (Sustainable-by-Design)

Other Impacted Spoke

- Air Mobility; Car and Tire; Waterways; Rail Transport; CCAM, Connected Networks and Smart Infrastructure; Urban Mobility; Logistics, Freight and Energy Networks; Innovative Propulsion; Electric and Battery Traction

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PIANO NAZIONALE DI RIPRESA E RESILIENZA

MOST
CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
UNIVERSITÀ	AIR MOBILITY	AUTO E GOMMA	VIE ACQUA	TRASP. FERROV.	LIGHT VEICHLE	CONN. AUTON VEHICLE	CCAM, RETI E SMART INFRA	MAAS E SERVIZI	URBAN MOB	LOGISTICA MERCI	MAT. INN.	PROP. INN.	ELETTRIC TRAC. SYST & BATT	H2 E NUOVI COMB.
MO-RE						SPOKE						PART	PART	
Bologna	PART	PART				PART	PART				SPOKE		PART	
Napoli	PART		PART	PART			SPOKE	PART		SPOKE				
Bari							PART	SPOKE			PART			SPOKE
Bergamo	PART				SPOKE									
CNR			SPOKE (RM-PA)	PART		PART (Imem)	PART (Na/Ba/IREA/ITC)				PART (Dip.Chim.)	SPOKE (NA-STEMS)		PART (ME-Itaee)
Torino	SPOKE	SPOKE				PART	PART				PART		PART	
Milano	PART			SPOKE	PART	PART			PART	PART			SPOKE	
Roma	PART			PART			PART		SPOKE		PART		PART	
Padova								PART			PART		PART	PART
Firenze				PART	PART				PART			PART		
Cagliari								PART	PART	PART				
Brescia					PART		PART				PART			
Unimib								PART					PART	
Palermo		PART	PART						PART			PART		
Pisa							PART			PART	PART		PART	
Cassino		PART							PART				PART	
Parthenope			PART				PART			PART				
Salerno		PART				PART	PART							
Marche							PART				PART			
UniTO														PART
UniGE			PART							PART				
Reggio Calabria				PART		PART								
Salento							PART							PART
TOTALE	6	5	5	6	4	7	12	5	6	6	9	4	9	5

Budget UNIPA: 6.721.572,17€

Coinvolgimento UNIPA:

- Spoke 2 -Sustainable Road Vehicle
- Spoke 3 –Waterways
- Spoke 9 -Urban Mobility
- Spoke 12 -Innovative Propulsion

AVANZAMENTO ATTIVITÀ

1

Review **della letteratura per identificazione di trend per mobilità sostenibile, condivisa e automatizzata in ambito terrestre, aereo e marittimo**

2

Identificazione, acquisizione e calibrazione delle attrezzature per *set-up* laboratori di ricerca per potenziamento infrastruttura

3

Stima della domanda per servizi di mobilità sostenibile in ambito terrestre, aereo e marittimo

AVANZAMENTO ATTIVITÀ

4

Sviluppo di algoritmi per la valutazione della esposizione alle vibrazioni meccaniche dei veicoli, in accordo con gli *standard* ISO

5

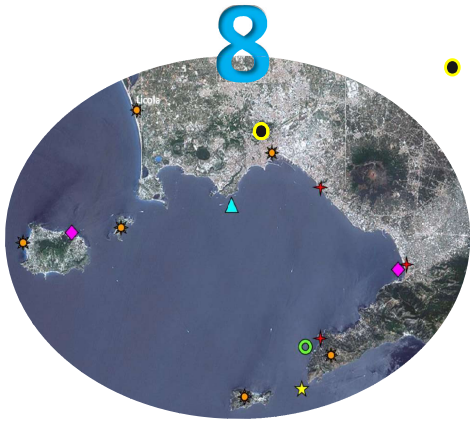
Test di laboratorio finalizzati alla valutazione della ergonomia per la ottimizzazione del *confort* alla guida nell'ambito dell'*assisted driving*

6

Svolgimento di meeting e partecipazione a conferenze per la disseminazione dei risultati

AVANZAMENTO ATTIVITÀ

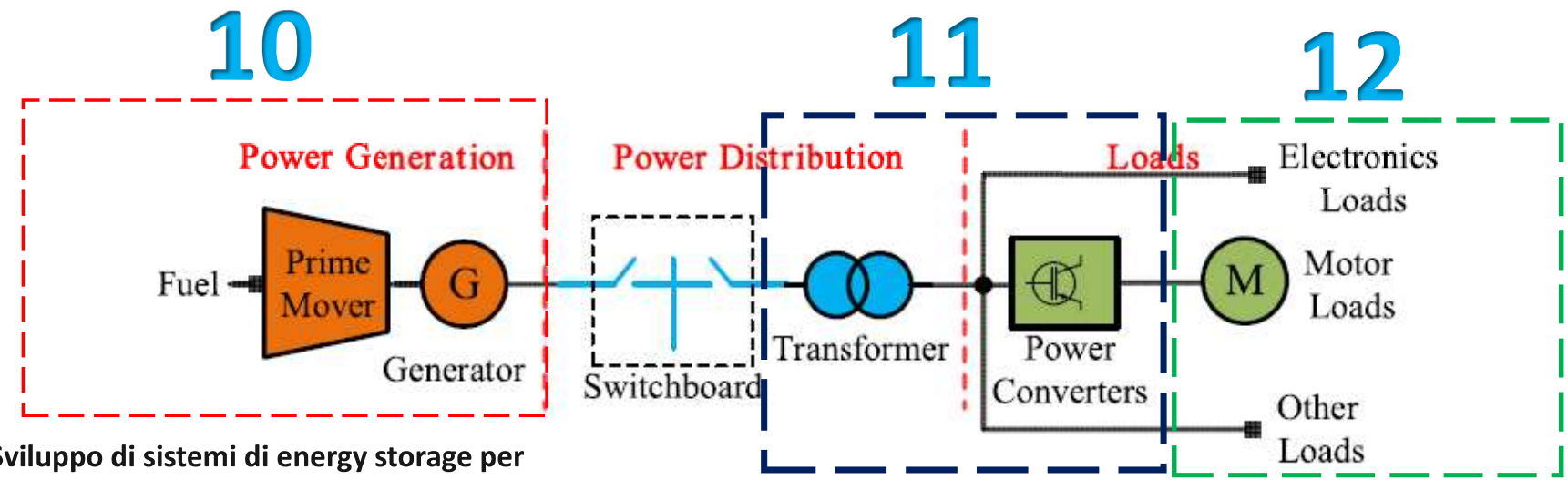
Sviluppo di metodologie di *Life Cycle Assessment* e *Life Cycle Costing* per le tecnologie sviluppate nel progetto.



Sviluppo di *Decision Support Systems* per l'ottimizzazione delle rotte e per l'identificazione delle variabili meteo-oceanografiche di più rilevante interesse per lo sviluppo del DSS.

Sviluppo di algoritmi per la navigazione autonoma.

AVANZAMENTO ATTIVITÀ

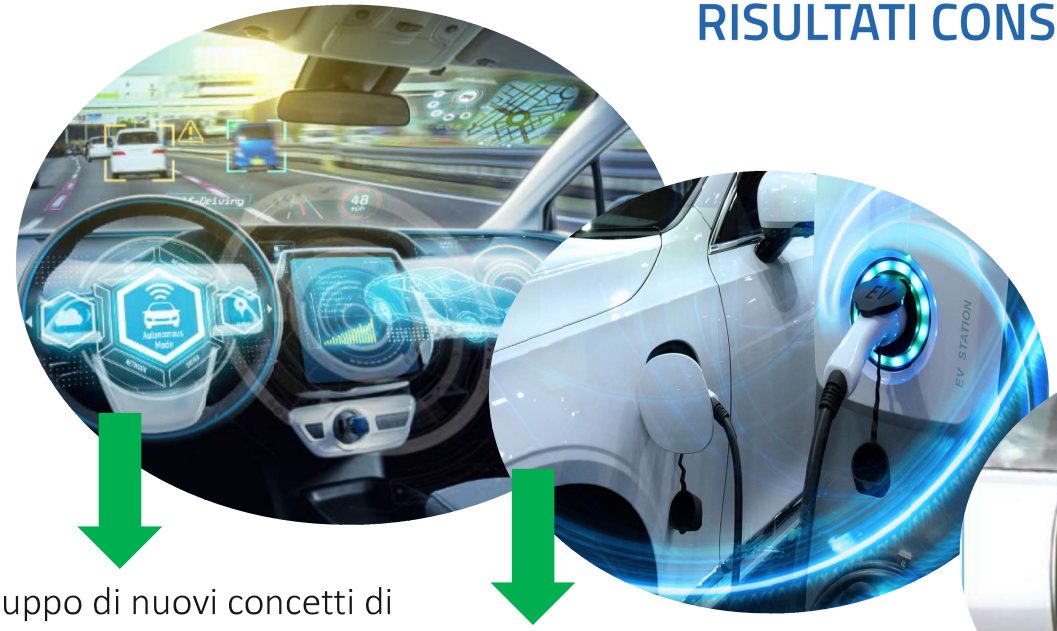


Sviluppo di sistemi di energy storage per sistemi di propulsion elettrica

Power electronics per sistemi di propulsione elettrica/ibrida

Sviluppo di motori elettrici innovativi

RISULTATI CONSEGUITI



Sviluppo di nuovi concetti di architettura dei veicoli a zero emissioni, comprese le tecnologie di guida assistita e autonoma.

Sviluppo di nuovi strumenti per l'integrazione del veicolo nelle reti elettriche

Sviluppo di componenti per migliorare ergonomia e guidabilità (secondo il codice 009bis - UE2021/241);

Riduzione dell'impatto ambientale minimizzando le emissioni non di scarico (secondo il codice 022 - UE2021/241

❖ Pubblicazioni

- Pellitteri, Filippo, et al. "Automotive Battery Charging based on Efficient Capacitive Power Transfer." 2023 International Conference on Clean Electrical Power (ICCEP). IEEE, 2023
- Tumminello et al. "A simulation-based study to assess safety and performance efficiency of Traffic Calming Measures combined with Connected and Automated Vehicle Technologies", Minisymposia 32 - Sustainable mobility (MS32) - EMI 2023 International Conference Palermo, Italy, August 27 - 30, 2023
- D'Orso and Migliore "Walking to access shared mobility services: a case study in Palermo, Italy", Minisymposia 32 - Sustainable mobility (MS32) - EMI 2023 International Conference Palermo, Italy, August 27 - 30, 2023
- Salvo and Sanfilippo "Development of a Decision Support System for increasing the resilience of urban road network", Minisymposia 32 - Sustainable mobility (MS32) - EMI 2023 International Conference Palermo, Italy, August 27 - 30, 2023
- Minaudo and Migliore "Walkability assessment for improving the attractiveness of the public transport system in the suburban areas" Minisymposia 05 - Sustainable Urban Mobility for Liveable Neighbourhood (MS05) - EMI 2023 International Conference Palermo, Italy, August 27 - 30, 2023
- Russotto et al. "Reduction of Hand-Arm Vibrations (HAV) when driving electric scooters", Minisymposia 05 - Sustainable Urban Mobility for Liveable Neighbourhood (MS05) - EMI 2023 International Conference Palermo, Italy, August 27 - 30, 2023

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Ministero dell'Università e della Ricerca

Italiadomani
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Borsa della Ricerca
XIV Forum

Expo PNRR

26/27 OTTOBRE

CATANIA

Monastero dei Benedettini

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GRAZIE PER L'ATTENZIONE

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