



Movilidad sostenible y logística multimodal. Retos y oportunidades tecnológicas

in-move by Railgrup
Cluster de Movilidad y Logística Multimodal



Dr. Eng. Ignasi Gómez-Belinchón
INM by RAILGRUP Director
gerencia@railgrup.net

Cluster de Movilidad Sostenible y Logística Multimodal

MOBILITY & MML

EU CLEAN ACTs

OPORTUNIDADES

RETOS

SOCIO- GEOPOLITICS- GEOGRAPHY

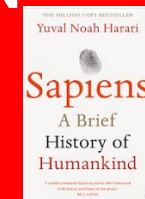
(Tim Marshal – The
Power of Geography)

SUSTAINABILITY



TECHNOLOGIES CCAM

REGULATION

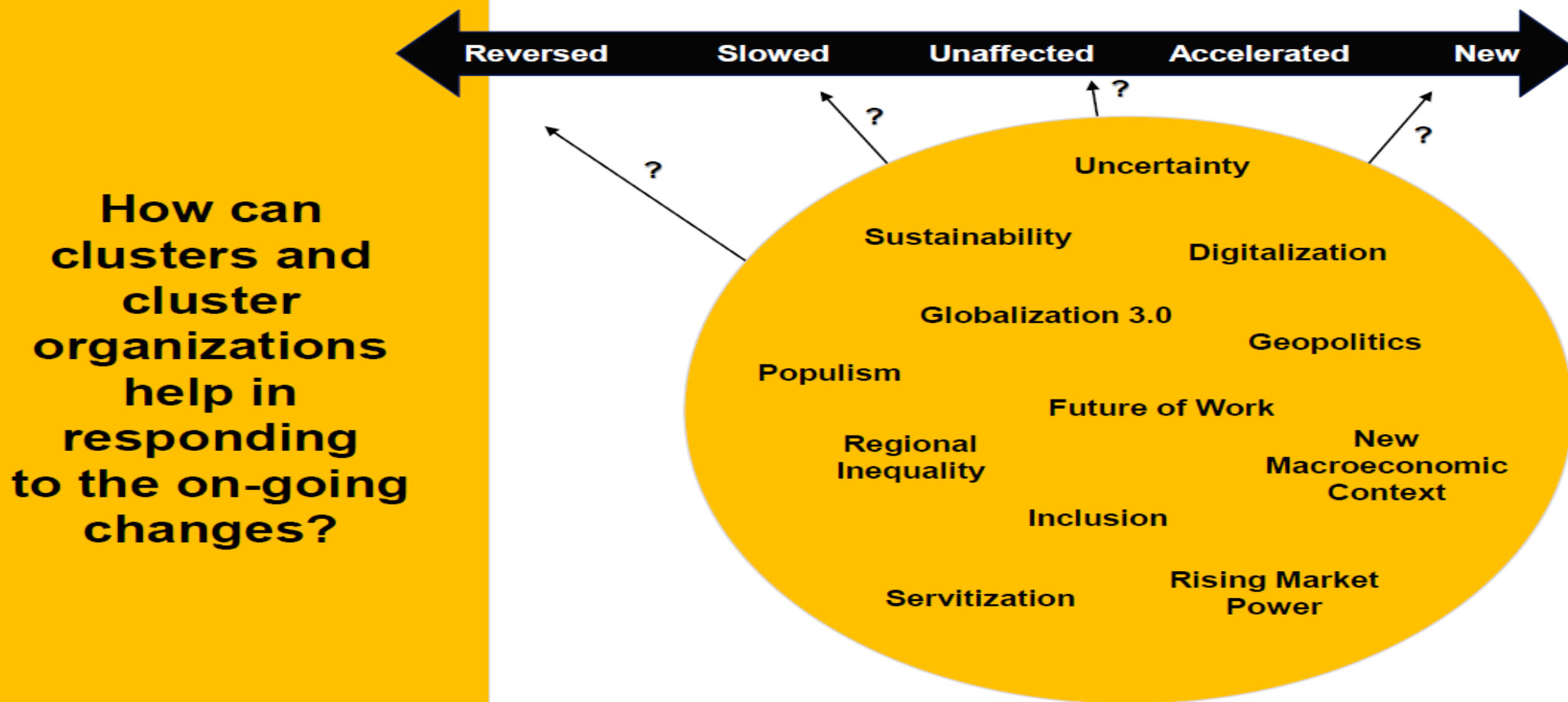


DEMOGRAPHY

The 15 minutes Cities
Prof. Carlos Moreno

Competitiveness Upgrading in Turbulent Times

The Global Economic Context is Changing



Competitiveness Upgrading in Turbulent Times

CCAM

Connected, Cooperative, and Automated Mobility

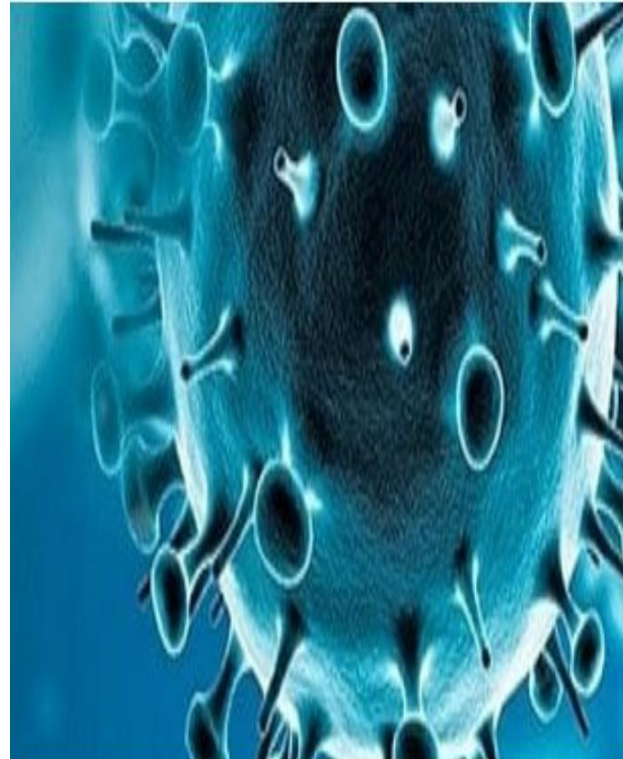


DATA + AI PREDICTIONS 2024

Intelligence will radically reshape data science, cybersecurity, applications and more



Señte caminando y en bicicleta en París, Francia. El concepto de ciudades de 15 minutos ganó fuerza después de ser defendido por la alcaldesa de París, Anne Hidalgo.¹



Coronavirus



The Green Deal Industrial Plan

The Critical Raw Materials Act



The Net Zero Industry Act



Critical Raw Materials Act



Needed for the green and digital transitions as well as for defence and space



To enhance our long-term competitiveness



To maintain our open strategic autonomy in a fast-changing and increasingly challenging geopolitical environment

- Strengthen EU's critical raw materials capacities along **all stages of the value chain**.
- Increase resilience by reducing dependencies, increasing preparedness and promoting supply chain sustainability and circularity.



https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act_en

The Green Deal Industrial Plan

The Critical Raw Materials Act



The Net Zero Industry Act



Net-Zero Industry Act

Create a simpler and more predictable legal framework for **net-zero industries** in the EU, as part of Europe's Green Deal Industrial Plan

- Improve conditions for investment in net-zero technologies & priority to Net-Zero Strategic Projects,
- Accelerating CO₂ capture
- Facilitating access to markets: to boost diversification of supply for net-zero technologies
- Enhancing skills
- Fostering innovation & innovative net-zero technologies
- Setting up a Net-Zero Europe Platform



https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en

RAILWAY SHOULD BE THE BACKBONE of A SUSTAINABLE MOBILITY FREIGHT AND PASSENGERS EU – IT IS NOT NOW... INFRASTRUCTURE DRIVEN WORLD...

in-move by Railgroup

ON MOBILITY IN EUROPE

- 1 European mobility as it has developed has empowered many people and implies self-determination; but these **ACHIEVEMENTS** also generate social and ecological **STRESSES**.
- 2 Mass tourism and trips on aircraft and cruise ships are particularly harmful to this **ENVIRONMENT**. The European single market has a **DECISIVE ROLE** to play in this regard and therefore Europeans have a fair share of **RESPONSIBILITY**.
- 3 Motorised **MASS TRANSPORT** has reached its limits. A European transport sector dominated by **FOSSIL FUELS** adds to global warming, pollution and stress.
- 4 Cars occupy too much space. The **LIMITED AVAILABLE PUBLIC SPACE** should be used **MORE EFFICIENTLY** for cycling, walking and various forms of public transport, especially in towns and cities.
- 5 Climate-friendly means of transport and fossil fuels are incompatible. Sustainable **ENERGY AND MOBILITY TRANSITIONS** go hand in hand.
- 6 **TRAINS** and railways will essentially be the backbone of a climate-compatible European transport system, but are today often limited to individual countries. Investments to extend and **REACTIVATE RAIL ROUTES** within and across borders are necessary.

Climate change, rising traffic demand, congestion, security and sustainable energy supply are some of the major issues that the European Union and the wider world are facing. At the same time, **good accessibility is necessary for a society to function and to ensure economic development, job creation and housing supply**. Tackling these challenges call for the railway sector to take on a larger share of transport demand in the next few decades.

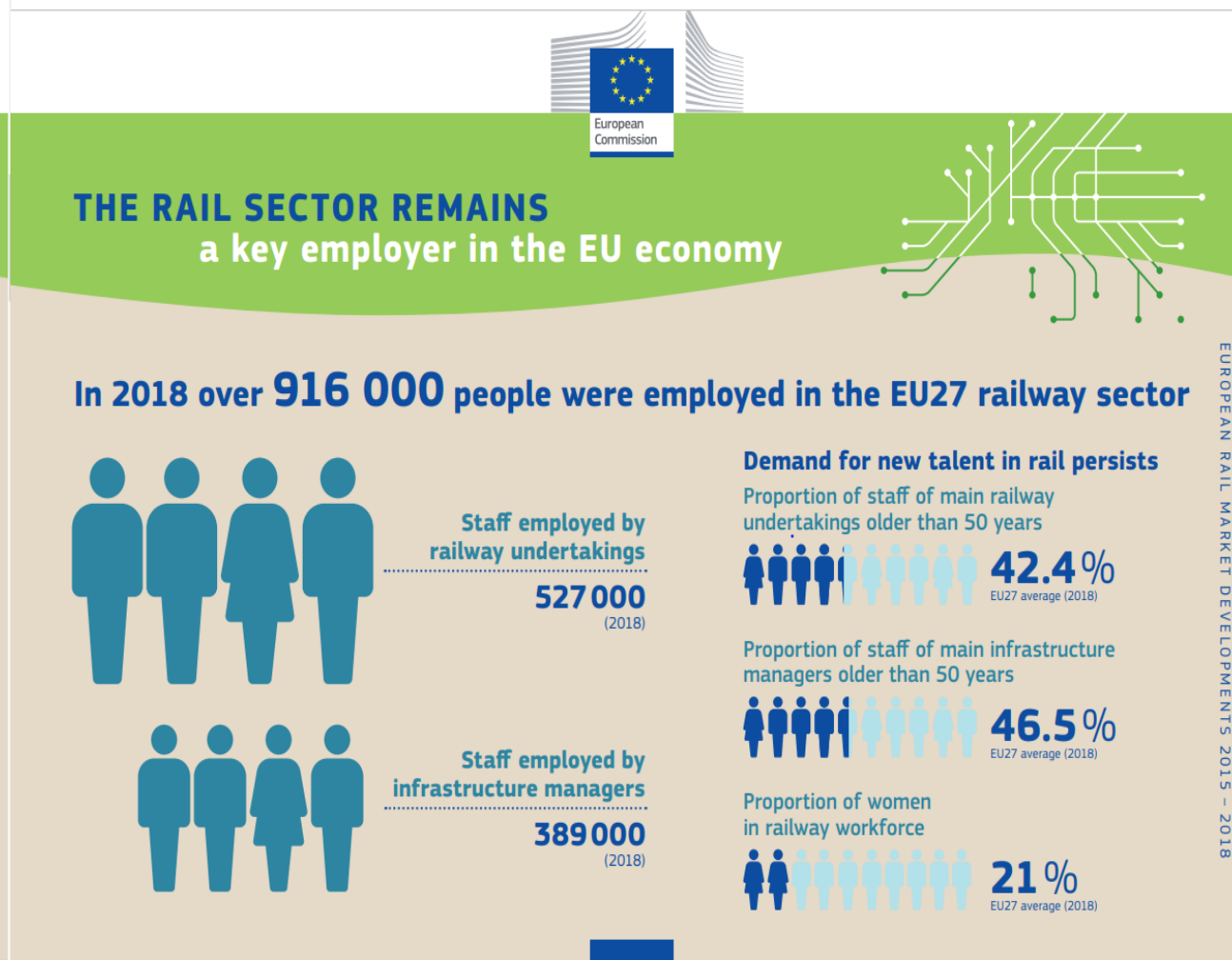
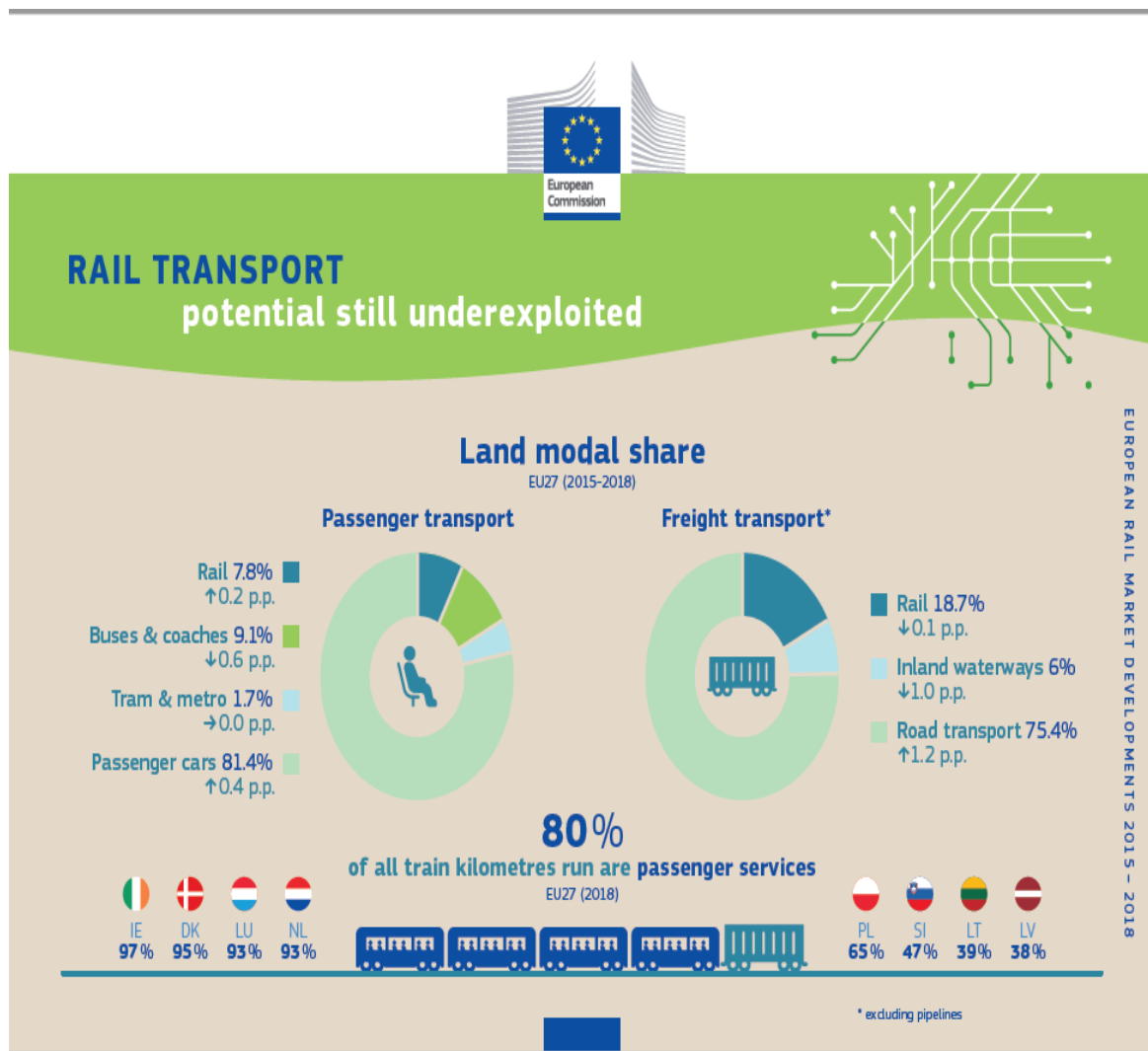
Transport amounts for more than 30 percent of greenhouse gas emissions in Europe. Mobility is a key element of the interconnected European Union and its neighbours. Rail is (?) and has been the way to connect Europe sustainably.

- 7 With its Trans-European **TRANSPORT NETWORK CORRIDORS**, the EU has set up a system for a Europe-wide transport infrastructure. It is crucial that policies implemented within the European Green Deal follow this **TRANS-EUROPEAN IDEA**.
- 8 **DIGITALISATION** of European transport brings along **OPPORTUNITIES** by linking different forms of transport in one single **APPLICATION**. The accessibility and availability of such technologies for everyone is a **CHALLENGE**.
- 9 Transport industries are manifold. The **EUROPEAN AUTOMOTIVE SECTOR** is undergoing thorough **CHANGES**. Bicycle production reinforces regional value creation and strengthens European small and medium-sized businesses.
- 10 **AVOID – SHIFT – IMPROVE** is the strategy to make mobility in Europe more sustainable. The Covid-19 pandemic has forced people to adapt their mobility behaviour and has created the need to **RETHINK** conventional practices.
- 11 The external costs of cars and planes as the most polluting modes of transport are not reflected in what we pay for using them. So far the implementation of the **POLLUTER-PAYS PRINCIPLE** is deeply flawed and needs to be tackled by EU policies such as taxation, carbon pricing or road tolls.
- 12 The **EUROPEAN MOBILITY OF THE FUTURE** entails interlinked, attractive, resource-efficient and climate-friendly means of transport within a European framework and contributes to a **HIGH QUALITY OF LIFE** in cities and **WELL-CONNECTED** rural areas.

ERRAC 2030

<https://eu.boell.org/en/European-Mobility-Atlas-2021-PDF>

EU POSITIONING DRIVERS for RAILWAY EU



KEY DRIVERS for RAILWAY EU - LOW EMISSIONS LOGISTICS – BUSINESS & TECHNOLOGY OPPORTUNITY



Environmental Sustainability and Carbon Free Mobility

As the railway is the cleanest mode of transport, promoting modal shift towards rail will support the reduction of emissions. But this is not enough, and rail will implement new light materials, new technical solutions for non-electrified lines and further increase its energy efficiency. **Improving the integration of transport systems in populated areas by reducing noise, vibration and carbon emissions** will be essential to increase social acceptance in urban environments and beyond. Indeed, rail systems are contributing to mitigating the climate change challenge.

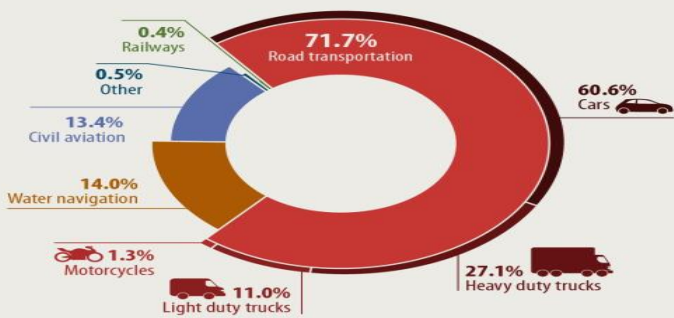
Additional research and innovation actions will improve the current situation from the environmental perspective. For instance to develop smart energy infrastructure. On board and line-side energy storage technologies and charging technologies will make it possible to recover a big amount of the braking energy and will support balancing the flow of energy. Electricity supply using SMART Grid technologies coupled with increasing the residence and variety of supply resources (e.g. main grid, local renewable, recovered, etc.), can be applied not only for rail traction systems but also for road usage and stations. Another example is the

necessity of work from an early phase on the adaptation of regulation and standards to consider (and even favour) the use of the cleanest technology being developed.



TRANSPORT EMISSIONS IN THE EU

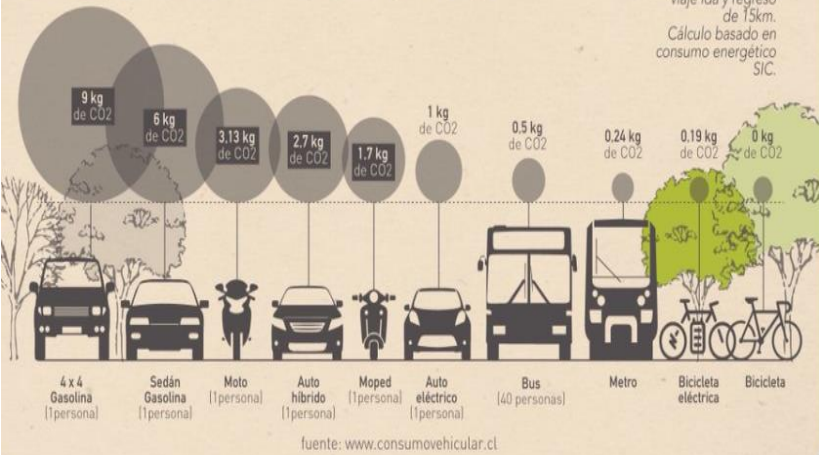
Greenhouse gas emissions breakdown by transport mode (2019)



Source: European Environment Agency (2022)



Comparación de emisiones por viaje*



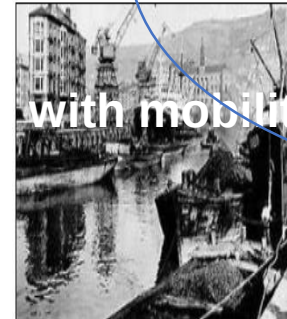
The future of livable cities starts with mobility



INFRASTRUCTURE DRIVEN WORLD...

Making the world in which we want to live

Cluster-Based Regional Development Basque Country, Spain



15-minute cities are by design intended to reduced use of vehicles, as all of the amenities and destinations residents need will be accessible within a short distance. This offers a wide range of benefits, from reduced traffic congestion to decreased CO2 emissions and the encouragement of greater physical activity.



El hidrógeno, clave para la movilidad del futuro

HIDRÓGENO vs ELECTRICAL



H2 RENFE TREN EN PRUEBAS

EL TREN DEMOSTRADOR DEL PROYECTO FCH2RAIL, PRIMER TREN DE HIDROGENO QUE CIRCULA EN PRUEBAS EN LA RED FERROVIARIA ESPAÑOLA.

PRIMER RECORRIDO DE PRUEBAS EN LA LÍNEA ZARAGOZA-CANFRANC, EN EL PIRINEO ARAGONÉS, PARA CONTINUAR EN LÍNEAS DE MADRID Y GALICIA

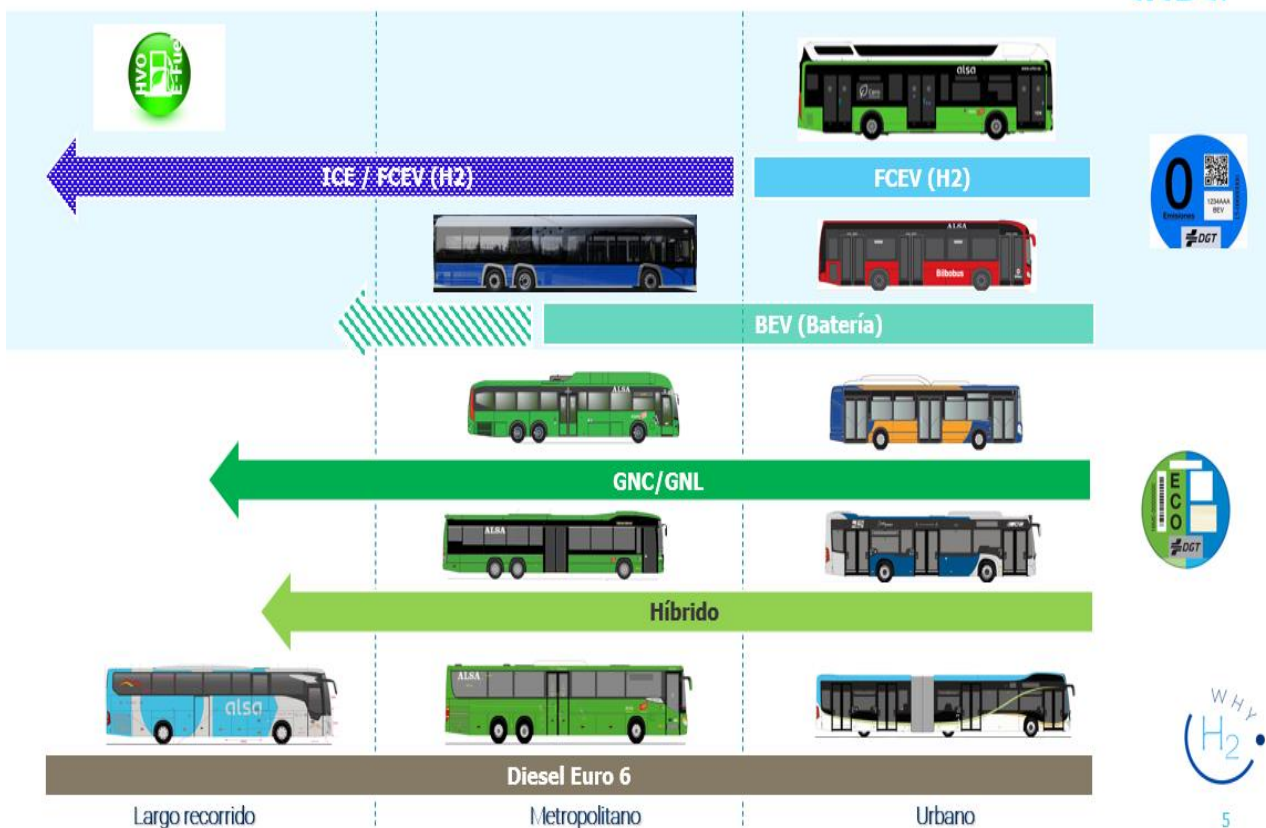
PROYECTO FCH2RAIL - CONSORCIO INTEGRADO POR CAF, DLR, TOYOTA, RENFE, ADIF, CNH2, IP Y STEMMANN-TECHNIK CON UN PRESUPUESTO DE 14 MILLONES

HA OBTENIDO LA AUTORIZACIÓN PARA CIRCULAR EN PRUEBAS POR LA RED FERROVIARIA DE INTERÉS GENERAL (RFIG)

CAF HA INSTALADO UNA NUEVA SOLUCIÓN PARA LA GENERACIÓN DE ENERGÍA ELÉCTRICA A PARTIR DE LA HIBRIDACIÓN DE LA

NOT JUST ELECTRICAL VEHICLES...SHIFT TO H2...

En Alsa nos movemos en verde. Tipología.



Despliegue de Proyectos comerciales Cero emisiones en líneas sin electrificar

Estudio/Validación



FCMU Alemania iLint pre-serie



BEMU Alemania Prototipo



FCMU UK Breeze concepto retrofit



BEMU UK IPEMU prototipo



Ejemplos de Proyectos comerciales



Coradia Continental

- BEMU - Batería y Catenaria
- Alemania
- 11 trenes



Coradia iLint

- FCMU - Hidrógeno
- Alemania
- 14 trenes & 27 trenes



Coradia Stream

- FCMU - Hidrógeno
- Italia
- 6 trenes

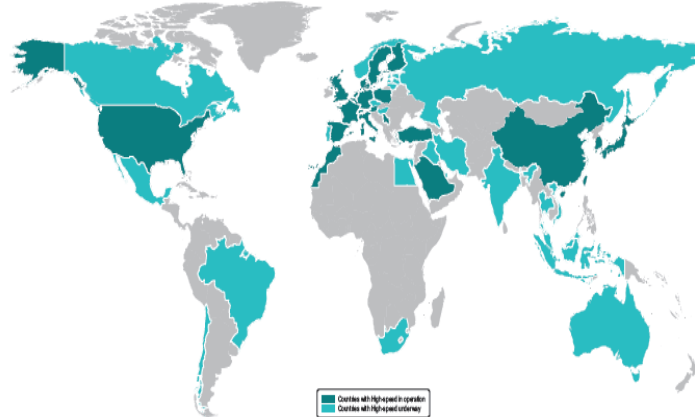


Xtrapolis

- FEMU - Batería y Catenaria
- Reino Unido
- 31 trenes

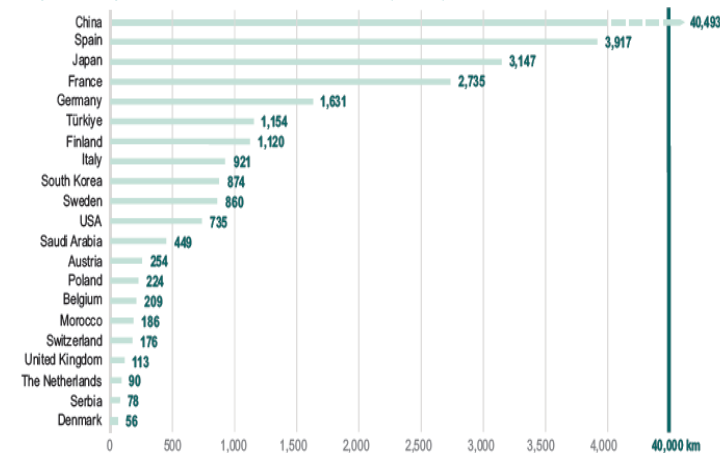
1.1 GLOBAL DATA

Countries with a high-speed rail network in commercial operation and underway



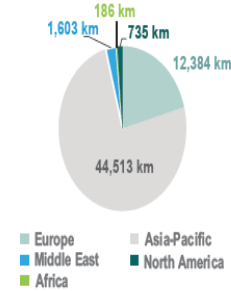
Note: Vast island territories in extreme latitudes are not considered for this map.
 Source: compiled by authors based on International Union of Railways, 2023

Length of the high-speed network in commercial operation by country



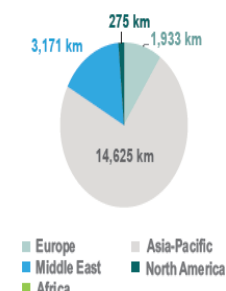
Source: compiled by authors based on International Union of Railways, 2022

Length of the high-speed network in commercial operation by UIC Regions



Source: compiled by authors based on International Union of Railways, 2022

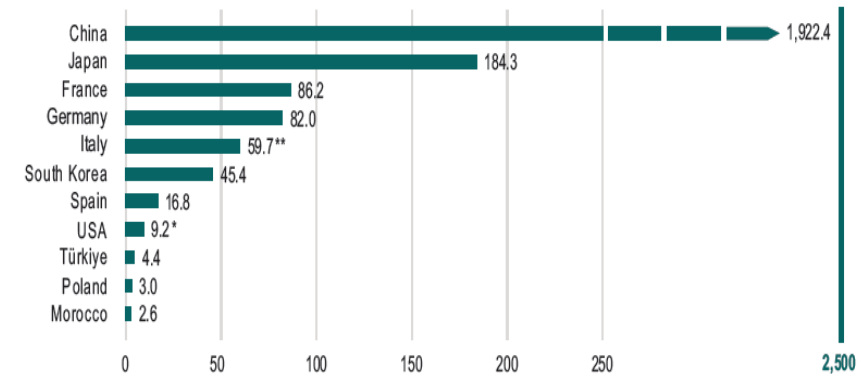
Length of the high-speed network under construction by UIC Regions



Source: compiled by authors based on International Union of Railways, 2022

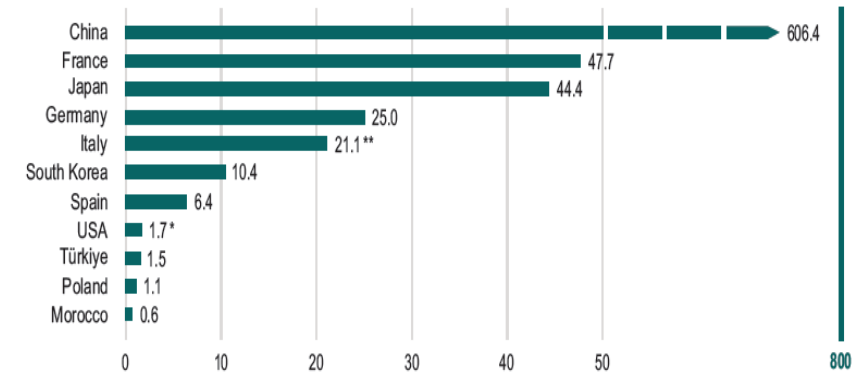
1.1 GLOBAL DATA

Number of passenger (millions) by countries (2021)



Source: compiled by authors based on International Union of Railways, 2023

Number of passenger.kilometre (billions) by countries (2021)



Notes:

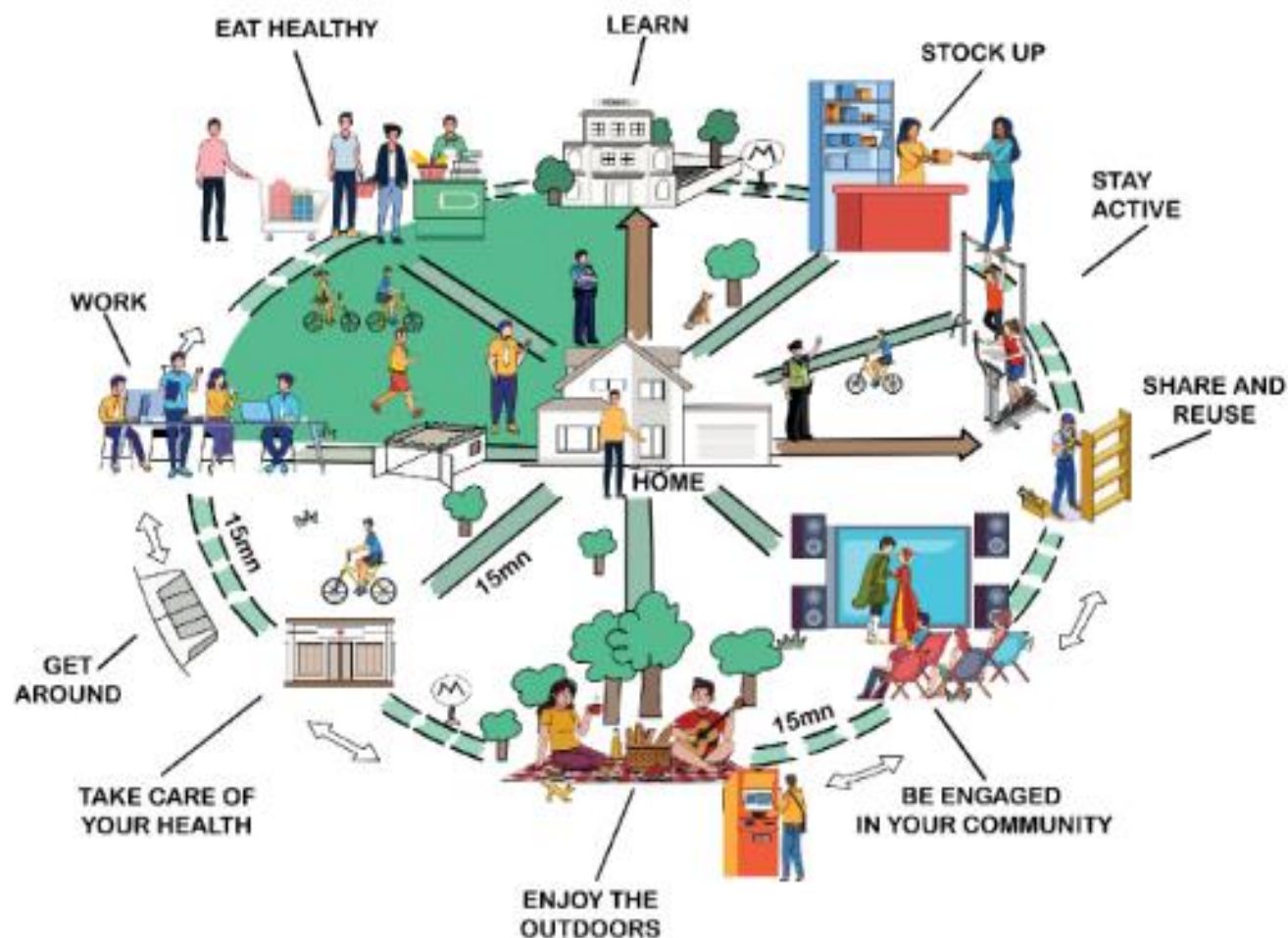
(*) Figures referred to fiscal year Oct 2021-Sep 2022

(**) Figures referred to 2019

Source: compiled by authors based on International Union of Railways, 2023



“ I think that the particular point of the **15-minute city** for explaining this amazing success is our capability for developing this convergence to fight against climate change, to develop a more vibrant economy, and to develop more social inclusivity. Ecology means more livability, economy, more viability, and inclusivity, more capability for living together. - Carlos Moreno ”



EL ROL DEL CAMBIO DE MODELO URBANISTICO

2% OF TOTAL SURFACE OF EARTH -CONCENTRATING 50% OF TOTAL EARTH POPULATION. 78% OF ENERGY
60% OF TOTAL CO2 EMISSIONS (CARS-COWS-DEFOREST. JAMES LOVELOCK)

80% OF WEALTH

62% POPULATION LÍVING ON 2% TERRITORY, 30% IN MORE THAN 1M INHABITANS CITIES, OF WICH 9% IN MEGALOPOLIS OF MORE THAN 20M INHABITANTS, 13% OF TOTAL POPULATION IN 34 CITIES, ...

50% OF POPULATION IN CITIES OF LESS THAN 500.000 SOULS. BY 20250, ESTIMATED THAT 41 MEGALÒPOLIS 15 % OF POPULATION

BUT, 45% IN “MÈDIUM” (?) SIZED CITIES
STRATEGIES FOR CITIES TO RECOVER AND ADAPT TO BENEFIT RESIDENTS, SAVING THEM PRECIOUS TIME. FROM T.O.D. INFRASTRUCTURE DRIVEN to NEW URBANISM.

TECHNIQUES TO CHANGE THE HABITS OF AUTOMOBILE-DEPENDENT CITY RESIDENTS AND MAXIMIZE SOCIAL BENEFITS OF LIVING IN A HUMAN-CENTRIC CITY

SCIENTIFICALLY DEVELOPED, RESEARCH-BACKED SOLUTIONS FOR ENDURING URBAN ISSUES AND PROBLEMS

**/ LA MOVILIDAD SOSTENIBLE
ES UNO DE LOS RETOS MÁS
IMPORTANTES DE LA
SOCIEDAD ACTUAL**

ES NECESARIO CONTAR CON
REDES DE TRANSPORTE DE GRAN
CAPACIDAD QUE OFREZCAN UN
ALTO NIVEL DE CONFORT A LOS
PASAJEROS Y QUE AL MISMO
TIEMPO SEAN RESPETUOSAS CON
EL MEDIO AMBIENTE

"Door to Door" Mobility Ecosystem

The usage of real-time information and data sharing will provide an accurate status within the full transport system and allow an overall optimization of the transport offer. **The emergence of new transports- and communication possibilities allows cities and regions to propose multimodal mobility-as-a-service solutions** (focus on shared and on demand) to address the traffic congestion issue and enhance the attractiveness of the public transport. The development of tools for public administration also provides valuable information to optimize the layout of stations and to refine the procedures for incidents. **With rapid development and disruptive solutions**, we can also expect both simpler and cheaper solutions than the now established technology.

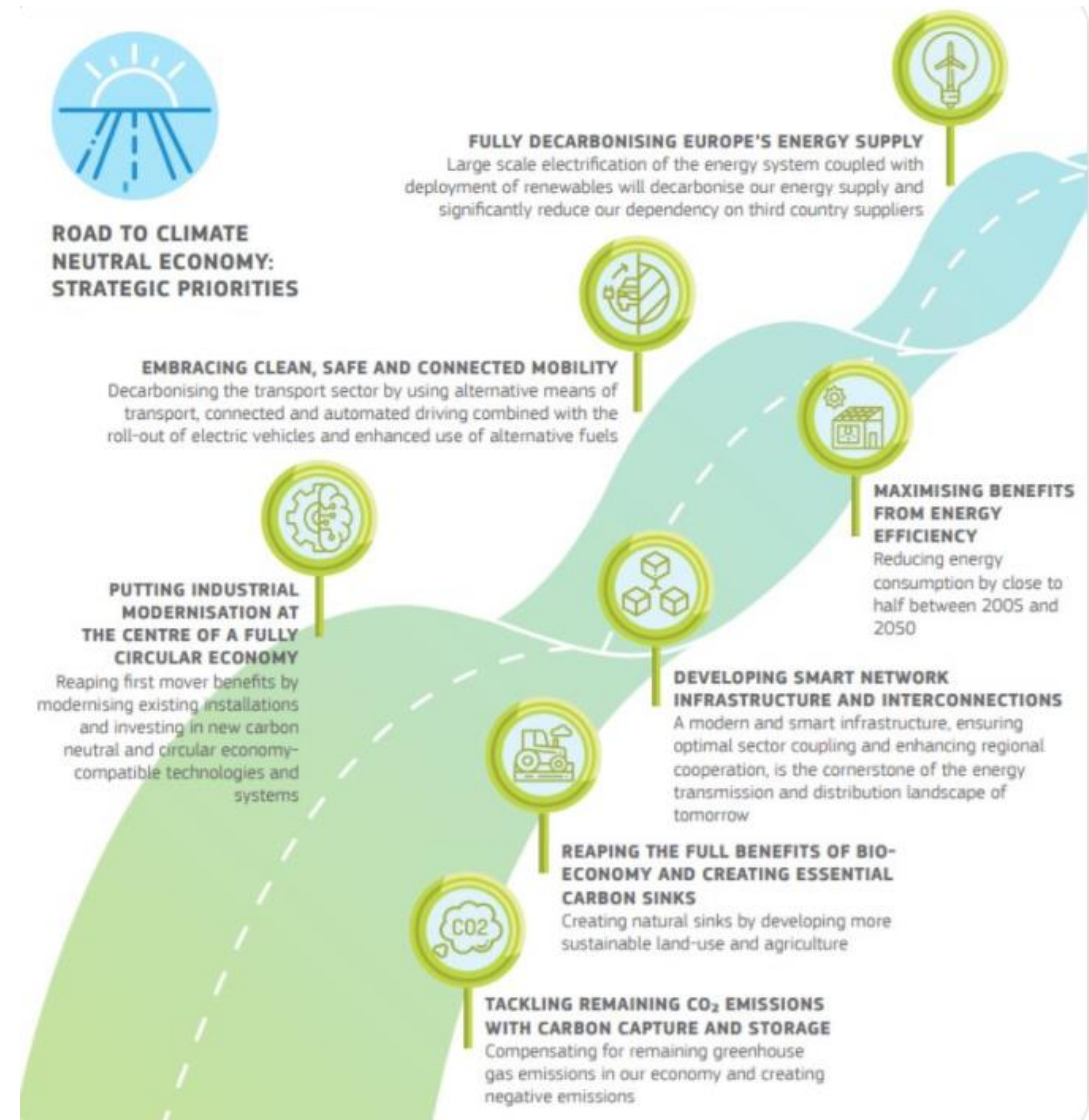
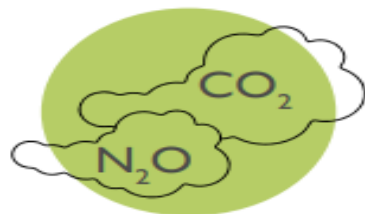


ILUSTRACIÓN I: Objetivos de la Estrategia para el año 2030.

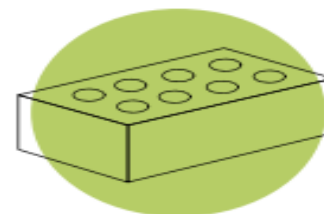
Reducir la emisión de **gases de efecto invernadero** por debajo de los 10 millones de toneladas de CO₂ equivalente



Mejorar un **10 % la eficiencia en el uso del agua**



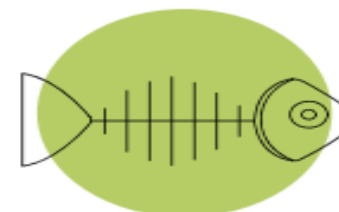
Incrementar la **reutilización** y preparación para la reutilización hasta llegar al **10 %** de los residuos municipales generados



Reducir en un **30 %** el consumo nacional de **materiales** en relación con el PIB, tomando como año de referencia el 2010



Reducir la generación de **residuos** un **15 %** respecto de lo generado en 2010



Reducir la generación **residuos de alimentos** en toda cadena alimentaria: **50 %** de reducción per cápita a nivel de hogar y consumo minorista y un **20 %** en las cadenas de producción y suministro a partir del año 2020, contribuyendo así a los Objetivos de Desarrollo Sostenible (ODS)

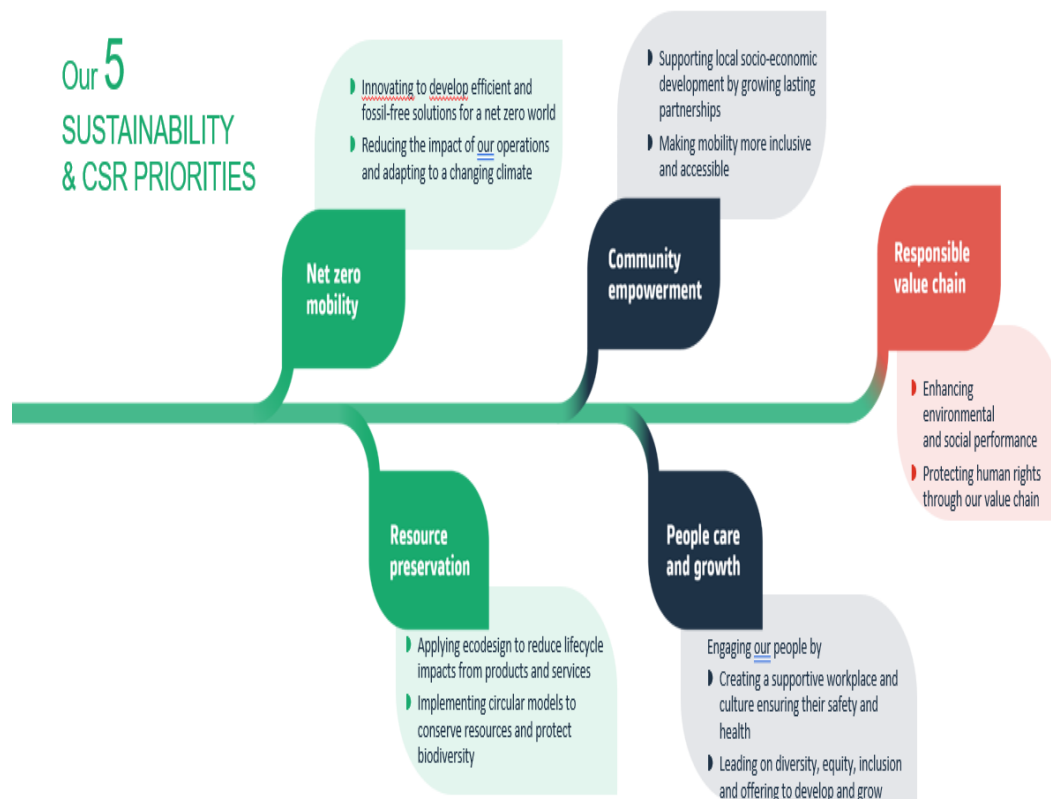


Our **5** SUSTAINABILITY & CSR PRIORITIES





Our 5 SUSTAINABILITY & CSR PRIORITIES



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2030 Targets

- **139 kt (-40%)** for emissions from Alstom sites ¹ (Scope 1 & 2: direct and indirect)
- **2.7 (-42%)** reduction in emissions intensity passenger solutions² (Scope 3: sold products)
- **5.9 (-35%)** reduction in emissions intensity freight solutions² (Scope 3: sold products)
- **665 gCO₂e/€ (-30%)** reduction in supply chain emissions intensity³ (Scope 3: supply chain)

- **40%** of circular (recycled) content in newly-developed trains and Infrastructure
- **85%** Waste recycling rate from Alstom sites

- **32%** women in management, engineering and professional roles
- Total recordable injury rate at **1.4**
- **100%** of social care / social protection coverage
- Learning culture: **25** hours per employee per year
- **72%** engagement Index

- **400,000** beneficiaries per year from local actions and Alstom Foundation

- **95%** of suppliers monitored or assessed on CSR with low or medium net risk
- **1,200** suppliers trained in sustainability and CSR

¹: Baseline year 2021/22, Target year 2030/31 in kt CO₂e
²: Baseline year 2021/22, Target year 2030/31 in gCO₂/pkm and Tkm
³: Baseline year 2022/23, Target year 2030/31 in gCO₂/added value (€)



ANÀLISI D'OPORTUNITATS DEL TRANSPORT FERROVIARI DE PRODUCTES CARNIS ENTRE CATALUNYA I EUROPA



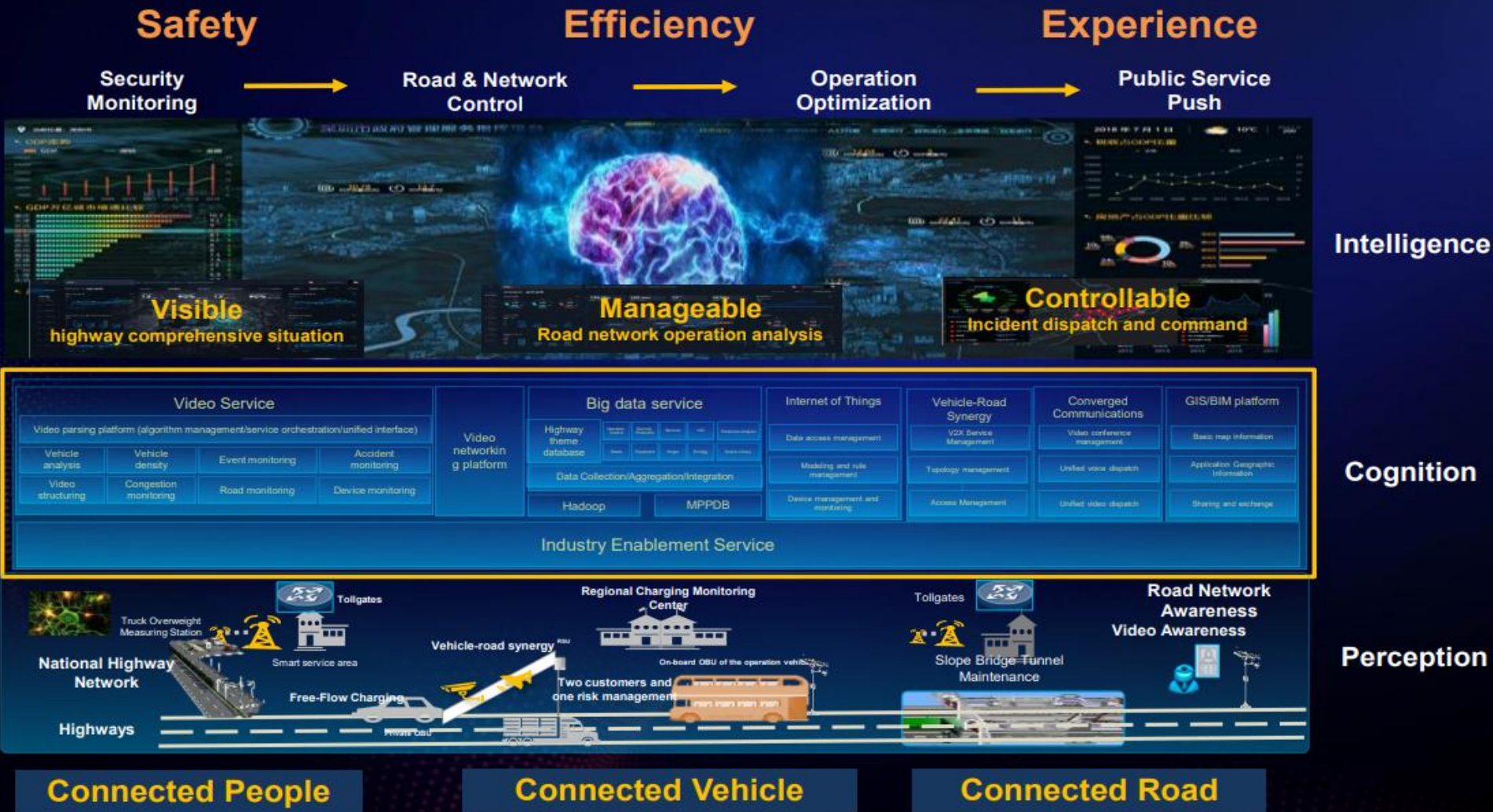
europa press

El transporte de mercancías por ferrocarril reduce un 92% las emisiones, según una prueba piloto

BARCELONA, 23 Dic. (EUROPA PRESS) -

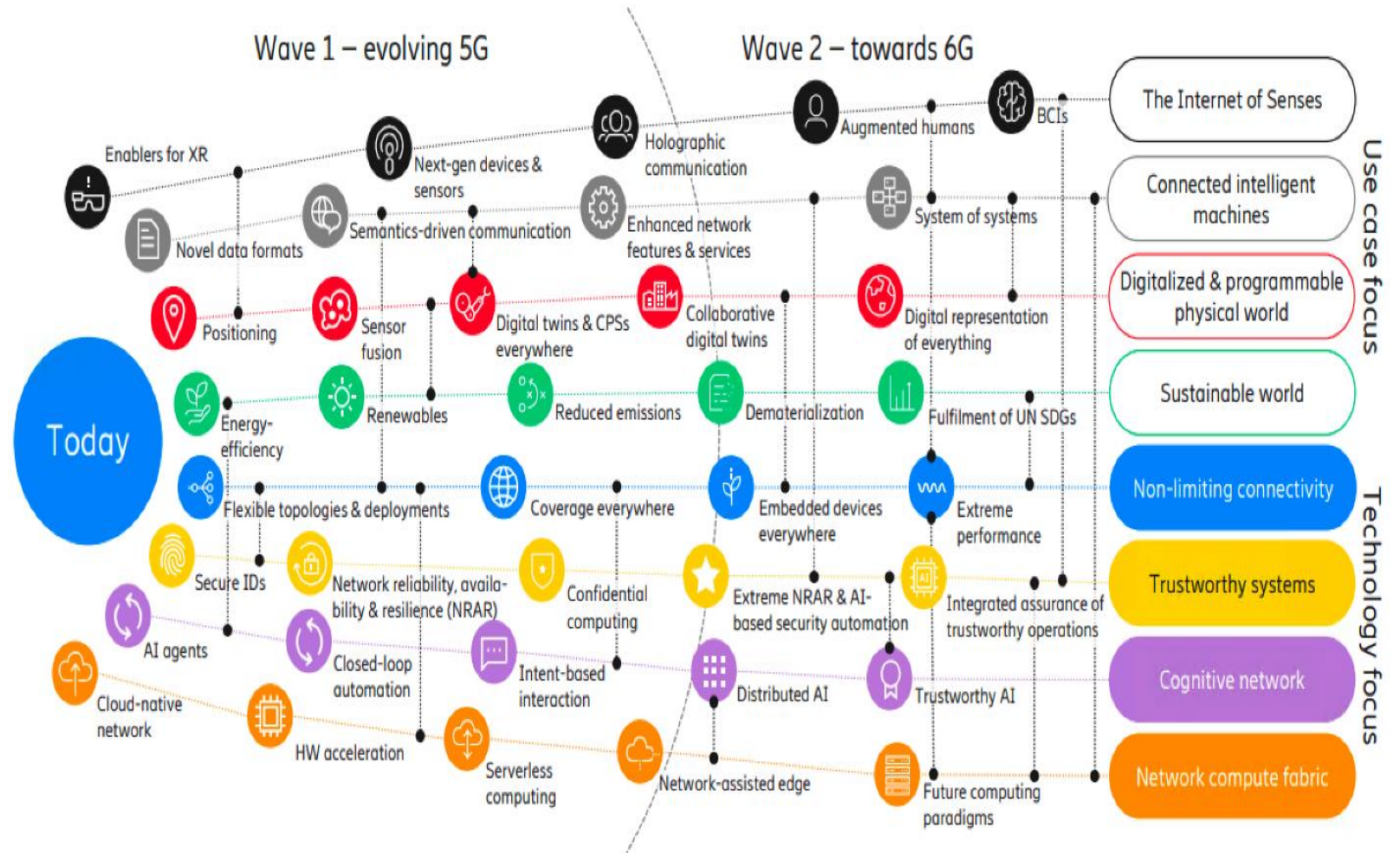


Sostenible.... Seguro → Eficiente y Orientado al Usuario





Technology journeys



INFRASTRUCTURE MODEL
EMPOWERED CITIZENS – SOCIETAL DRIVEN MODEL
TECHNOLOGY ENABLERS
FROM KNOWLEDGE MANAGEMENT to INSIGHTs
VALUE on THE VALUE CHAIN
PEOPLE+PROCESSES+TECHNOLOGIES
LIVABLE CITIES

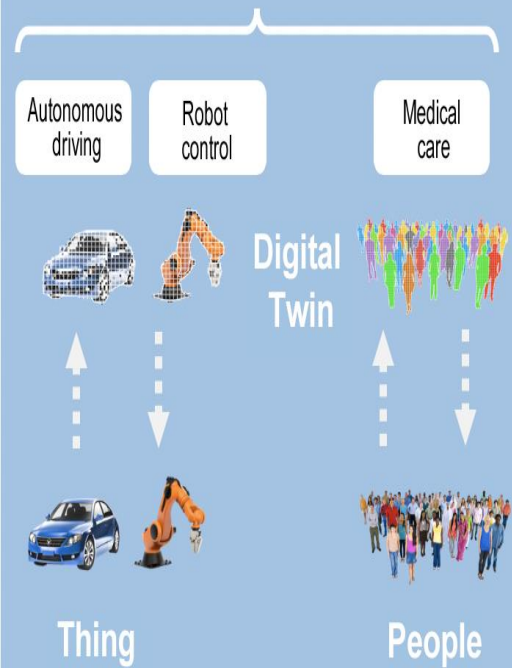


TALVI- Automatic Maintenance vehicle inspection

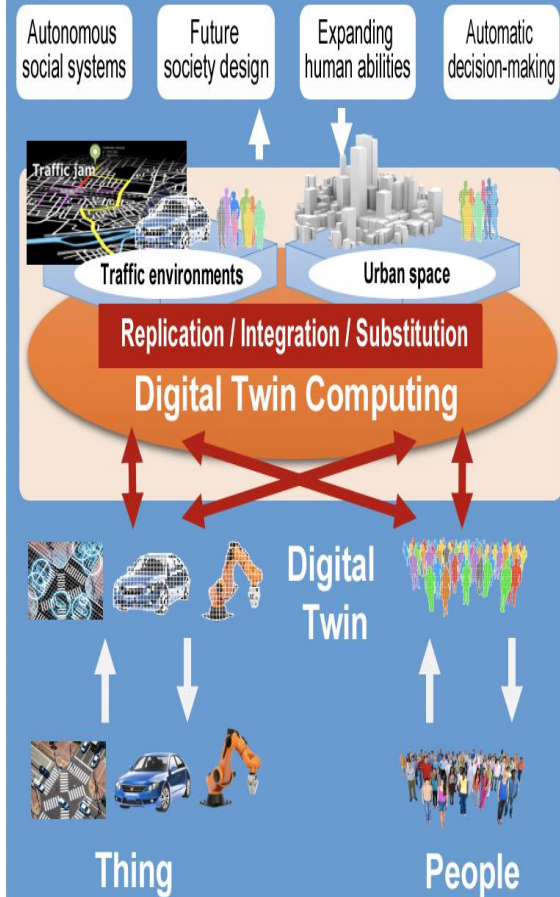
In seconds, on track, in real time

Conventional digital twins

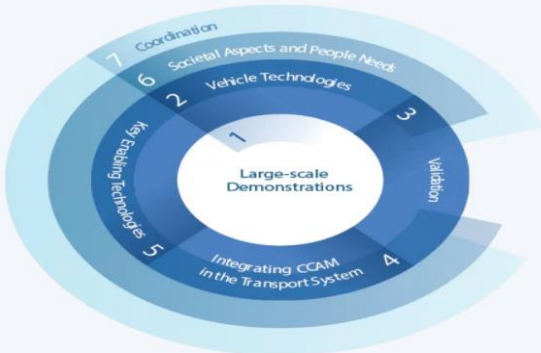
Digital twins used in specific cases



Digital Twin Computing



CCAM – PDI Connected, Cooperative, and Automated Mobility. Physical Digital Infrastr.



The 7 Clusters structure the activities of the CCAM Partnership, organising the necessary R&I actions to advance towards deployment readiness



Impacto internacional

MODI

A leap towards driving automation level 4 features

The MODI project aims to accelerate the introduction of highly automated freight vehicles through demonstrations, and by overcoming barriers to the rollout of automated transport systems and solutions in logistics. The logistics corridor from the Netherlands to Norway has been chosen for demonstration activities as the Netherlands, Germany, Denmark, Sweden and Norway are expected to be among the first movers to implement fully automated vehicles in Europe.

MODI comprises five use cases, each describing a part of the logistics chain in confined areas and on public roads. It identifies what is already possible on an automated driving level without human interaction and what is yet to be developed. The MODI objectives are to:

- Implement new CCAM technology
- Define recommendations for the design of physical and digital infrastructure
- Demonstrate viable business models for connected and automated logistics

COORDINATOR
ITS Norway (Norway)

PROJECT DURATION
01/10/2022 - 31/03/2026

EU FUNDING
42,000,000

WEBSITE
<https://modi-project.eu>

23

PODIUM

Accelerating the implementation of CCAM technology

PODIUM aims to build trust and sustainability for Connected, Cooperative and Automated Mobility (CCAM) and accelerate the implementation of CCAM services. Physical and digital infrastructure (PDI) is key to improving CCAM services. Physical infrastructure elements include road side traffic signs, communication network components and vehicles. Digital components include traffic rules and regulations, as well as input from roadside, vehicle and user sensors.

PODIUM will identify and assess the connectivity and cooperative solutions to achieve higher levels of automation and advance important PDI technologies. The necessary enhancements will be validated and evaluated in real traffic conditions in three well equipped Living Labs in Germany, Italy and Spain: Connected and Automated Vehicles (CAVs), conventional vehicles and Vulnerable Road Users (VRUs) will be integrated with PDI in all the projects use cases, while data coming from multiple channels and external sources will be used to facilitate the identification of conflictive situations and improve the interaction between road users.

The consortium consists of 29 partners from 10 EU Member States. Five demonstrations are planned: Pignone - Periglioso cross border corridor (France/Spain), Ulm-Lehr (Germany), Torino and Autostrada del Brennero highway tunnel (Italy), and Barcelona (Spain).

COORDINATOR
CCV Gwent

PROJECT DURATION
01/10/2022 - 30/09/2025

EU FUNDING
65,000,000

WEBSITE
<https://podium-project.eu>

19

- **MODI & PoDIUM proyectos generados en el seno de IN-MOVE!**
- **Se incluyen otras proyectos donde socios de IN-MOVE participan: ULTIMO, AWARE4ALL, MOVE2CCAM...**
- **Top 18 iniciativas CCAM de Horizonte Europa – CINEA!**

MODI A LEAP TOWARDS
SAE L4 AUTOMATED
DRIVING FEATURES

HOME ABOUT LIBRARY NEWS CONTACT

CNN International highlights the benefits of the MODI Project

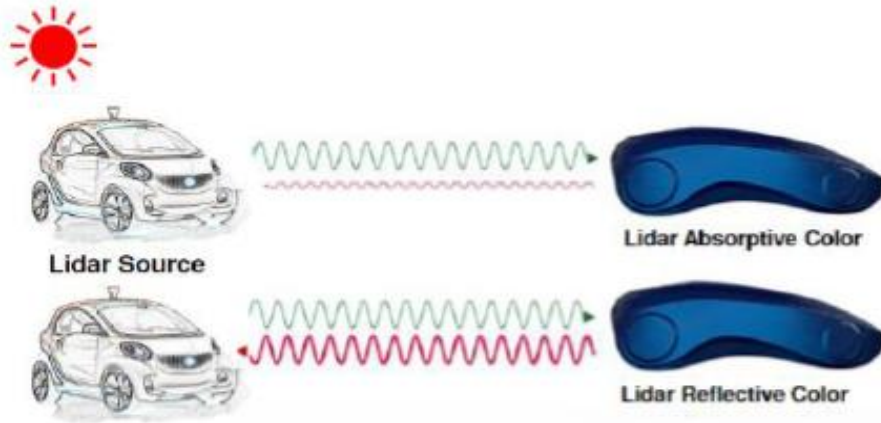
20/03/2023

CNN International has broadcasted a report about the MODI Project's goals in Global Connections, a program that focuses on examples of positive impacts on international trade.

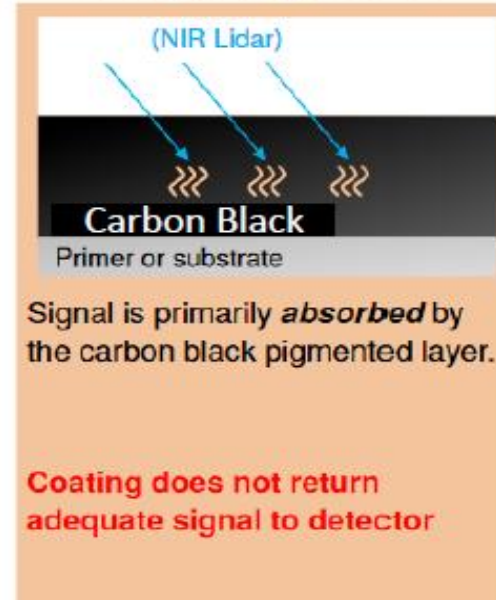
LIDAR

Low reflectivity objects are harder to discern or 'see'

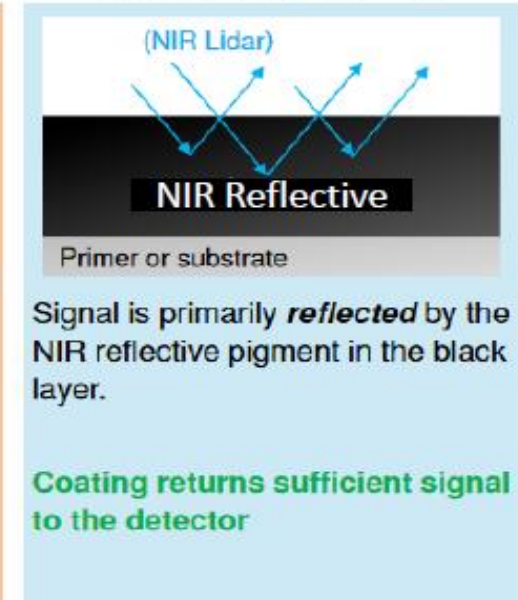
Objects with a low reflectivity compete with ambient noise so are not readily detected or classified by Lidar systems.



Absorptive Pigmentation



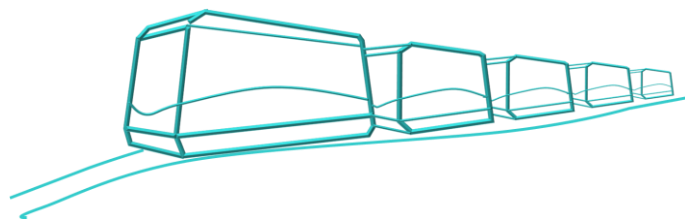
Reflective Pigmentation





Dear Small

Transporte a demanda por ferrocarril
con vehículos ferroviarios ligeros



Ganadores del I premio
Antena TrenLab de Renfe en
la categoría reto
disruptivo



renfe

TecnoCampus



<https://www.lavanguardia.com/economia/innovacion/20230315/8823639/sistema-gestion-trafico-carreteras-movilidad-futuro-brl.html>

Desarrollamos el
orquestador de tráfico con
Ferromobile

FERROMOBILE

www.ferromobile.fr

Advanced Materials for Clean and Sustainable Energy and Mobility

Composite Materials: Lightness and Strength

One of the most significant developments in rail track and wagon construction is composite materials. These materials combine properties such as lightness and structural strength, making them ideal for reducing wagon weight and improving energy efficiency. Carbon fibre composites, for example, offer high tensile strength and

Advanced Alloys: Durability and Reliability

Advanced alloys are also revolutionising the railway industry by offering greater durability and reliability in extreme conditions. Alloys such as stainless steel and lithium aluminium are used to manufacture wand railcar components that must withstand corrosion, wear and dynamic loads. These alloys not only extend the service life of equipment but also reduce maintenance costs and increase operational safety.

Recycled Materials and Sustainability

Moreover, in line with the principles of the circular economy, the railway industry is increasingly adopting recycled materials in the construction of tracks and wagons. From rails made from recycled steel to carriage interior panels made from recycled plastics, these initiatives not only reduce the environmental impact of production but also contribute to sustainable resource management.

Thermal and Acoustic Insulation Innovation

Advances in thermal and acoustic insulation are key to improving the user experience in modern trains. New materials, such as high-density polymeric foams and composite materials with sound-absorbing properties, are being used to reduce both external noise and heat transfer, creating more comfortable and energy-efficient environments in carriages.

Análisis de **Diseño orientado al ahorro de material**

Ideas



Sustitución

Vidrios electrocrómicos vs Cortinas

Electrónica impresa integrada

Exterior tren en composite

Materiales compuestos reemplazan partes metálicas

Impresión funcional

Cables impresos

Panelado grueso reduce estructura

Reducir densidad de los materiales

HPL + PET para interiorismo

Optimización

Difusor de aire integrado en anclajes

Suelos con pisaderas integradas

Perfiles extrusión uniendo sistemas-asideros, fijación techo, luminarias

Materiales más funcionales

Proyectar info en testeros, puertas,

Objetos doble funcionalidad

Aleaciones de mayores prestaciones para reducir espesores

Fabricación aditiva optimiza diseño

Eliminación

Eliminar ventanas

No equipajes

Eliminar pintura-materiales vistos

Diseño Generativo (bio inspiring)

Design for Manufacturing

Eliminar asientos

Eliminar tornillería-por adhesivos

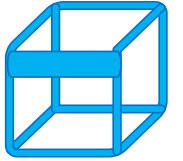
Asientos sin carcasa exterior

Una sola cabina

Segundo uso scrap produccion

Análisis de Nuevos materiales para interiorismo

Ideas



Mesilla multifuncional

- Soportes en asiento para dejar el móvil y cargarlo
- Material cargador para el móvil
- Soporte para móviles en la bandeja posterior al respaldo
- Bandejas con posiciones ajustable para comer, leer, etc
- Pestaña en la bandeja para dejar el móvil

Materiales inteligentes para calibrar automáticamente las desviaciones nivelando por ejemplo los pisos

Reciclabilidad

Composites reciclables en estructuras interiores
Scratch de piezas aeronáuticas para hacer piezas de fibra de carbono recicladas y matriz termoplástica
Metodologías de reosing a partir de productos en fin de vida (por ej. Palas eólicas) para piezas de confort

Partes del tren comestibles

Iluminación variable en intensidad y color

Ruidos

Material reverberante para absorber ruidos (por ejemplo, en la carcasa trasera del asiento)
Evitar el ruido, no eliminarlo

Contactless

Superficies contactless
Detección para abrir puertas del baño sin contacto

Soluciones que incorporen aislamiento + recubrimiento interior (igual que la interior) ahorrando material

Climatización ajustable personalizada individualmente

Asientos climatizados

Asiento inteligente

Espumas inteligentes –misma sensación de confort independientemente del peso de pasajero

Identificación en las pantallas (quizás en ventanas) de la zona de paso con información de la misma

Identificación en las pantallas (quizás en ventanas) de la zona de paso con información de la misma

Señalización de asientos

Proyector con el número de asiento en el propio asiento o en la ventana
Tejidos luminosos

Nuevos suelos

Suelos de marmol
Suelos de caucho

Desinfección

Superficies antibacterianas
Materiales antibacterianos
Asiento cantilever para facilitar la limpieza
Evitar olores
Suelos y pavimentos cerámicos de bajo peso para evitar olores

Puertas de intercurrencia de barrera de aire

Análisis de Reducción de ruido, vibraciones- Ideas



Ideas para trabajar en la detección del ruido

Involucrar al usuario en la toma de datos, reporte de fallos desde el usuario

Trazabilidad de los equipos susceptibles de producir ruido

Trazabilidad de los equipos susceptibles de producir ruido

Sensorizar partes del tren

Ideas para evitar el ruido en fase de diseño

Guía de diseño uniones a evitar

Diseño garantice correcto ensamblado

Estandarización tolerancias

Combinación materiales absorbedores de ruido y vibraciones

Combinación de materiales de cierre para reducir vibración

Aislamientos reposicionables

Vinilo con aislamiento térmico/ acústico

Ideas para corregir el ruido con el tren en explotación

Aislamiento acústico áreas conflictivas (Bogies, Climatización, Motores diésel)

Aislamiento de espumas de piso

Equilibrio entre peso y resistencia (demasiado aligeramiento puede ser peligroso)

Recycling carbon fiber



World's first carbon fiber rail bogie (Source: Materials Today: Proceedings)



MIT College of Railway Engineering and Research

Recycled carbon fiber reinforcements are becoming an increasingly popular alternative in this context since they provide a potentially cost-effective and sustainable solution.

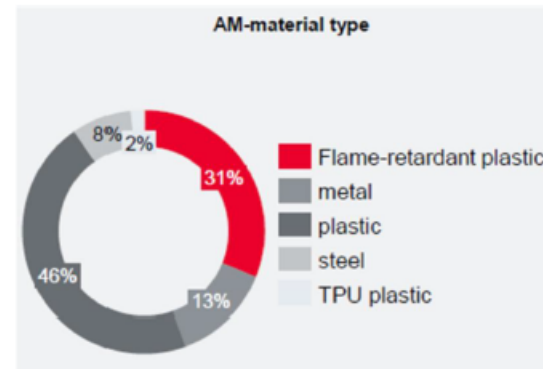
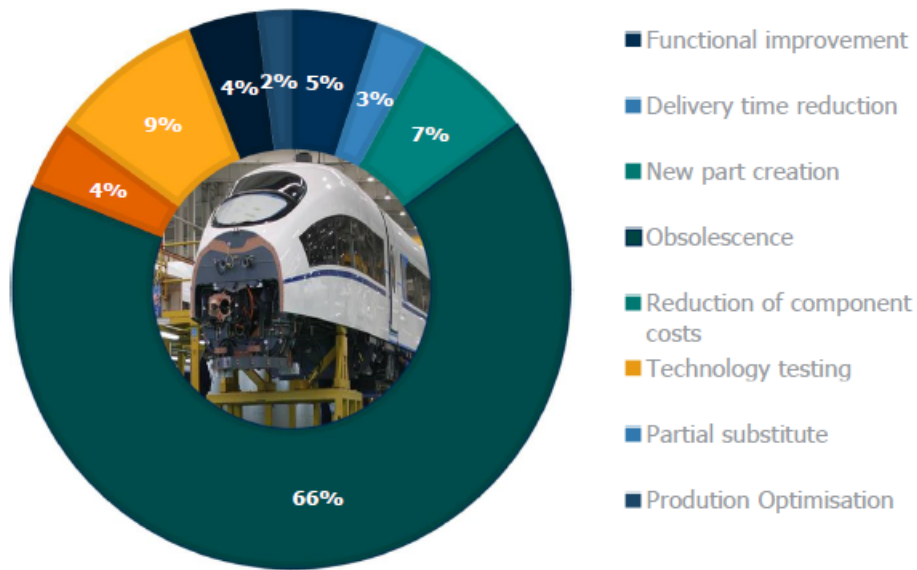
<https://mitcorer-barshi.medium.com/advanced-materials-in-railways-to-improve-operational-efficiency-fd3aac309fba>

Full composite train body



CRRC Changchun Railway Vehicles, a Chinese rolling stock manufacturer that is publicly traded, has made a big breakthrough in rail transit by constructing a carbon fiber train body for the first time.

3D PRINTING – Operators Facts



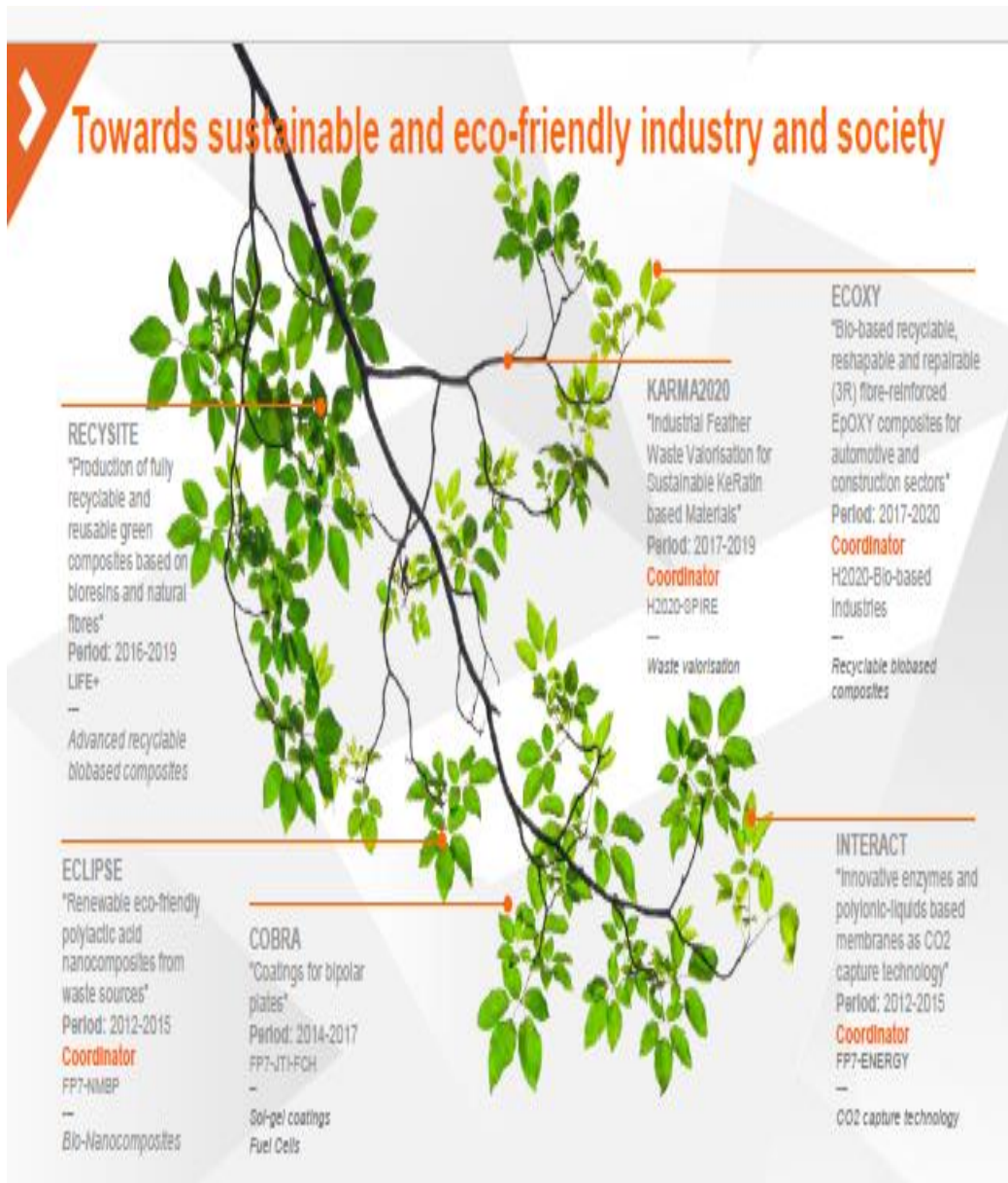
66% of parts produced due to obsolescence & 80% in plastic



FREIGHT!!!

STRUCTURAL vs NON STRUCTURAL

NON CRITICAL SPARE PARTS



© 21 | 02 | 2024

CIDETEC Surface Engineering develops a type of epoxy to build lighter and more sustainable trains

NANOMEDICINASURFACE ENGINEERING

OMNIPHOBIC TECHNOLOGY (REPELLENCY TO ALL KINDS OF LIQUIDS REGARDLESS OF SURFACE TENSION)

DESCRIPTION OF THE TECHNOLOGY OR KNOWLEDGE

An omniphobic surface repels both polar liquids (such as water) and non-polar (oily) liquids, and therefore, has useful technological applications in self-cleaning surfaces, anti-icing, anti-graffiti, anti-finger print, anti-bacteria or easy removal of insects from surfaces. Thus, they can be applied to industrial sectors such as transport, fabrics, architecture or electronics, promoting the low adhesion of particles and materials. In order to achieve these properties, CIDETEC developed a patented technology that overcomes the limitation of the omniphobic state of the art. These technologies are based on high slippery with excellent sliding properties versus polar and non-polar liquids and on covalent bonding to the substrate, which increases the durability and lasting properties of the coating. CIDETEC technologies have been applied on a wide range of substrates, from metals, plastics, paper to textiles.

Key insights

- KPI de sostenibilidad
- Ecodiseño pensando en mantenibilidad y reciclabilidad fin de vida
- Funcionalización de elementos
- Lightweight
- Ahorro energético
- Experiencia de usuario

New technologies are helping mobility to reach new dimensions, to optimize models and to offer more sustainable and efficient mobility solutions.

Multimodal platforms and digital payments

The integration of multimodal platforms and digital payment systems provides users with a one-stop solution for planning, booking and paying for various modes of transportation. It opens up unified mobility management spaces with buses, trains, metros, ridesharing services and even micro mobility such as electric scooters and shared bikes.

Access to different transport services through a single digital platform has improved the overall travel experience for citizens, making it smoother and easier.

The use of digital payment systems has streamlined the transaction process, providing autonomy and reducing waiting times.

This technological solution not only saves time for users, but also contributes to a more efficient and cost-effective means of managing and operating public transportation systems.

In these environments, users can easily recharge their accounts, purchase tickets and access real-time information.

This compilation of services has significantly expanded the options available to people with diverse mobility needs. This represents a breakthrough in creating a more inclusive transportation system tailored to individual needs.

Maps and improvements for people with reduced mobility

Advanced mapping technologies, together with improvements adapted to the needs of people with reduced mobility, have brought real and effective progress:

- ✔ Providing detailed and accurate information on accessible routes, the location of elevators and ramps
- ✔ Availability of other essential facilities
- ✔ Designated parking spaces
- ✔ Accessible restrooms, etc.

The integration of real-time data into mapping applications helps people with reduced mobility make better decisions about their travel routes.

In addition, the development of navigation tools designed specifically for users with reduced mobility has further improved the accessibility of urban mobility.

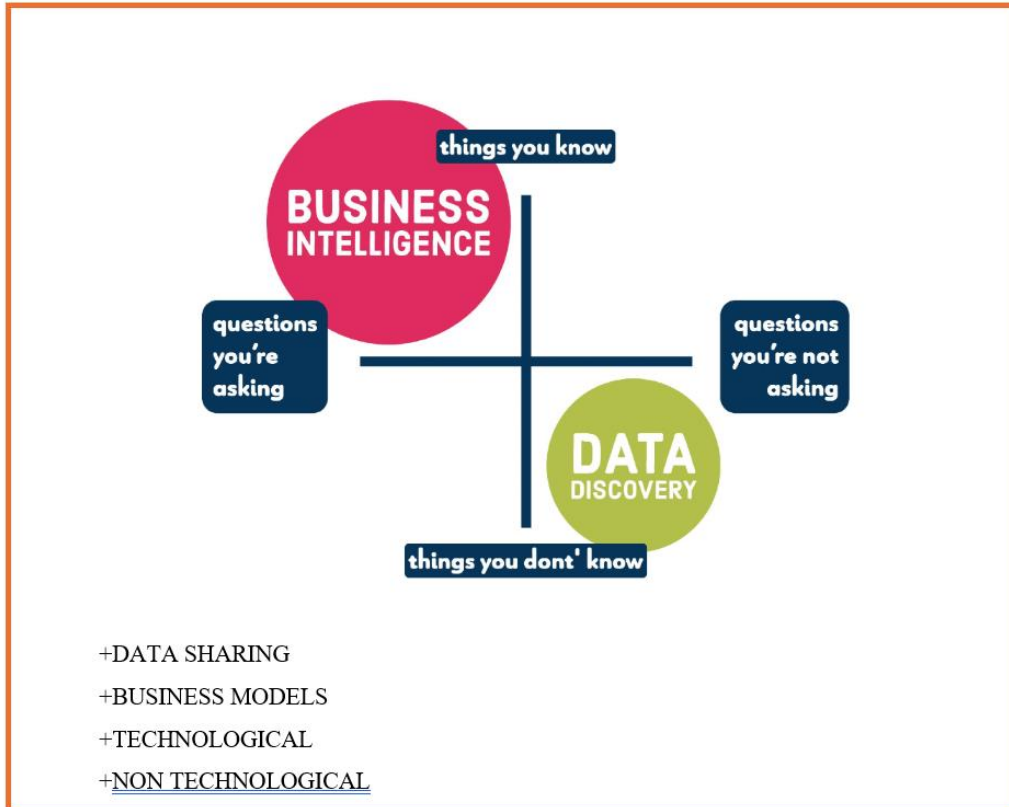
Latest developments in the mobility sector

Among the most recent developments in the mobility sector, the following stand out:

- ✔ Vehicular communication, intelligent infrastructures and shared mobility.
- ✔ Algorithms and data for route optimization.
- ✔ Autonomous vehicles and delivery robots.

New technologies applied to mobility

New technologies are helping mobility to reach new dimensions, to optimize models and to offer more sustainable and efficient mobility solutions.

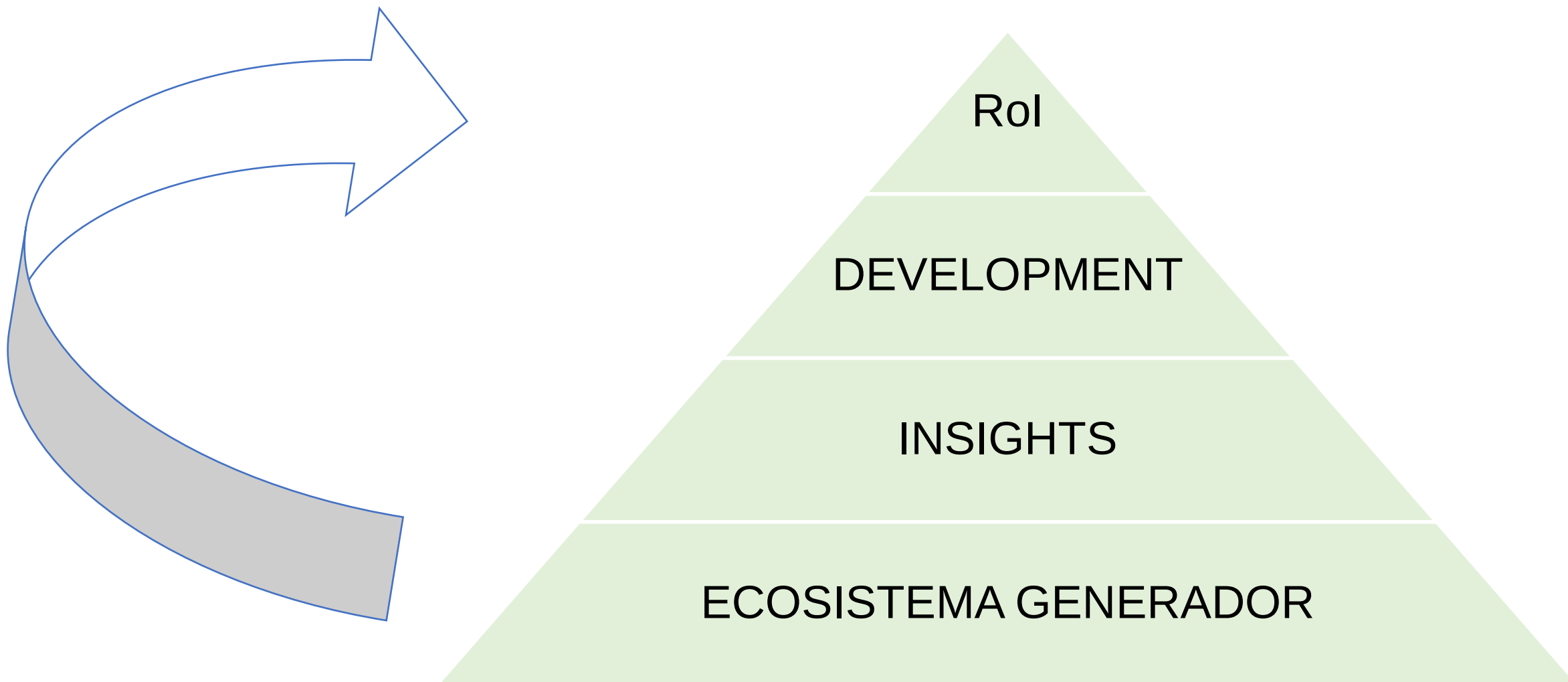


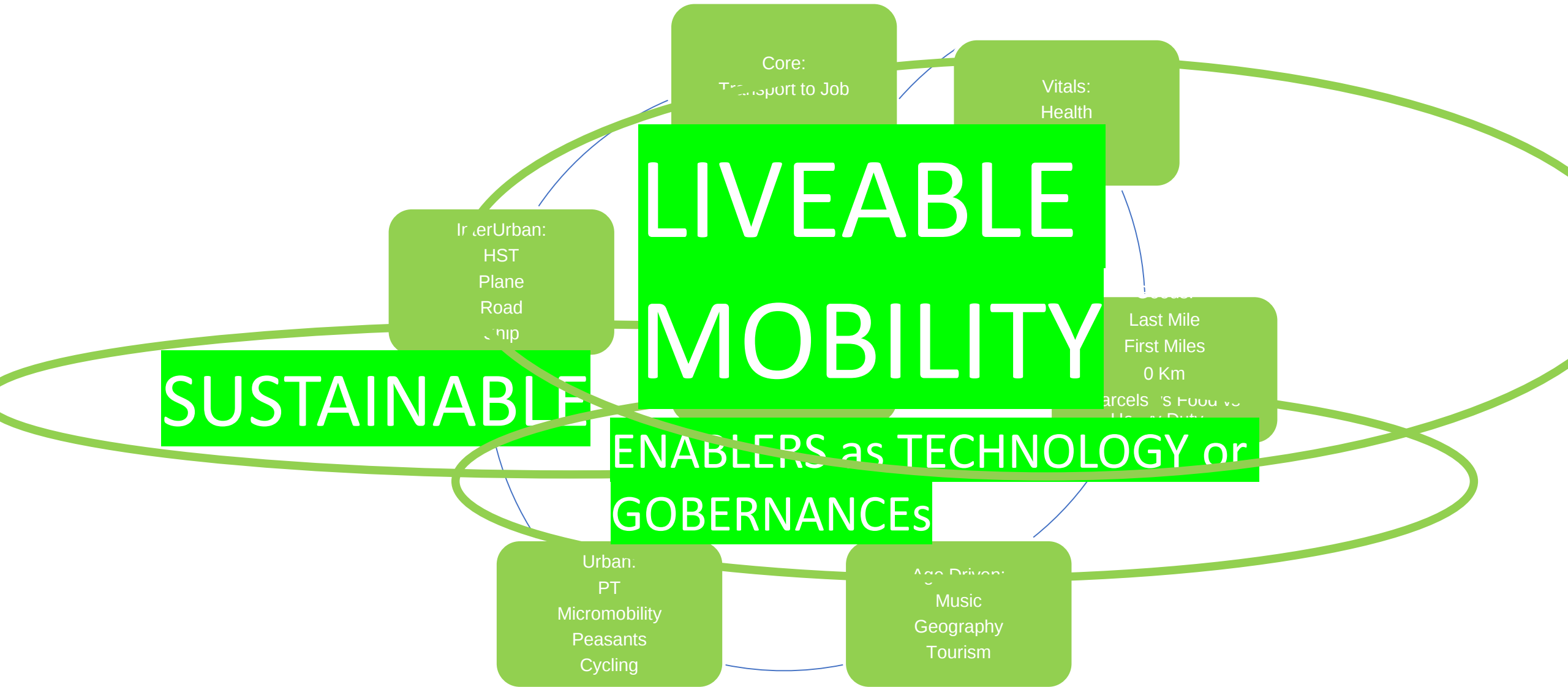
Benefits of implementing new technologies in mobility services

In conclusion, the integration of new technologies such as artificial intelligence, IoT and cloud computing into mobility is revolutionizing the way we move.

Among the most obvious benefits are:

- ✓ The improvement of multimodal transportation planning systems.
- ✓ Optimization of time spent on mobility with the associated lower environmental impact.
- ✓ The creation of more accessible options for people.
- ✓ The creation of smart cities.
- ✓ Increasing safety in public spaces.
- ✓ The exploration of new forms of mobility.

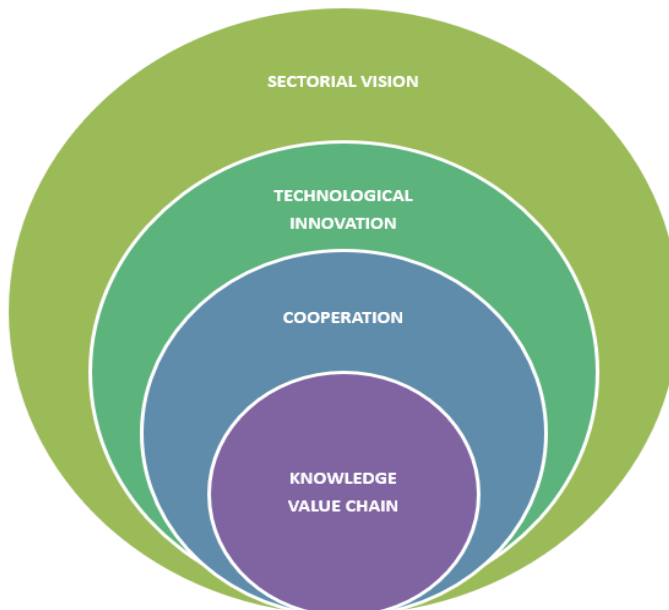




About IN-MOVE, by RAILGRUP



- Innovative Cluster based in Barcelona.
- **Business Innovation & Digital solutions** to meet social challenges in **Sustainable Mobility and Multimodal Low Emissions Logistics** sector;
- INMOVE by RAILGRUP (INM) **Cluster was created in 2002** as the result of an initiative to strengthen the competitiveness of the railway industry
- Access to a **large industrial network** of partners at International level;
- INM has become a benchmark cluster in Spain not only in the railway ecosystem but in the transport sector in general.



Harvard
Business
School

N9-724-404
NOVEMBER 07, 2023

CHRISTIAN H.M. KETELS

Three Decades of Cluster Policy in Catalonia: What's Next?

The mood was festive among the close to 400 leaders from government and the private sector that entered the World Trade Center in Barcelona on December 10th, 2022. There was a clear sense that 30 years of cluster policy in Catalonia was something worth celebrating: few other policy programs had been sustained over such a long period of time, surviving through deep changes in political leadership and economic circumstances. And there were strong indications that this success in keeping the program active reflected the value it was delivering to Catalonia and its economy. Private sector leaders confirmed how engaging with the cluster activities had helped their businesses in critical ways. Additional government agencies wanted to engage on new cluster efforts.

With the anniversary event drawing to a close, the discussions in the leadership team of ACCIO, the Catalan Agency for Business Competitiveness, turned to the future. Should the program continue in its present form, or was there a need for change? Was the cluster approach still relevant 30 years on, given a fundamentally different economic context and a policy debate that was now considering ecosystems, societal missions, and "new" industrial policies? And was the cluster program playing its full potential role in addressing Catalonia's broader competitiveness issues, from dealing with a highly complex external economic context to nagging questions about whether Catalonia and its capital Barcelona were losing their touch?

Through **open innovation, technological excellence, cross-sectoral knowledge** and the development of joint projects.

INM currently gathers more than 126 members including public and private operators, engineering firms, start-ups, sensor-mobility systems, OEMs, rail infrastructure suppliers and logistics stakeholders.

INM is founder member of the European Railway Cluster Initiative (ERCI). 15 Clusters along EU, collaborating together to enhance the competitiveness of companies in the cluster. More than 2000 SMEs under the E.R.C.I. Ecosystem.

+20 framework programme projects catalyzed for members

- [Nace IN-MOVE by Railgrup | Cluster de Movilidad y Logística Multimodal](#)



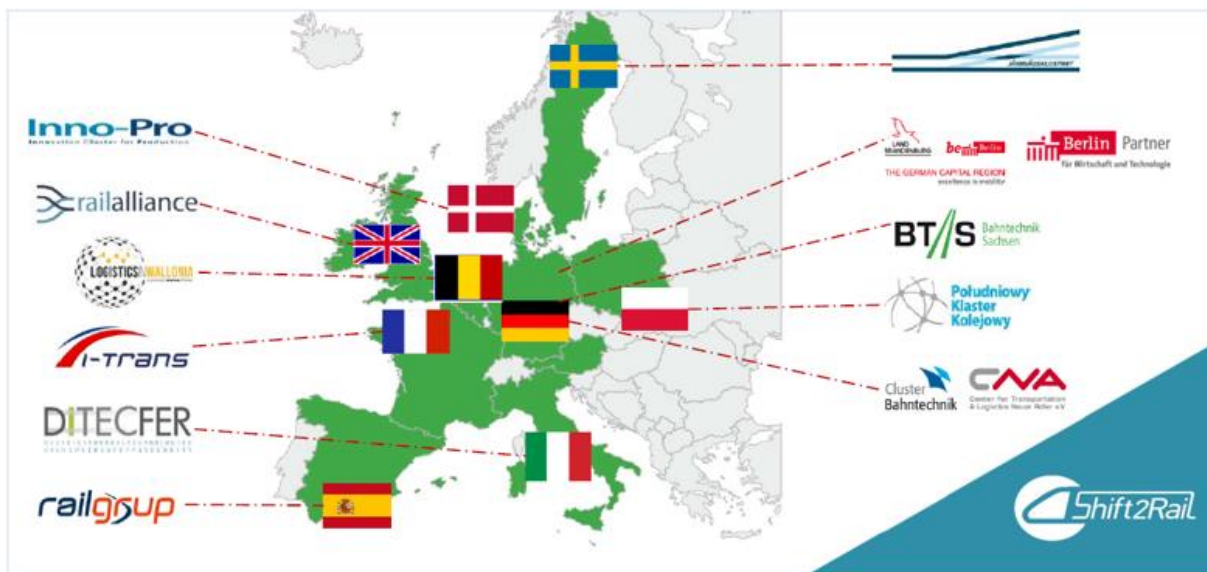
About IN-MOVE, by RAILGRUP

in-move by Railgrup



European Rail Clusters Initiative

railgrup



It's about Communication between people, the rest is Technology. Peter Ferdinand Drucker.



MOLTES GRÀCIES

gerencia@railgrup.net

www.railgrup.net

ESTUDIO de MOVILIDAD de IN-MOVE by RAILGRUP 2022

in-move by Railgrup

4. Tendencias del sector: Experiencia del viajero

Seamless Mobility

Este concepto hace referencia a la facilidad de uso del transporte público por parte del viajero, que debería de ser accesible y totalmente integrado. La capacidad de pagar de forma *contactless* por los controles de entrada y salida (*pay as you go*) es una innovación que permite facilitar la movilidad al viajero.



En el metro de Sevilla o de Londres ya aceptan la modalidad *pay as you go* por parte de los viajeros.

<https://www.mckinsey.com/business-functions/sustainability/our-insights/the-road-to-seamless-urban-mobility>

Mayor visibilidad de datos

El viajero quiere conocer toda la información para realizar un desplazamiento, como la disponibilidad del servicio, la previsión del tiempo de la ruta, alternativas de medios de transporte, entre otros. El *door-to-door mobility* facilita al consumidor una movilidad versátil, resiliente, intuitiva y con total transparencia.



La aplicación TMB ayuda a planificar el recorrido con toda la información de diferentes operadores de la AMB con el objetivo de mejorar la experiencia del viajero.

https://errac.org/wp-content/uploads/2019/09/ERRAC_2019.pdf

Liveable Mobility

El transporte ya no es únicamente un servicio, sino un elemento que es necesario adaptar a las vidas de los ciudadanos, a los nuevos patrones de movimiento, a las nuevas generaciones y a las nuevas necesidades.



La capital de Noruega, Oslo, e 'está convirtiendo en una de las ciudades más "liveable" en lo referente a la movilidad, gracias, en parte, a su programa llamado "Car-free Livability".



El Forum del Transporte Urbano para Ciudades Habitables, que se organiza en Manila (Filipinas), tiene como objetivo principal analizar casos de éxito de las ciudades más "habitables" en Asia en lo relativo a movilidad.

33

in-move
Cluster de Movilidad y Logística Multimodal
by Railgrup



We have a momentum - now is the time to act!

Through wise investments today in the railway, the most environmentally-friendly mode of transport, we can create a sustainable, inclusive, affordable and accessible alternative for tomorrow's people and goods.

Together with other modes of transport, we will build and develop a multimodal system with the railroad as the backbone of mobility.

It is a good investment - for us, the society and for future generations.



4. Tendencias del sector: Espacios para la movilidad

Accesibilidad urbana

Las ciudades y los medios son cada vez más accesibles, facilitando que cualquier ciudadano pueda acceder a todos los espacios urbanos sin ninguna dificultad.



La ciudad de Madrid se ha marcado el objetivo de ser el destino turístico accesible referente en Europa.



Valladolid ha tomado medidas para hacer su movilidad más amigable para aquellas personas con movilidad reducida.

Urbanismo táctico

Este concepto está directamente relacionado con el diseño participativo y activo del espacio urbano mediante intervenciones acotadas y de bajo coste pero que suponen cambios efectivos y a largo plazo.



La autoridad "Transport for London" en Londres impulsa la movilidad activa con el objetivo de que el 80% de los trayectos se hagan a pie, en bici o en transporte público en el año 2024.

The 15-Minute City
Putting people at the center of urban transformation

El proyecto Ciudad de 15 minutos está diseñado para ayudar a que las transformaciones urbanas sean lo que necesitamos que sean: ambiciosas, inclusivas, medibles y eficaces. Cualquier sitio debería de estar a 15 minutos caminando o en bicicleta.

Rediseño de espacios

Muchas grandes ciudades del mundo están adaptando sus espacios para facilitar el uso de vehículos de micromovilidad y garantizar los espacios de seguridad de los lugares.



Copenhague se ha convertido en uno de los lugares más amigables para los usuarios de las bicicletas.



El objetivo de las super-islas en Barcelona es conseguir un espacio público saludable, más verde y seguro, que favorezca las relaciones sociales y la economía de proximidad.

30

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by Railgrup

Multimodalidad

Posibilidad por parte de los usuarios de informarse, reservar i pagar un trayecto completo desde un mismo lugar y aplicación, aunque se utilicen diferentes medios de transporte. La movilidad como servicio permite realizar todas estas acciones por parte del viajero.



Con la aplicación TMB App se pueden gestionar diferentes títulos de transporte y validarlos con el móvil.



GotoGlobal permite el uso integrado de diferentes vehículos que el usuario necesita para desplazarse por la Ciudad de Madrid.

Cambios en el reparto modal

Algunos de los cambios sociales y demográficos ponen en evidencia la necesidad de reestructurar el reparto de los modos de transporte de pasajeros y mercancías.

millor mou-te...



Algunos ayuntamientos como el de Tarragona han iniciado campañas de sensibilización para fomentar un cambio de hábitos en los ciudadanos, priorizando modos de transporte más sostenibles que el vehículo privado.



El plan del MITMA establece diversas líneas de actuación y medidas concretas para fomentar un cambio modal en el transporte de mercancías hacia modos de transporte más eficientes.

28

4. Tendencias del sector: Medios de transporte

Vehículos eléctricos

A nivel estatal, la venta de coches eléctricos ha aumentado mucho en los últimos años, pero aún no se pueden comparar con las ventas que experimentan la mayoría de países de Europa.



La gama de vehículos de movilidad urbana de Seat, llamada Moo, incluye motos, patinetes y coches eléctricos.



TMB utiliza varios autobuses eléctricos en Barcelona.

Vehículos autónomos

Algunos tipos de vehículos ya están totalmente automatizados (con algunas líneas de metro) mientras que hay otros que aún no están preparados (coches particulares).



La línea de metro que conecta el aeropuerto de Josep Tarradellas con la ciudad de Barcelona es completamente autónoma.



Todos los coches Tesla vienen de serie con un hardware avanzado capaz de ofrecer las funciones de Piloto Automático.

Aumento de la micromovilidad

Los Vehículos de Movilidad Personal (como los patinetes eléctricos) y las bicicletas se utilizan cada vez más en las grandes ciudades.



Lime ofrece sus patinetes eléctricos a diversas ciudades del mundo, entre ellas está Madrid.



Bicing dispone de más de 7.000 bicicletas en la ciudad de Barcelona, de las cuales aproximadamente un 20% son eléctricas.

29

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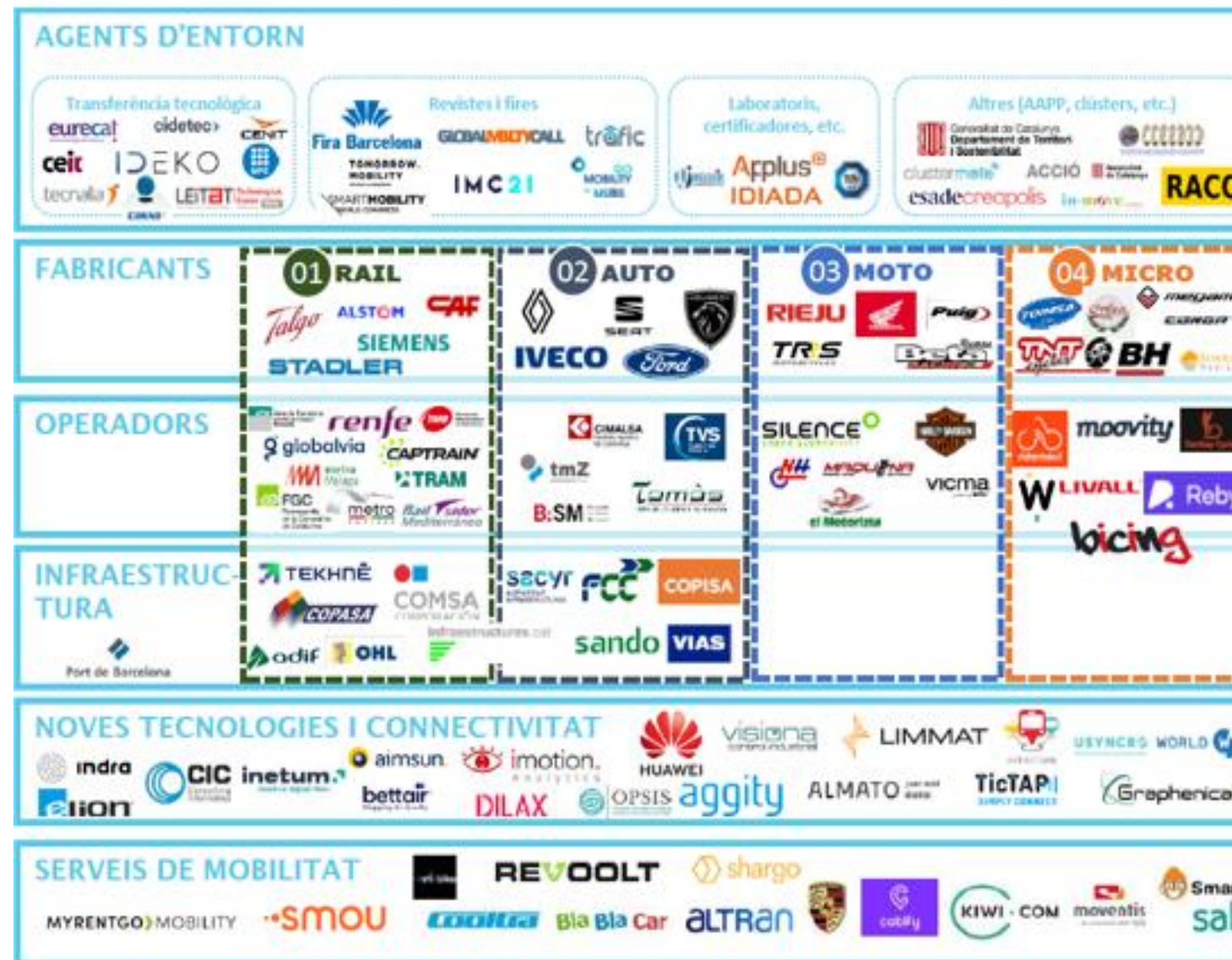
1848 – SPAIN. 175 years

RAILWAY IS STILL THE FUTURE but WE ARE NOT IN YET!!!

- .-ADVANCED FUNCTIONALIZED MATERIALS
- .-NEW INTERIORISM
- .- ECODESIGN
- .-CLIMATE CHANGE RESILIENCE
- .-DIGITAL SOLUTIONS
- .-CBM – DIGITAL TWIN
- .-TRAVELLERS – USER – CLIENT EXPERIENCE
- .-MaaS/MaaF
- .-CONNECTED COOPERATIVE AUTOMATED MOBILITY (CCAM)
- .-PHYSICAL DIGITAL INFRASTRUCTURE (PDI)
- .-AI – IOT – CONNECTED TO PEOPLE NEEDS BY USING THE TRAIN
- .-LOW EMISSION LOGISTICS – FREIGHT (3% RAIL in SPAIN. MULTIMODAL-MULTIPRODUCT-MULTICLIENT. GROWING MARKET)

.-Technology Cooperation

.-H2????



Networking – Insight - innovation



Valor creado 



MODI and its requirements are disclosed to international stakeholders



MODI participates at FISITA World Congress!





2012. THE USER OF THE FUTURE, TOGETHER WITH RENFE



creafutur + railgoup

EASY TRIP FIRST APP. BASE of RaaS, in 2012.
LEADER of 2012 THE PROJECT IS NOW 2020 DIRECTOR OF RENFE HST LOW COST AVLO



EFFICIENT MOBILITY, MULTIMODAL-PARK&RIDE



01. Beginning of the journey

From traditional mobility to **Mobility as a Service (MaaS)**



Renfe positions itself as a leader in this mobility ecosystem, innovating and adapting to new needs and generating positive impact on society while keeping alive its key values.



Digital Transformation

Exponential evolution of technology not only impacted the transport sector but also the user's perception of mobility.



New mobility patterns

Climate change action, improvement of air quality and decentralization of urban areas require:

- The use of eco-friendly vehicles and energy.
- Solutions to reduce traffic congestion and crowds in public transport.
- The need to improve security and safety.



Impact of telework

A demand forecast based on predictive analysis rather than historical data, and the need to optimize transport offer at every moment of the day.



Emergence of platform economy

The emergence of integrated and integral platforms that foster mobility data exchange and collaboration between mobility operators to share data for the public good.



Integration of micromobility

The increase of micro-mobility in cities as a direct response to traffic congestion and air contamination, and enhanced solutions to reach destination quickly and avoiding traffic jams.

UNIVERSAL ACCESSIBILITY IN THE BACELONA METRO



Universal Accessibility is a condition that processes, goods and services must be as well as objects and devices are understandable and practicable for conditions of comfort and independent autonomous movement possible

In Catalonia there are more than **79,000** people between 65 and 79 years of age who present **visual impairment**. If we add those over the age of **80** we reach **123,000** people who may experience difficulties in moving autonomously using public transport, if there was no accessibility measures.

KEY DRIVERS for RAILWAY EU

<https://www.railgrup.net/in-move-events/>

PREVIOUS EXPERIENCE RAILGRUP on ECOINNOVATION RAILWAY



2015



2017



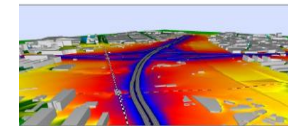
2019

PROYECTOS REALIZADOS SIGNIFICATIVOS

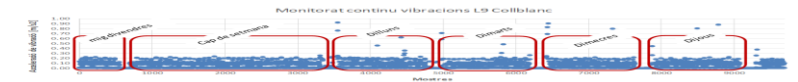


Objective

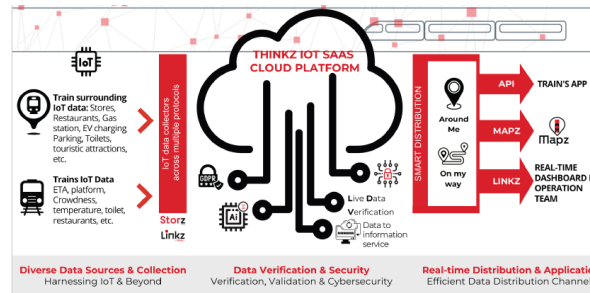
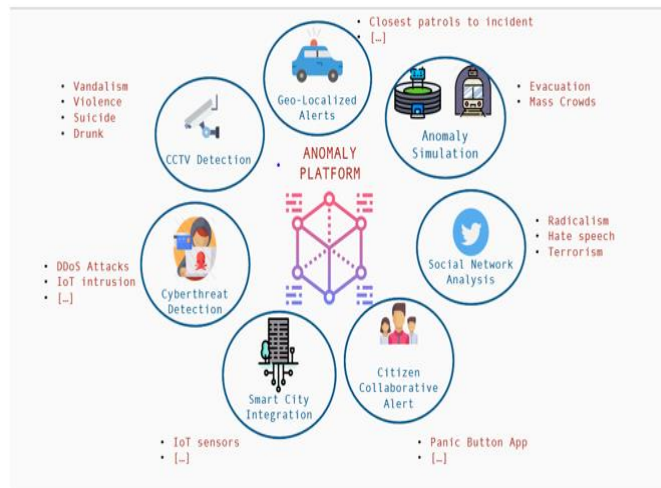
In the transportation sector, the objective of AV Ingenieros is to transfer the experience and know-how of its team to have a more environmentally respectful transportation infrastructures and to guarantee the comfort standards for its users.



... Noise and Vibration Creativity

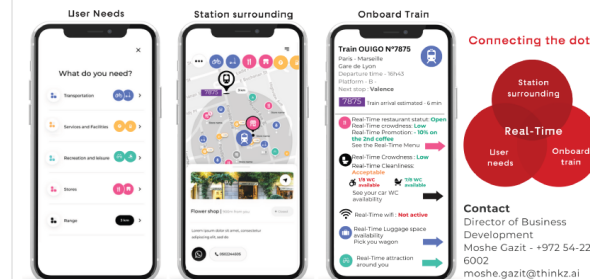


ANOMALY-CYBERSECURITY



Thinkz Real-Time IoT Multi-Layer Map

Innovative multi-layer real-time technology, based on IoTs that communicate with each other.



SMART LINING SYSTEM

REVESTIMIENTO E INTEGRACIÓN DE SISTEMAS

APLICACIONES ACTUALES

Procesos encadenados de diseño y montaje:



IMAGEN: BOMBARDIER

Ecosistema innovador



Reproducir vídeo

App&Town Compagn

Smart Railway Station



imotion.
Analytics

Artificial Vision as a Service



IoT
sensing



Traitement
Vidéo
Local



Traitement
metadata
Cloud



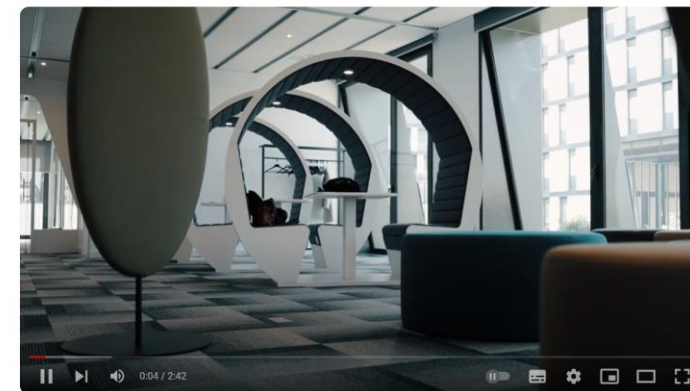
BI &
Tableau de bord

Experts en vision artificielle

Compteur précise et rapide,
en Temps Réel
et non intrusive.



TAD HYPERVISOUL



Premio Astres-TrenLab 2022. Un emprendimiento ganador del reto "Keep it Asset"

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cargar

Empresas Limmat



Limmat

Website
limmat-group.com

Sector
económico

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IN-MOVE es miembro de la asociación CCAM a nivel europeo y ha establecido contactos con agentes de 1º nivel en Movilidad en España para crear un grupo de interés y presión CCAM a nivel estatal.



