Regione Lombardia

Allegato B

SMART MOBILITY
&
ARTIFICIAL INTELLIGENCE

Strategy and projects for the innovation of the Lombardy Region mobility system

November 2020

SUMMARY

Executive Summary

This current historical time is characterized by continuing technological developments, which lead to an extraordinary acceleration in the change of economic and social processes on a global scale.

More than others, the mobility sector is experiencing some transformation mega-trends that are profoundly changing its physiognomy. The main trends, described in Chapter 2, represent the most important factors of change characterizing the competitive scenario in the near future, with significant implications for the ecosystem players, who are called on to respond to new problems, which have never been tackled before, and to implement rapid transformation processes according to a very tight schedule.

Moreover, the COVID-19 health emergency is generating dramatic economic and social consequences, placing public decision-makers and industrial players before completely unique challenges, as well as potential opportunities.

The implications of the process of change in the mobility sector are extraordinary: if well governed, it **may guarantee exponentially better living conditions for people** in terms of health (less pollution), space management, time use, easier relations and social cohesion. At the same time, above all in the production field, like all processes of disruption, there are risks for the orderly social and economic development of territories that cannot be underestimated.

In this context, Lombardy, with a strong, articulated and composite production fabric, enjoys a competitive advantage - in terms of the capacity for innovation - over other regions, and therefore has the chance to play a key role in designing the future lines for development of the sector, in relation to its values and distinctive approach, which privileges people and their needs. Chapter 6 offers a description of the rich and variegated ecosystem of economic players who have found the ideal conditions for growth and expression in the Lombardy region.

The possibility to exploit these developments is however closely linked to the ability of the local production fabric to intercept the great waves of change in progress, thanks to an increasingly marked ability to **support innovation processes**. If possible, the health emergency makes it even more pressing and urgent to base future growth paths on competences linked to the highest levels of research, development and industrialization, otherwise the Lombardy-based services companies and component manufacturers risk not being able to play a key role in the profound processes of redesigning the industrial supply chains of the automotive sector and mobility services.

Starting from these considerations, the Lombardy Region has set the goal of creating a **research and innovation hub for mobility of the future** in its territory, promoting the birth and development of experimental projects able to make the Lombardy area more attractive both nationally and internationally. The aim of the regional administration is not that of duplicating the facilities and roles

already present in the territory. On the contrary, it is a matter of involving all mobility players working in Lombardy (industries and services, Universities, Research Centers, Local authorities, citizens), creating synergies and fostering the birth of joint partnerships and projects.

This intent has been concretely implemented firstly by listening to and reflecting with a large number of industrial and services players who were invited to contribute to the identification of the needs of the region and the extended automotive supply chain.

In operational terms, a "Smart Mobility & Artificial Intelligence" Working Group has been established; not only has it held three plenary sessions, but it has also contributed with ideas during individual meetings and interviews to discuss the ideas and issues emerging during the working group meetings.

The various analyses produced, along with the intermediate discussions, have led to the identification of **four project areas**, which constitute the priorities of the Lombardy Region in the mobility field, relating both to the allocation of available funds and the creation of a regulatory framework favorable to their implementation. Furthermore, the Public entity has the possibility to promote innovation, fostering new highly innovative visions for the development of the region and its services.
The ideal references for this intervention are naturally characterized by the conceptual paradigms of (environmental, social and economic) sustainability, the circular economy[1], the use of technological innovation serving the public good, in a phase of profound transformation of European societies and economies.

The four projects are presented as synergic and integrated, with implementing time frames that distribute their impacts over both the short and medium-long term. The time frame for identifying and implementing the project concepts is consistent with the next European programming cycle (relating to the period 2021-2027).

The project areas fall within a framework of prior or ongoing initiatives, in a context of (institutional and other) players who are involved in various ways in the development of the mobility sector. For this reason, it will be fundamental to consider - in the concrete definition of the activities, the framework of current activities and relations – on different levels:

- interregional, aiming not to duplicate ongoing initiatives but rather to enhance the potential synergies;
- with the Ministries which, nationally, are tackling the issue of mobility;
- with other more industrially developed regions in Europe as part of the existing cooperation relations among the so-called "4 motors" (Baden-Württemberg, Catalonia, Rhone-Alpes, as well as Lombardy).

[1] Refer to the document "Circular Europe. How to successfully manage the transition from a linear to a circular world", Enel and The European House – Ambrosetti, 2020

The four project areas identified below have been imagined within a system of needs they can offer a coherent and complete response to.

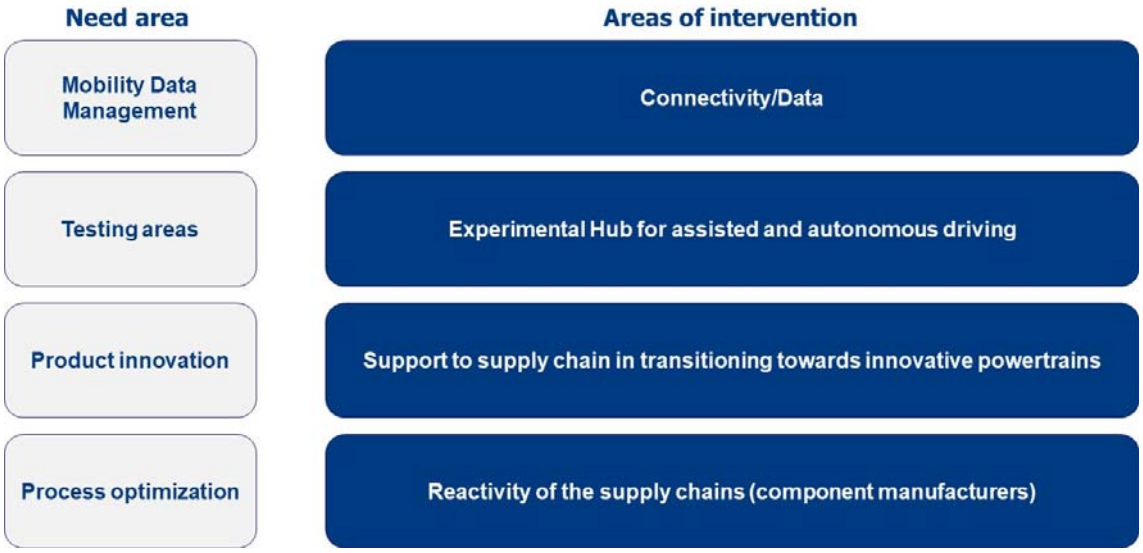

Figure A. Identified project areas and the needs they respond to. Source: The European House – Ambrosetti, 2020

Transversal to these project areas are some fundamental issues, the centrality of which depends on their priority for the industrial system and/or the mobility system as a whole.

The first certainly include the issue of **reducing vehicle weight** in terms of the materials used and the design choices, which will lead to a structural modification of the vehicles and, consequently, increasingly efforts in research and development by the whole automotive and component supply chain. This is a very important chapter, which lies between fields C (Support to the supply chains in the transition to new powertrains) and D (Reactivity of the component supply chains).

The second include the need to adopt increasingly advanced solutions for a **Local Public Transport** system that demands further innovation, also through the adoption of tools to increase the safety of citizens (remote controls, driver assistance, etc.).

The project areas, described in detail in Chapter 11 of this document, are:

a. **Connectivity / Data with reference to the digital evolution of mobility services**

The possibility to share mobility-related information and data in an open manner able to grow over time is one of the great game-changers in the life of territories, intended to facilitate the management of public mobility services by creating environments that are favorable for experimenting innovation.

Over time, the Lombardy Region has set up a database of proprietary data it can make available to companies wishing to share their data, using the methods already tested with the E015 platform. In this way, it will be possible to create experimental services for citizens, with a virtuous dynamic for the companies interested in sharing their data, given the possibility to "enhance" them using data of public origin or from other companies.

The project aims to create the conditions for a more structured knowledge of mobility dynamics and their reasons, in order to:

- facilitate the management of public mobility services, starting from the activation of public-private forms of intermodality and the promotion and management of initiatives with a clean & smart mobility logic;
- create an environment favorable to experimentation and innovation in which to promote private initiative and public-private cooperation for the development of new mobility services (including digital services), incentivizing the convergence between the physical (products and services) and digital world.

b. Experimental Hub for driver assistance and self-driving (and other forms of experimentation in controlled contexts)

Driver assistance and self-driving have been possible today by the use of vehicles that travel with less input by the driver, as they are able to exchange information with the surrounding environment.

While there are still some very challenging obstacles to overcome to make advanced self-driving solutions operational in real contexts, mainly for safety reasons, some encouraging factors are linked to the nature of the technology used: information digitization, the availability on the market of increasingly advanced connectivity solutions (5G), the use of artificial intelligence software that can be constantly updated.

Starting from these considerations, the identified project involves the creation, in Lombardy, of an international excellence hub for the research and experimentation of assisted and self-driving mobility solutions, through access to specific facilities and the range of services for the experimentation of innovative solutions applied to vehicles and infrastructures, ensuring the necessary variety of articulated spaces, tools and infrastructures.

The aim is to create a unique context for experimenting self-driving and driver assistance for different technology readiness levels (TRL), with a broad scope of intervention, running from vehicles to single components, as well as all other "extra-vehicle" technologies (i.e. signposting, field sensors, antennas, etc.), with expected benefits not only for the private sector but also for public transport, and, in future, widespread positive consequences also for local citizens.

Where flexibly designed, the facilities set up to experiment self-driving and driver assistance solutions can also be used to test solutions in other fields (for example braking systems), guaranteeing access to facilities suitable for the development of a wider range of technologies.

c. Support to supply chains in the transition towards new powertrains

As a consequence of the significant regulatory changes promoted both within Europe and in other parts of the world, the result of a renewed environmental sensitivity, the component supply chains are having to cope with a new context compared to the past, even though still in transition, in terms of the technologies associated to vehicle structures and traction.

Although for many reasons it is still difficult to predict the time horizon of the development of these scenarios, they are structural phenomena which will have a significant impact on the re-design of the boundaries of the reference scenario and the value constellations in which the players of this ecosystem will move.

The nature of the third initiative identified involves the facilitation of the re-positioning of the Lombardy industrial mobility system in the renewed context of the automotive industrial supply chains, the results of the current transformations, supporting it in the implementation of research and development activities which are fundamental for product redesign and for the management of new technologies, new materials and the related enabling infrastructures.

It is within this working scenario that we also find the last fundamental piece of the articulated puzzle of factors that make it possible to design and adopt advanced mobility models in the territories, concerning the infrastructures and info-structures needed to manage a modern mobility system. Here we refer particularly to:

- on one hand, the presence in the region of modern telecommunications networks able to support the exchange of increasing data volumes and develop business models enabled by digital platforms;
- on the other hand, the physical infrastructures needed to support the development of electric and hydrogen mobility and self-driving and driver assistance.

A huge amount of innovations is currently being developed in these areas, in a context in which the technological choices and territorial governance choices have not yet determined the convergence towards set market standards.

d. Reactivity of the component supply chains

As for the previous working scenario, the last project aims to support automotive component manufacturers in view of the ongoing transformations in the sector.

In this case, it is a matter of promoting the adaptation of the operational model of automotive component manufacturers, aiming to increase the degree of flexibility in their production and industrial organization, in order to manage the greater complexity/volatility and above all the speed of the market. This implies aspects relating to know-how (access to specialist knowledge of operations and legal fields), access and use of software (to overcome the high cost of licenses and above all the long times for development of "internal" solutions) and investments in new production technologies.

Furthermore, the project explores the broad area of requalification of human capital, which today is crucial for a very large number of companies in the sector.

1. Introduction

The **Three-Year Strategic Plan for research, innovation and technology transfer of the Lombardy Region**, approved by the Regional Council on 19 March 2019, identified eight reference ecosystems on which to base the future strategies for territorial innovation[2]. In the document, "ecosystem" is used to refer to the *set of public and private players and associations working in the Lombardy region, the activities and resources of which contribute to meeting a set of individual or collective needs*.

An ecosystem is organized around the need to be satisfied and includes a variety of players who, each according to their own specific features, contribute to achieving this objective. The ecosystem does not coincide with an industrial sector or even a certain legal form, as what is important are the interactions between players which can multiply the generated value by virtue of their diversity and complementarity.

The ecosystems deemed strategic for the future include that of **Smart Mobility and Architecture**, which "respond to people's need to move around and be welcomed in urban and extra-urban spaces, but also to ensure the transfer or resources and goods, as well as the connection between territories. The management of the public and private urban space is closely linked to that of mobility, which implies a joint vision for the two areas within a single ecosystem, in the cities and urban areas".

With specific reference to mobility aspects, the examples of innovative development areas indicated in the Three-Year Plan include:

- the development of mobility structures for citizens with limited mobility;
- the development of (public-private) mobility structures for the public, with a view to lower environmental impact (e-mobility) and self-driving;
- the adoption of innovative V2V (vehicle – vehicle), I2V (infrastructure – vehicle) and V2I (vehicle – infrastructure) communication systems to increase the safety and comfort of public and private transport systems for people and goods;
- the design of innovative intelligent transport and/or self-driving systems for the inter- and multi-modal management of passenger traffic and goods freight transport;

[2] The Lombardy ecosystems identified as fundamental for the development of an effective innovation strategy are: Nutrition, Health and life science, Culture and Knowledge, Connectivity and Information, Smart mobility and architecture, Sustainability, Social Development, Advanced Manufacturing.

- the development of innovative technologies, new vehicle subsystems or components to reduce engine emissions and environmental impact, particularly to reduce the carbon footprint and/or other emissions (including particulate matter);
- the creation of innovative systems for vehicle energy recovery;
- the implementation of innovative solutions for slow, fast and rapid (highway) charging for electric personal, collective and freight mobility, with a view to integrating and optimizing charging stations in the territory;
- the identification and promotion of forms of inter-modality for local and long-range transport.

Starting from the general guidelines developed in the Plan, the Directorate-General for Research, Innovation, University, Export and Internationalization of the Lombardy Region has **defined the contents of a set of projects to promote and accelerate the development of Smart Mobility in the Lombardy Region** for 2020-2030.

These projects can benefit from the European ERDF/ESF funds for 2021-2027.

2. Mobility Macro-trends

In this historical time, in which the effects of technological developments are accelerating the global change in economic and social processes, the mobility sector - more than others- is experiencing some transformation mega-trends that are profoundly and structurally changing its physiognomy.

The implications of this process of transformation for people are extraordinary: if well governed, it may guarantee exponentially better quality of life for people in terms of health (less pollution), space management, time use, easier relations and social cohesion. At the same time, above all in the production field, like all processes of disruption, there are risks for the orderly social and economic development of territories that cannot be underestimated.

Five of these great global trends are worthy of mention, and are described below in brief:

a. Connectivity and Big Data

Investments in new technologies, intended to enable developments in the field of connectivity and data and information management, are growing rapidly worldwide. From 2014 to February 2019, a huge increase in research spending was recorded associated to the study of advanced mobility technologies compared to the previous four years (2010-2013), which were in any case marked by significant investments in terms of both size and quality.

Technolgy cluster	Cumulated CAPEX (as of 2010, Bn$)	Yearly average CAPEX (Bn$) 2010-13	2014-Feb 2019
7. E-Hailing	56,2	0,2	11,4
9. Semiconductors	38,1	0,8	7,4
1. Sensors for autonomous vehicles	29,9	0,6	5,6
5. Connectivity/Infotainment	20,8	0,6	3,9
6. Plug-in elecrtic vehicle	19,0	0,6	3,0
4. Batteries	14,3	0,8	2,1
2. Software for automomous vehicles	13,5	0,3	2,3
10. Telematics and intelligent traffic	12,4	0,5	1,9
3. Back end/Cybersecurity	9,0	0,2	1,4
8. Man-machine interface and voice recognition	7,4	1,2	0,6
	220,6	**5,9**	**39,5**

Figure 2.1. Investments in new automotive technologies – cumulative figures for 2010-Feb2019 and annual averages for 2010-2013 and 2014-Feb2019. Source: The European House – Ambrosetti elaboration of McKinsey data, 2019

A total figure of $39.5 billion were invested in research and development in this period, compared to $5.9 billion in the previous period.

In parallel, new consumption models are taking hold, in which car ownership is one of the various possible solutions for private mobility. Increasingly often, emotional reasons for purchasing a car which led naturally to ownership are being replaced by more pragmatic approaches which, above all with reference to urban mobility, are starting to privilege sharing and peer-2-peer services, supported by the exchange of data and by IoT technologies. The car rental world is also destined to undergo a profound transformation due to the increase in customer service levels, made possible by the increase in available data volumes, with the possibility to offer more accurate profiling, a better customer experience and greater safety for the user.

The most significant impact of the greater circulation and sharing of data, above all in an urban context, will however lie in the dimension of public-private intermodality, with the possibility to optimize movements along city routes using all the infrastructures and with access to all the available service alternatives, in a logic of close integration. Moreover, as a consequence of the creation of other pools of economic value, we can expect to see new players entering the value constellation of mobility and innovation in business models.

In this regard, attention must be paid to the consequences of the COVID-19 health emergency and the social distancing rules which will remain in force for many months to come, in order to limit the spread of infection. In this perspective, intermodality will remain an important option for consumers but there could also be a preference for individual means of transport, such as the bicycle, motorbike and electric scooter, compared to local public transport. This choice, protecting health, goes hand in hand with a renewed focus on the environment.

At the same time, many vehicle manufacturers have taken the opportunity offered by the COVID-19 emergency and its disruptive effects on traditional business models to break with the past and accelerate the transition towards alternative propulsion systems to combustion engine vehicles. Many car manufacturers have further concentrated the available economic, technical and production resources on electric and hybrid vehicles, welcoming this historical opportunity to transform the market and satisfy the new sensitivity of consumers.

The emergency also imposes the need, as well as the possibility, for Administrations to profoundly review their choices in terms of mobility models and, more generally, territorial governance. The management of the post-emergency phases makes it more feasible to make choices that are radically different from the past, and more sustainable. Consequently, these choices, strongly influencing the choices of citizens, have the possibility to stimulate the supply chains to produce innovation in order to meet these new needs, thus anticipating future market scenarios.

While data will be the enabling factor of future mobility models, the management of privacy, the solution to the problem of data ownership and the guarantee of correct infrastructures for collecting and using data are the main challenges that must be tackled in order to free their potential value. In addition to this, the increase in cyber-security risks will demand the adoption of increasingly advanced cryptographic and systemic solutions.

More data availability could also be promoted by the cultural transformation of Italy and can be considered one of the positive effects of the health emergency which has affected and continues to affect our country in different ways. To manage a completely unexpected and unforeseeable scenario, we have seen the exponential growth in the adoption of digital technologies, which are essential for guaranteeing the performance of many remote activities, complying with the containment and prevention measures laid down for the Coronavirus infection. The accelerated adoption of digital means by all citizens brings with it greater awareness of the benefits associated to it and the sharing of personal data, potentially facilitating the growth of data consciously made available to businesses in exchange for services of proven utility.

b. Reduction of environmental impacts

As we know, emissions limits in Europe[3] are progressively becoming tighter, driving vehicle manufacturers to adopt all the skills required to manage a larger range of technologies, running from internal combustion engines to hybrids/electric, to natural gas, and on to electric fuel-cell and, in future, hydrogen. In future, the co-existence of different powertrain technologies will guarantee effective and efficient road mobility solutions, with low emissions levels.

Also in this field, the convergence between economic sectors is important: the possibility of the transport and mobility sector to contribute substantially to the reduction of environmental impacts will depend on the co-evolution of the energy system and the diversification of energy sources, with an increasing role played by renewable energy, as appears clear by the prospect of using hydrogen as a "zero" environmental impact energy vector.

Once again, it will be the combination of technological progress and innovation in business models that, in future, will guarantee the overall sustainability of mobility systems.

[3] The European Parliament has approved a new reduction in emissions limits to 95g CO_2/km from 2021. Furthermore, the European Parliament's Environment Committee has already approved additional cuts of 20% by 2025 and 45% by 2030 compared to the 95g Co_2/km threshold.

c. Sociodemographic evolution

In Europe, with a stronger trend in some countries (including Italy), the population is aging rapidly. Moreover, there is an increasing divergence in consumer models associated with the demographic variable, particularly with reference to the dematerialization of economic transactions. In Italy, the Y and Z generations – which represent 35% of the population – are characterized by new and particular consumption paradigms, with a stronger lean towards online purchases and services management.

On one hand, the set of these factors generates new mobility needs, which technology can offer complete responses over time, and on the other hand, more structured needs and possible responses, which will require new and different operational approaches.

d. Economic variables

A further element to consider when assessing the prospects of mobility models in western countries is the growing divergence in spending power. While generally the gap between rich and poor is increasing worldwide, in Italy 5% of the population owns the same wealth as 90% of the worse off[4]. Unfortunately, the global emergency caused by the pandemic will increase expenditure differentials, with dramatic consequences on household consumption. The global economic crisis of 2020 will leave us with a world made of more indebted individuals, families, businesses and countries and a lower investment and consumption capacity.

Istat[5] estimates that in Italy in 2020 household consumption will drop by 8.7% and investments will also fall by 12.5%. Both variables are expected to start to rise again in 2021 (with growth respectively of 5% and 6.3%), but this is in any case a significant setback for our economic system and will be difficult to recover.

The emergency economic policies adopted, marked by extremely expansive monetary and fiscal policies, will take time to re-absorb these imbalances, with clear inflation risks in the medium term.

It should also be noted that the prospects for both European and Italian economic development were not particularly sparkling even before the crisis, fueling the perception of an increasing loss of competitiveness of Europe compared to other areas in the world.

Also for this reason, within a European economic policy focusing on sustainability and research - in different countries (including Italy) - into new productivity gains

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[4] "Public good or private wealth", Oxfam 2019.

[5] Le prospettive per l'economia italiana nel 2020-2021, Istat, June 2020.

it appears more important than ever to structure increasingly efficient mobility models, able to guarantee broad access for citizens and provide support to generating value in the business system, with significant investments in infrastructure.

It should be remembered that Italy already suffers from the delays in adapting its critical infrastructures and that the rate of development of new infrastructures enabling innovative forms of mobility will be an important constraining factor. It will be indispensable to intervene on this element in order to accelerate the transition to truly innovative and sustainable mobility scenarios.

Working to define more efficient and eco-sustainable mobility systems is therefore a fundamental step in increasing the system competitiveness and for promoting social equity.

e. Urbanization

Worldwide, the urban population exceeded that resident in rural areas in 2010. In future, 70% of the European population will live in urban areas in the coming years and will exceed 80% by 2050[6] (it was 60% in the 1980s).

In Italy too, there is a very strong trend towards urbanization: the metropolitan cities are dynamic places that can lead innovation in many sectors.

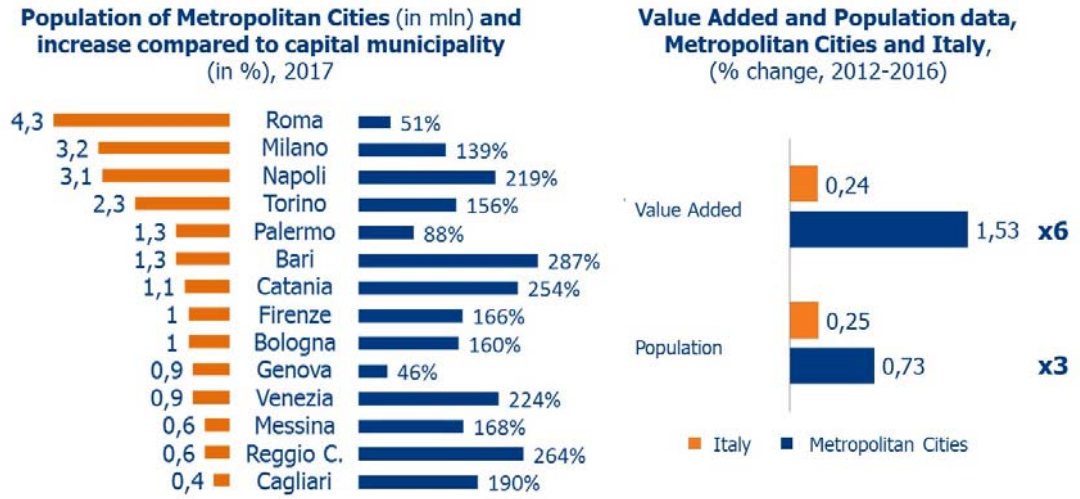

Figure 2.2. The role of Italian metropolitan cities in promoting innovation. Source: The European House – Ambrosetti elaboration of ISTAT data, 2019.

And yet, today cities suffer from major problems linked to obsolete transport systems, causing serious hardship for people (particularly the more fragile segments of the population):

[6] United Nations, 2019.

- in the most congested cities, almost 200 hours a year are lost in traffic; in 2019 Rome was the third city in the world for number of hours lost in traffic, with a value of 166[7];
- 70% of global CO_2 emissions are generated in cities[8];
- it is estimated that, by 2050, urban mobility will be responsible for the consumption of 17.3% of the planet's resources (x5 vs 1990);
- in the United States, every year 3.6 billion hours are spent looking for a parking space. This activity leads to the consumption of 6.4 billion liters of fuel and costs the economy 72.7 billion dollars[9].

In short, the mobility of the future will be molded by the action of a group of major drivers of change, which the policy makers must be able to interpret, demonstrating governance skills which also include the ability to support the organization of new public-private ecosystems, guiding transformations that can generate value for citizens and businesses.

[7] INRIX Global Traffic Scorecard, Inrix, 2020.

[8] UN 75 – I grandi temi: una demografia che cambia, United Nations, February 2020https://unric.org/it/un-75-i-grandi-temi-una-demografia-che-cambia/).

[9] The impact of parking pain in the US, UK and Germany, Inrix, 2017

3. Transversal enabling factors

The activation of a path for building a Smart Mobility system requires the **management of a wide range of enabling factors**, in order to build a structured platform of specific projects that can generate value for the region.

Eight transversal enabling factors seem particularly important:

- *Enhancement of strategic assets*. New technologies enable innovative mobility models which must be tested before being placed on the market; for this purpose, above all in this phase, mobility players require numerous experimental environments (virtual spaces and laboratories for the first phases, as well as open spaces that recreate urban situations, and on to real urban contexts), associated with the presence of research centers and simulation tools to support their research and development activities;
- *Promotion of open innovation processes*. Innovation in the mobility field is marked by long go-to-market horizons (3-5 years), but – above all in this phase – with frequent new product releases. Furthermore, innovation programs are increasingly more capital intensive. Lastly, more and more opportunities are being generated by cross-industry contamination, also due to the need of many industrial players to rapidly reposition themselves within new value chains;
- *Review of regulations to promote research and development and create new economic activity*. In all high innovation sectors, regulations tend to play a decisive role in the development of new technologies and new business models. Today, frontier research and development activities are performed within a regulatory context that has not yet been defined, is not uniform across Europe and often lags behind the needs of sector players. On the contrary, harmonious and flexible regulatory frameworks must be implemented at different levels of legislative autonomy in order to rapidly transpose the needs linked to the development of new technologies. In the mobility field, regulation significantly affects the market; in this way, highly innovative laws can stimulate innovation, demanding that supply chains propose innovations to vision needs that can potentially be exported to other global contexts;
- *Formulation of a unitary strategic direction for regions with an industrial vocation*. In Italy, numerous regions are running Smart Mobility research projects. To enhance the system of Italian regional excellences, there is a need to rationalize and effectively focus research activities and resources, promoting synergies and the structured exchange of knowledge;
- *Coordination among different governance levels (central and local)*. The rationalization and overall targeting of resources available to the Italian economic system, associated with the need to benefit from any initiatives already underway through the systematic dialog with the involved stakeholders, is a further point for attention. In this context, the Lombardy

Region can play a decisive role in promoting the development of projects in line with European requirements, in order to benefit from the related funding;

- *Facilitation of access to public/private funds*. The needs linked to the development of research projects and the significant investments in the optimization or reconversion of production systems are particularly onerous, above all for SMEs. Moreover, there are potential difficulties in access to debt capital (e.g. lack of guarantees, exposed or inefficient capital structures, etc.) and potential unpreparedness in the definition and implementation of extraordinary finance plans or in the interaction with investors and funds (e.g. lack of appropriate business plans, etc.). Also in this field, the Lombardy Region can play a role as a catalyst of resources and relations aiming to access economic resources for enhancing higher quality projects;
- *Use of communications to enhance investments in R&D*. One of the main demands of component manufacturers is that of holding a position within Smart Mobility perceived as innovative, being able to benefit from the contribution of the institutional communications developed by the Lombardy Region;
- *Effective infrastructure planning*. The creation of innovation lines in the field of advanced mobility will allow the Lombardy Region – if it is appropriately structured – to define the requirements of mobility infrastructures of the future way in advance, with the possibility to create a 2030 roadmap of Smart Mobility for the Lombardy region, promoting the introduction of some constraints in public infrastructure maintenance/construction tenders, in order to transpose project needs in line with the outcomes of the research and development processes implemented.

Where possible, these context elements were considered in the formulation of the projects described below. Generally, these ***factors must be managed with a view to overall mobility planning****, in the medium and long term.*

4. A new way of designing and producing means of transport is taking hold

One of the most commonly used acronyms, above all in the English-speaking world, to synthetically define the characteristics of the new models of mobility is CHIPS, (Connected, Heterogeneous, Intelligent, Personalized, Shared; or CASE, Connected, Autonomous, Shared, Electric) to represent the main research and development trends developed starting from the understanding of the trends presented in paragraph 2.

This is a working hypothesis that pursues that aim of high intermodality facilitating (urban and extra-urban) mobility through new forms of connectivity (between people, vehicles, infrastructures) supported by an increasing level of self-driving (the reliability of which today is close to level 3) possibly characterized by forms of sharing, at least in some circumstances. In the meantime, powertrain research is proceeding at a very fast pace, to guarantee the reduction in emissions laid down in new regulatory frameworks. For heavy goods vehicles and freight transport, the possibilities offered by new and different powertrains are being verified (LNG, and in future hydrogen) as well as by different technical and economic models (such as platooning[10]).

This revolution, made possible by a number of factors, is however **first and foremost a consequence of the structural change in the conception (design and production) of vehicles**.

A process of completely redesigning vehicle design and construction processes is underway, concerning, among others:

- the disruption caused by new forms of powertrain (in an electric car, whole subsystems are replaced, the weight distribution is changed, the importance of software increases, etc.);
- the need to reduce the weight of vehicles, to achieve emissions targets which requires - with equal safety - the research of new materials;
- the widespread use of digital co-design platforms, with a view to significantly reducing vehicle design and engineering times;
- the use of digital simulation models, leading to a very significant reduction in product development times and costs;
- the use of artificial intelligence and IOT, during data collection and control (with significant impacts on product optimization, development and innovation);

[10] Platooning is the connection of two or more trucks in a convoy, using connectivity technologies and automated driver assistance systems. In this way, the vehicles automatically remain at a fixed, close distance, offering benefits in environmental (reduction of emissions), safety (reduced reaction times of the following trucks) and efficiency terms (more efficient road use).

- the entry of new players, often with digital backgrounds, active in the early phases of the value chain (vehicle design) interfacing both with car makers and component manufacturers, providing industrial know-how and new operational models;
- the change in the procurement chains, due to the obsolescence resulting from the transformation in progress, which requires different skill sets from those in the past;
- industrialization processes increasingly shared among the different stages of the supply chain, with the demand for stronger research and development skills by component manufacturers, which in cases of excellence must become even more versatile specialists than they already are today, able to intervene in whole car subsystem co-development;
- the increasing importance of software. Software will progressively offer the chance for stronger customization in the use of cars and the generation of the value perceived by the customer;
- the emergence of forms of delayed-OEM in key niche markets, to support increasingly diversified needs and uses, consistently with the possibilities made available by new construction approaches.

In short, we are witnessing the end of an era, where mass-production has made way for mass-customization, made possible thanks to increasingly more automated and flexible industrial plants along with an increasingly more precise and detailed customer segmentation.

Today this second era also seems obsolete, due to the progressive transformation of the vehicle, in a context in which in terms of both product and industrial process the use of digital instruments is becoming increasingly important.

Changes are being made not only to products but also to production and investment models.

In parallel, alongside the technological progress in the car sector, there is a rise in the use of scooters and flexible, low-cost urban micro-mobility, including electric scooters and e-bikes, needed to offer multi-modal users the necessary range of options.

5. The European Union introduces a new sustainability paradigm, with impacts also on the mobility sector

The issue of sustainability, which has always been dear to the European institutions, has become central once again, with the inauguration of Von der Leyen's Commission in November 2019 and the announced "*Green Deal*" as a priority for the next five years. The Green Deal, which responds to the challenge of making the European Union "*carbon-neutral*" by 2050, proposes a roadmap of actions aiming to promote an efficient use of resources, by adopting a circular economy model, restoring biodiversity and reducing pollution. To achieve these goals, the European Commission has set out two lines of action:

- the adoption of a "*European Climate Law*" transforming the neutrality of emissions into a legal requirement, with all that follows in terms of the transformation of the European economic and productive system (investments in environmentally sustainable technologies; support to innovative businesses; implementation of cleaner, cheaper and more healthy public and private forms of transport; decarbonization of the energy sector; energy-efficient buildings);
- the creation of the "*Just Transition Mechanism*" used to provide economic and technical support to businesses, territories and citizens most affected by the transition to a green economy.

The *Just Transition Mechanism* will make available to citizens and individuals, businesses and states and regions, all the tools needed to facilitate the transition to a neutral economic system to prevent this process, which can be put off no longer, from generating winners and losers, as occurred in the past in comparable situations. The mechanism will have three pillars to guarantee its effectiveness to all beneficiaries:

- Just Transition Fund: a fund worth around €40 billion, generating investments worth between €89 and €107 billion;
- InvestEU Just Transition scheme: a mechanism that will reserve part of the InvestEU funds (around €1.8 billion) for projects submitted by businesses focusing on the transition process;
- loans by the European Investment Bank worth around €10 billion, able to generate investments worth between €25 and €30 billion.

The Commission's attention to the sustainable transformation of the European economy has been confirmed and indeed strengthened following the COVID-19 emergency affecting the majority of European countries. The necessary measures to fight the spread of the virus have had disruptive effects on economic and social systems, and have made a European-wide intervention even more important for relaunching the economy of the whole region and fighting the worsening social inequalities. In this light, the instruments laid down in the *Just Transition Mechanism* were transposed to the *Next Generation EU* plan, guaranteeing its central role in the European Commission agenda as well as access to additional

resources compared to those laid down in the current (2014-2020) and future (2021-2027) EU budget.

6. The Smart Mobility Ecosystem in Lombardy

a. The strategic assets of the Lombardy mobility ecosystem

The high industrial concentration, the disposable income of its inhabitants and the considerable population density are factors which, over the years, have helped to place Lombardy among the most developed regions in Italy and allowed it to become one of the "motors of Europe", along with Auvergne-Rhône-Alpes, Baden-Württemberg and Catalonia.

In the Lombardy region, these characteristics produce a **constant flow of mobility of goods and persons** – both within the Region and in relation to other Italian and European regions – and give Lombardy the original role as a privileged observatory of the social and economic transformations that will help to mold the mobility ecosystem of the future, making the territory an ideal laboratory for experimenting new mobility options.

Thanks to the characteristics of the area and its privileged economic position, Lombardy is the peninsula's main element of connection with the rest of the European regions: a wide range of airports, a well-structured road and rail network, and various logistic and collective transport systems ensure the Region's unique competitive advantage over the adjacent areas[11]. Not by chance Lombardy is included in three of the four TEN-T corridors[12] involving Italy, and plays a pivotal role between the Ligurian port system and the European areas along the three Corridors.

As in other fields, also in the infrastructure sector the Region holds some records. In the rail transport sector, the first railway in Lombardy, from Milan to Monza, inaugurated on 17 August 1840, was the second to be built in Italy[13]. Moreover, Lombardy shares the title of the construction of the first ever motorway with

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[11] Lombardy has over 700 km of motorways, over 10,000 km of provincial roads, around 1,000 km of state roads and over 58,000 km of municipal roads.

[12] The TEN-T network (Trans European Networks – Transport), born with the goal of improving territorial cohesion and competitiveness, is structured in a first level "core" network and a second level *"comprehensive" network*. The TEN-T network covering Italy consists of four corridors, the first three of which involve Lombardy: i) Rhine-Alpine Corridor connecting the ports of the North Sea, including Rotterdam and Antwerp, to the Mediterranean Basin, in Genoa; ii) Mediterranean Corridor, connecting Iberia to the Hungarian-Ukrainian border, crossing the Alps and Northern Italy and connecting the Balkan countries; iii) Scandinavian – Mediterranean Corridor, connecting Sweden and Finland to Malta, crossing Germany, Austria and Italy; iv) Baltic – Adriatic Corridor, connecting Poland with Slovenia and Italy (Trieste), crossing the Czech Republic or Slovakia and Austria. For European policies, the construction of a trans-European transport network is a priority for guaranteeing the mobility of goods and persons, and for offering high-quality infrastructure across Europe, to increase territorial cohesion and connections with other markets.

[13] In 1875, Milan station, completed 10 years earlier, was the country's most important.

Berlin: the 'Autostrada dei Laghi', inaugurated on 21 September 1924 between Milan and Varese (today classified as the A8) was the first toll road reserved for cars in Italy and worldwide.

Thanks also to its solid, cutting-edge infrastructure networks, Lombardy has over time become a fertile ground for the dissemination of a rich and varied ecosystem of economic players who have found the ideal conditions for growing and developing here.

Among the characteristic innovation accelerators of Lombardy, on the issue of mobility we should also mention the activities of the universities in the region[14]. To name but a few examples of excellence and capacity for innovation, Politecnico di Milano – to respond to the new mobility needs of the future – in 2019 launched the first Masters Degree in "Mobility engineering", blending many disciplines to train mobility engineers of the future. Another project run by the University is the INRIMOS of the Lombardy Mobility Cluster[15], which has led to the acquisition of a new-generation driving simulator by Politecnico di Milano. This installation will be the hub of a regional network of laboratories supporting the Lombardy automotive industry.

Lombardy is the second largest area in Europe for number of workers, fourth, along with Piedmont and other regions, by importance in Europe[16] and 2nd in Italy and has around six hundred companies in the component cluster, of which 67% in the mechanical supply chain, 17% in the plastics supply chain and 11% in the electronics supply chain. The 37 specialist Research Centers located in the region are strategic for the development of the sector[17].

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[14] There are 13 universities in the region (Università degli Studi di Bergamo, Università degli Studi di Brescia, Università degli Studi dell'Insubria, eCampus telematic University, Università degli Studi di Milano, Università degli Studi di Milano Bicocca, Politecnico di Milano, Università Commerciale Bocconi, Università Cattolica del Sacro Cuore, IULM University of Languages and Communication, Università Vita Salute S. Raffaele, Humanitas University, Università degli Studi di Pavia) and 1 superior graduate school (IUSS - University School for Advanced Studies Pavia).

[15] Technological clusters are structured groupings of businesses, universities, research centers and other public and private subjects, focusing on a specific thematic field, with legal personality and a governance model. The nine clusters recognized in Lombardy are: Lombardy Aerospace Cluster, Lombardy Intelligent Factory Association, Lombardy High Technology Agrofood Cluster, Lombardy Mobility Cluster Association, Lombardy Energy Cleantech Cluster, Lombardy Green Chemistry Association, Lombardy Life Sciences Cluster, Lombardy Technologies for living environments Cluster, Foundation Cluster Technologies for smart cities & communities - Lombardy.

[16] Report EOCIC (European Observatory for Clusters and Industrial Change), 2020.

[17] 12 Institutes of the CNR – National Research Council (out of a national total of 110), 21 territorial offices and detached units of other CNR institutes (CNR, 2015), 3 branches of the National Institute of Nuclear Physics (INFN) and the European Joint Research Center (JRC) located in Italy in Ispra, in the province of Varese.

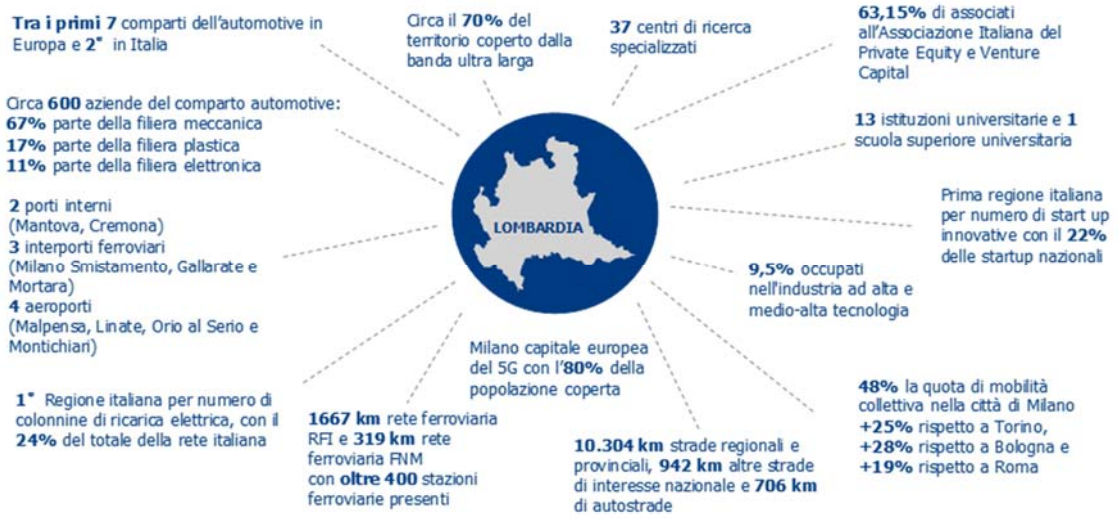


Figure 6.1. Tangible and intangible assets characterizing the mobility ecosystem in Lombardy. Source: The European House-Ambrosetti elaboration, 2019

It is precisely the rich, composite supply chain, along with a lively intellectual ferment produced by research institutes, universities, the world of start-ups and the many Venture Capital Funds active in the region that qualify Lombardy as a fertile laboratory for the proliferation of innovative business models and cutting-edge experimentation linked to the mobility of the future.

For example, in 2019 the Sharing Mobility phenomenon also recorded growth and development. In this regard it is worth underlining that in addition to cars, more and more sharing mobility services concern all the means of individual micro-mobility (bicycles, electric scooters). In geographical terms, these services are most widespread in the north of Italy, where almost 60% of all Italian sharing mobility services can be found[18], compared to the center and south of the country.

To conclude, the global context, characterized by an increasingly rapid succession of disruptive innovations, is also contributing to redefining the boundaries of mobility, in the world and in Italy. In this continuously evolving scenario, once again Lombardy has the chance to play a **leading role in defining the lines of development in the sector**, in relation to its values and distinctive approach, privileging people and their needs.

b. State of the art of the automotive supply chain in Italy and in Lombardy

The automotive supply chain is one of the **key national industrial sectors.** With a turnover of €93 billion, the automotive sector is worth over 5% of Italian GDP and employs over 250,000 staff (equal to 6% of employment in the whole

[18] In Milan alone, 3,201 cars are available from car sharing services, with over 6 million hires in 2018. Source: Sharing Mobility Observatory, 2019.

manufacturing sector). In 2019 a slowdown in Italian car production was recorded, in line with European trends, with a 25% drop in January 2019 compared to the same month of the previous year, also due to a decline in new car registrations, which fell by 7% in the first month of 2019 and by 2.4% in February (compared to the same months in 2018). This halted the recovery trend which began in 2014. In the last five years, the average annual production of cars in Italy was over one million vehicles, 32% more than the production in the previous five years (2009-2013) when, in mid-crisis, it had stopped at 760,000 vehicles[19].

In the automotive sector, Italy's industrial fabric is supported by a high number of component manufacturers, alongside the final assemblers. This latter segment is driven mainly by exports counting for 65% of the total turnover.

Dividing the component supply chain into macro-classes, the major sector is that of mechanical parts, counting for over €13.9 billion in turnover (2017), followed by the engine sector with €4.7 billion and the tire and rubber articles sector, worth €1.3 billion. Overall, in Italy the automotive component sector is represented by around 1,900 companies (2017), although the current trends, particularly electrification and self-driving, will very probably change the scope of the sector, leading to its concentration[20].

The Italian regions with the largest automotive supply chains are Piedmont, Lombardy and Emilia-Romagna. In particular, in these regions the car industry is characterized by regional production systems with strong local roots: the direct interaction with the final assemblers and the long and complex production chain, consisting of several supply levels, have led to the formation of production networks and clusters, also with the contribution of major global suppliers[21].

Table 6.1 shows the number of companies in the component sector in the three regions. While on one hand, it shows the wealth of the Lombardy production fabric, on the other we can see the worrying signs of an 8.4% reduction in the number of companies between 2008 and 2018.

[19]Source: "Bilancio a 4Ruote – Cambio di marcia – La filiera dell'automotive di fronte alle sfide del mercato globale", Cassa depositi e prestiti and SACE SIMEST, 2019.

[20] Lombardy Mobility Cluster Association, 2019.

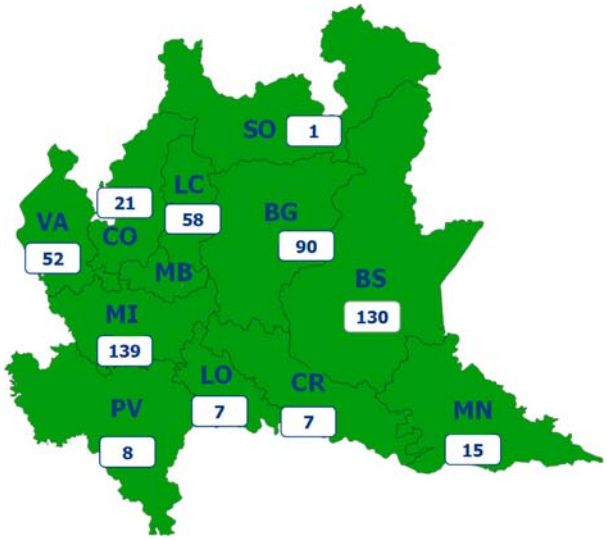
[21] In Lombardy there are no longer any local final assemblers, only some major international suppliers, including Bosch and Pirelli, characterizing the industrial panorama.

REGIONE	n. Imprese 2018	n. Imprese 2008	Variazione
Lombardia	**592**	**646**	**-8,4 %**
Piemonte	791	882	-10,3 %
Emilia-Romagna	229	241	-5,0 %
Totale	1.612	1.769	-8,9 %

Table 6.1. Number of companies in the component sector working in Lombardy, Piedmont and Emilia-Romagna (absolute value and percentage variation), 2008 and 2018. Source: Lombardy Mobility Cluster Observatory 2018

Alongside the component manufacturers belonging to the supply chains traditionally associated to the automotive world, it is worth underlining how the transition to electric mobility can represent an excellent opportunity for Lombardy. It is in fact estimated that the region already produces a turnover of almost €2 billion, equal to 33% of the turnover generated nationally, in this field. Moreover, Lombardy is home to almost 40% of businesses working nationally. In the whole country, starting from the over 160 businesses already present in the sector, it is expected that the transition to e-Mobility can involve over 10,000 companies working in sectors that can be related through a process of reconversion/focus of the current business model[22].

With specific reference to the component supply chain, we can see a very heterogeneous distribution of companies among the various provinces of Lombardy (Fig. 3.2), with the provinces of Brescia, Milan and Bergamo with the highest number of businesses.



[22] "La filiera della mobilità elettrica Made in Italy: imprese, territori e tecnologie della e-Mobility", Motus-E and The European House – Ambrosetti, 2019.

Figure 6.2. Number of companies in the component sector working in Lombardy, distribution by province. Source: Lombardy Mobility Cluster Association, 2019.

The companies working in the region can be further divided according to the production chain they work in (Fig. 3.3) and the size of the company (Fig. 3.4). As concerns the production chain, this can be divided into mechanical – certainly the largest sector – plastics, electronics, engineering firms working in product and process research and development.

Numerically, there are certainly far more small and medium companies than medium-large and large ones. The smaller companies are also those which have most suffered from the economic difficulties of recent years, recording a reduction in the number of operators. This distribution, both in terms of the production chains and the company size, is very similar to the other regional clusters of Piedmont and Emilia-Romagna.

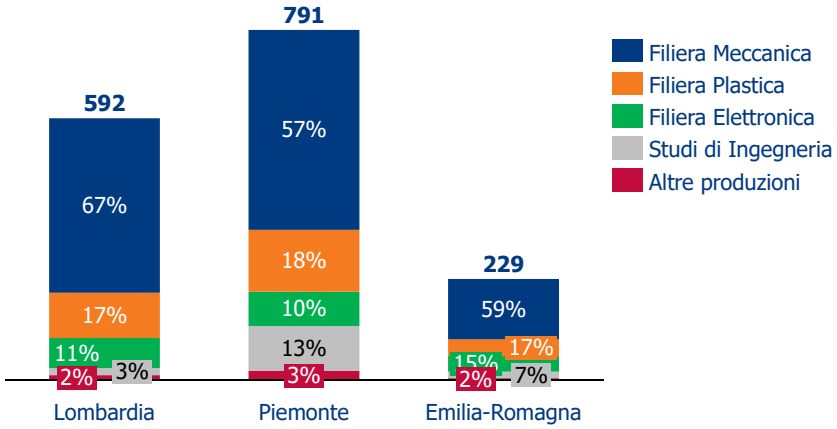


Figure 6.3. Number of companies in the component sector by production chain in the main regional clusters (percentage values), 2017. Source: Lombardy Mobility Cluster Association, 2019.

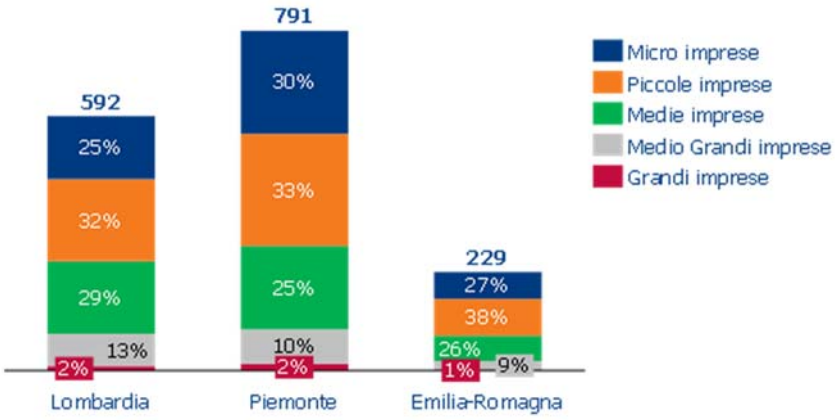


Figure 6.4. Number of companies in the component sector by size of company[23] in the main regional clusters (percentage values), 2017. Source: Lombardy Mobility Cluster Association, 2019.

Observing the territorial location of the companies in the sector, we can see the presence of some provinces with greater specialization with a high concentration and higher values in terms of turnover. This is certainly the case for the provinces of Brescia and Bergamo, characterized by larger numbers of mechanical companies than the regional average. In fact, 80% of automotive companies in Brescia belong to the mechanical supply chain, while in Bergamo these values fall to 63% (Figure 3.5). In the latter province, on the other hand, there is a significant presence of companies in the plastic supply chain (31% in terms of numbers and 30% in turnover).

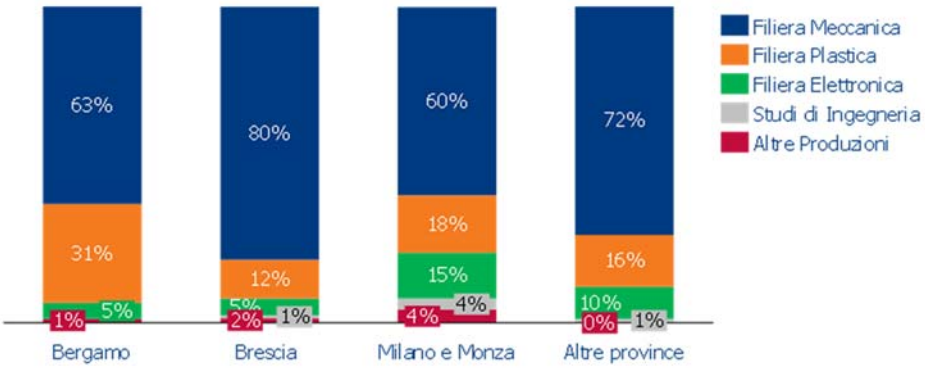


Figure 6.5. Number of companies in the component sector by production chain in the main provincial clusters in Lombardy (percentage values), 2017. Source: Lombardy Mobility Cluster Association, 2019.

[23]EU law establishes three groupings of companies: i) micro companies (less than €2 million turnover); ii) small companies (from €2 to €10 million turnover) and iii) medium-sized companies (from €10 to €50 million turnover), - to which medium-large companies (from €50 to €300 million turnover) and large companies (turnover above €300 million) were added. The companies in the samples analyzed in this research were classified according to the average values recorded in the analyzed period.

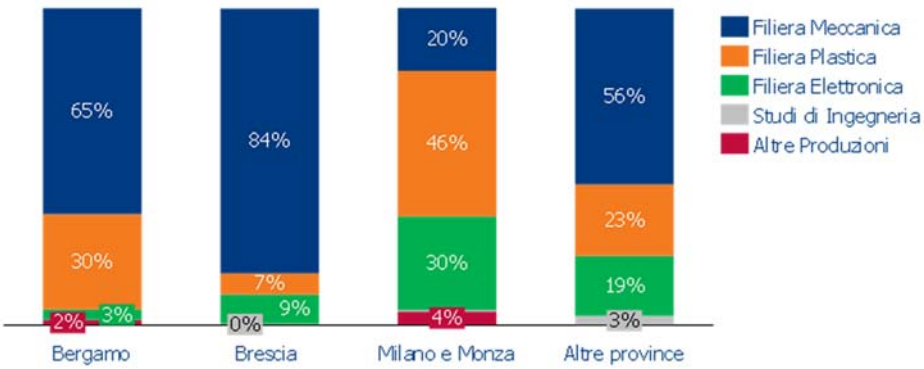


Figure 6.6. Turnover in the component sector by production chain in the main provincial clusters in Lombardy (percentage values), 2017. Source: Lombardy Mobility Cluster Association, 2019.

In the provinces of Milan and Monza, compared to the regional average, many companies operate in the plastics (46% of turnover) and electronics supply chain (15% in terms of numbers and 30% in turnover).

As regards the evolution of economic performance of the companies in the three largest territorial clusters, identified in the provinces of Bergamo, Brescia and Milan – Monza and Brianza, and the residual grouping of the other provinces, the Lombardy automotive clusters show dissimilar performances (in the period between 2008 and 2016), as shown in the graph below.

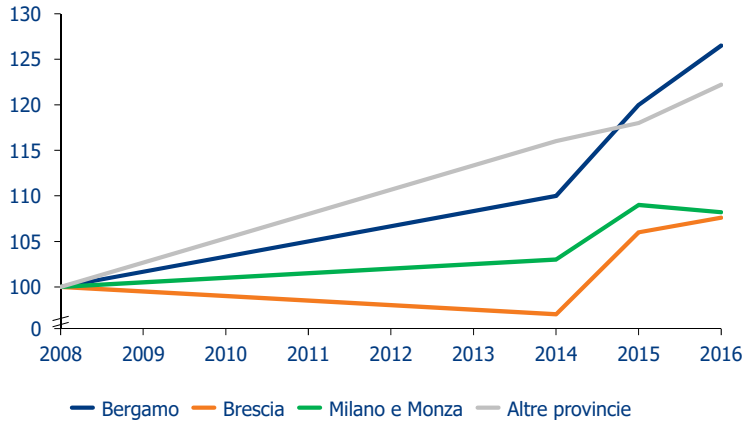


Figure 6.7. Turnover trends of the component sector in the main Lombardy provinces (percentage variation), 2008-2016. Source: Lombardy Mobility Cluster Association, 2019.

From the analysis of the performance differentials of total turnover and export turnover, we can see that foreign demand has grown more than national demand by around 20 percent in all provincial clusters, further confirming the importance of export markets for the development of the main supply chains in Lombardy.

The data given are not yet affected by the trauma of the COVID-19 pandemic, which is destined to leave profound scars on the Lombardy economic system. At the same time, they provide an image of the quality and strength of the sector,

which holds a central position in the production supply chains in the design and production of medium-high segment vehicles in Europe.

This element of competitiveness must be preserved also with a view to the impending major changes in the competitive scenario, which will lead to considerable developments for all players in the supply chain, called on to respond to new challenges and make the most of the significant opportunities for transformation.

It will therefore be fundamental for sector operators to initiate innovation processes that are even more effective than in the past, to respond to new market demands.

c. Evolution of public and private mobility in Lombardy

The strong attractiveness of the Lombardy region, in terms of both work opportunities and tourist attractions, has supported the development of a structured and evolving mobility network. The considerable dynamism of the region, accelerated also by the presence in the area of a series of major international events – including the Expo in 2015 and the Milan-Cortina Winter Olympics to be held in 2026 – overlaps with the ferment experienced by the whole mobility sector, linked to the birth of innovative business models and cutting-edge experimentations.

Tourist flows and mobility in Lombardy

The great flow of tourists crossing Lombardy every year helps to feed both the mobility flow in the area and the demand for functioning, effective transport services. In 2018, overnight stays in Lombardy grew to 41.2 million (almost 10% of all overnight stays recorded nationally), up 3.5% on 2017 and up 26.4% on 2013, when the number of arrivals in Lombardy grew by over 3.5 million.

In 2017, foreign travelers to Lombardy spent €6.5 billion (1.4% less than in 2016), with a higher average daily expenditure than that recorded nationally (€125.10 vs €106,20). The city of Milan alone attracts over 53% of the amount received in the Region (almost €3.5 billion) followed by Como, Brescia and Varese. In terms of the allocation of expenditure by foreign travelers, transport counts for 13.1% of the total, in addition to accommodation expenses (46.2%), shopping (34.7%), food and drink (24.7%) and, finally, entertainment (6.3%).

Efficient mobility infrastructures and services represent significant attraction factors for national and international tourist flows. This is why the far-reaching dissemination of infrastructures guaranteeing more accessible tourism, reducing connection times between cities and tourist sites with a view to intermodality and integration between services, should be considered a priority for the development of Italy and the Lombardy region.

In line with these strategic priorities is the national Special Plan for Tourist Mobility 2017-2022. The document defines a model based on the Access Gateways for tourism in Italy: ports, airports and railway stations. Major importance is also given to digital infrastructures, considered to be a decisive structural element for guaranteeing quality tourism mobility.

Source: The European House – Ambrosetti elaboration of Bank of Italy, PoliS-Lombardia and Istat data, 2019

Every day in Lombardy almost **20 million journeys** are recorded, an increase compared to the 16.4 mln recorded in 2014, as a consequence of the growing regional resident population, which rose from 9.7 million in 2012 to 10.1 million in 2019 (+4%).

If we look for example at railway journeys, the Lombardy network counts for over 1,920 km of lines and 428 stations, managed by 2 companies (Rete Ferroviaria Italiana RFI and Ferrovienord). Every day, around 800,000 people travel on 2,560 trains and buses on the regional railway services managed by Trenord, on over 2,000 km of rail networks and over 400 stations. In total, the rail service provides over 2,000 services a day, and 77% of the municipalities in Lombardy in which 92% of the residents live has a railway station within a 5 km radius.

As regards freight traffic[24], the majority travels by road. Road transport covers almost 93% of the total freight transport in Lombardy. Over 50% of this share relates to domestic transport, while the share of international traffic is less than 3%. Excluding the traffic component within Lombardy (around 49% of the total, with characteristics that are unsuited to the railway system), rail transport counts for around 14% of the total. The role of the railways is more significant when focusing on the modal allocation of the international component of freight traffic. Here the railway counts for 67.4% of all international traffic. The majority of international rail traffic consists of intermodal transports (around 62%).

The Lombardy airport system[25] counts for over 25% of national passenger traffic and around 70% of freight traffic. Three of the four airports in Lombardy are part of the European "TEN-T Core" network[26] and are among the top 5 in the national passenger traffic table: Malpensa (around 22 million people/year); Linate (around 9 million people/year); Orio al Serio (around 12 million people/year).

Finally, every year the regional navigation service carries 8.5 million passengers and around 700,000 vehicles, as well as over one million tons of goods. Public navigation services on the five largest lakes are assured by a fleet of 122 ships working on 142 landing stops (of which 84 in Lombardy).

The available technologies and those being developed, particularly the big data and IoT revolutions, bring the promise of making it possible, in the near future,

[24] The data relating to freight traffic are updated with the most recent figures available (2014). Source: Regional Mobility and Transport Program.

[25] The Lombardy airport system includes the following airports: Milan Malpensa, Milan Linate, Bergamo Orio al Serio and Brescia Montichiari.

[26] Montichiari airport is on the other hand part of the "comprehensive" network.

to ensure the dynamic optimization of the various forms of transport[27], through the implementation of an organic mobility system guaranteeing the intermodal management of traffic flows. This is why, in this scenario, the key factor of innovation within the broad and complex set of mobility services characterizing the regional area is represented by the possibility to collect and share data and make data management more effective.

The real challenge for operators in the Lombardy mobility sector and for the institutions governing the region therefore lies in the possibility to ensure the broader circulation and sharing of data, above all at urban level, with a view to public-private intermodality, **aiming to optimize movements along city routes** using all the infrastructures and with access to all the available service alternatives, based on synergy and high integration.

Already today, the E015/L15 project allows citizens to find out about all the different possibilities offered by public transport. The next step of this process could be the passage to a dynamic system, where data are shared and exchanged in real time between the various systems to ensure the proactive management of traffic situations and congestion levels.

Through sensors monitoring public and private traffic, weather meters, on-site data processing and implementation devices, the information from secondary data and social networks, it will be possible to improve the overall efficiency of the mobility system, for example by suggesting alternative routes for private traffic which bring advantages in terms of both times and costs, with fees modified in real time, adapting traffic light timing to the actual situation, deviating public transport vehicles to alternative routes in critical situations, implementing integrated payment management, improving freight traffic management and the loading and unloading operations in urban areas, with constant monitoring to guarantee personal safety.

d. Mobility and the environment: a challenge for the Lombardy ecosystem

As explained, the configuration of a mobility model compatible with the protection of the environment, safeguarding air quality, will be increasingly crucial for the future development of the sector. An unhealthy environment can significantly affect personal quality of life, without considering that, every year,

[27] The costs deriving from traffic and traffic jams account for around 1% of the regional GDP. Source: Lombardy Region, 2017.

polluted air causes the premature death of 80,000 people in Italy alone[28]. The Po Valley, and, generally, the whole regional territory, is one of the Italian areas which – for reasons linked to its morphological characteristics – suffers most from the phenomenon of air pollution.

The surveys performed by ARPA, the Italian Regional Agency for the Protection of the Environment, highlight how the transport sector is the main contributor to pollution in the Region, counting for 23.1% of total annual emissions of traditional pollutants – followed by heating, counting for 18.6%, and energy production and fuel transformation (15.4%).

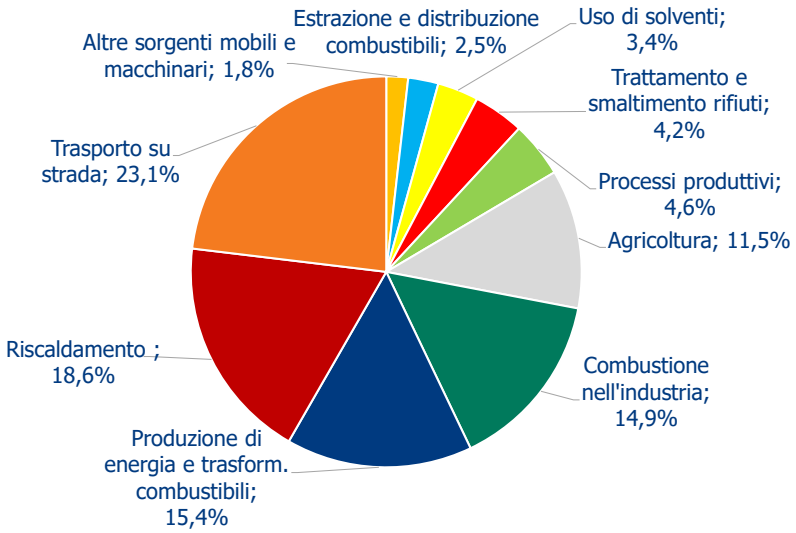


Figure 6.8. Annual emissions of traditional pollutants by sector (percentage values), 2016. Source: The European House-Ambrosetti elaboration of ARPA Lombardy data, 2019

To protect the health of the population and at the same time guarantee an effective and sustainable mobility model, the issue of air quality must be tackled in Lombardy, alongside the fight against climate change, by adopting an integrated approach that can trigger greater responsibility among all players involved.

With this in mind, the Lombardy Region has implemented significant coordination actions with the Regions in the Po Basin and nationally, leading to the Po basin agreement for air quality improvement[29], which represents a decisive moment for implementing integrated measures to fight air pollution.

[28] According to World Health Organization estimates, globally every year around 8 million people die of causes linked to air pollution.

[29] The Agreement, which involves the implementation of joint measures to improve air quality, was signed in Bologna, during the G7 Environment on 9 June 2017, by the Minister of the Environment in office, and by the Presidents of the Lombardy, Piedmont, Veneto and Emilia-Romagna regions.

Along with heating and spreading in agriculture, fighting particulate and pollutant emissions generated by vehicle traffic are the three main areas of intervention of the Agreement. In particular, through these measures it has been possible to set joint interventions to limit the use of particularly polluting diesel vehicles, install high-performing heaters and flues to replace obsolete models with high environmental impact and reduce ammonia emissions in agriculture.

Precisely due to its weight on total air emissions, the regional policies to defend air quality and fight air pollution extensively involve the transport sector, particularly road transport.

The MoVe-In Project

MoVe-In (MOnitoraggio dei VEicoli Inquinanti - Monitoring of Polluting Vehicles) is an experimental project run by the Lombardy Region, promoting innovative methods for controlling vehicle emissions by monitoring routes, considering the effective vehicle use and adopted driving style. A black box installed in the vehicle records the information needed for this purpose through a satellite connection to a specific technological infrastructure enabled to manage the circulation limits of the most polluting vehicles.

In brief, the MoVe-In Project makes it possible to use a measurable and controllable "kilometric derogation", which extends the limits to all days of the week and all hours of the day, thus able to reduce emissions. This reduction in emissions is transformed in kilometers that can be redistributed throughout the day and the week, in relation to those currently possible for limited vehicles (which can use the roads on weekdays from 7.30 pm to 7.30 am and all day on Saturday, Sunday and public holidays). Therefore, this kilometric derogation makes it possible to drive a set number of kilometers whenever the driver wishes, on the basis of the vehicle category and emissions class, within the year of subscription or until the allocated kilometers have been used. If the allocated kilometers are used before the end of the year the vehicle may no longer be used in the areas subject to limitations, until the end of the year.

Source: The European House – Ambrosetti elaboration of Lombardy Region data, 2019

For this reason, road transport and mobility are also one of the three macro-sectors of activity in the **air quality intervention plan (Piano regionale degli interventi per la qualità dell'aria, PRIA)**, a substantial tool for the governing action of the Lombardy Region[30]. The plan includes 91 structural measures acting on all the many sources of emissions in the three macro sectors producing air pollutants: 40 in the transport sector, 37 in the energy and heating sector, 14 for agricultural activities.

Some permanent structural measures are also in force, aiming to reduce pollutant emissions into the atmosphere and improve air quality, limiting the circulation of

[30] In particular, the aims of the regional air quality planning and programming include: (i) returning to below the limit values in areas and urban agglomerations in which the level of one or more pollutants exceed these references; (ii) prevent the areas and urban agglomerations in which the pollutant levels are stably below the limit values from worsening.

the most polluting vehicles[31]. To encourage businesses and the population to replace more polluting vehicles with others with lower environmental impact, additional €26.5 million were allocated for the period 2019-2020, of which €8.5 million for businesses and €18 million for the population[32].

[31] With the recent resolution of the Regional Council, No. 2055 of 31/07/2019, as of 1 October 2019 circulation limits are in place all year round for Euro 3 diesel vehicles. The limits for Euro 0 petrol or diesel, Euro 1 diesel and Euro 2 diesel cars, are active all year round in Area 1 and in Area 2, covering the area of the 209 municipalities in Category 1 and the 361 municipalities in Category 2 (for a total of 570 municipalities).

[32] For more details, visit the website: www.aria.regione.lombardia.it.

7. The consequences of the COVID-19 pandemic crisis

As explained, the first half of 2020 was drastically affected by the COVID-19 pandemic which, initially a health emergency, soon turned into a fully-fledged crisis with both economic and social consequences. The gravity of the health situation and the high infection rate of the virus have imposed a series of drastic measures, including the suspension of all work activities, with the exception of essential activities to meet primary needs, and home confinement. Like all the other countries affected by the pandemic, Italy locked down for several weeks, and, while essential to protect the health of the population, this choice has had - and continues to have - consequences on the economy and on society that cannot yet be quantified.

In economic terms, **this is one of the worst crises in recent history**. As can be seen in the figure below, the world economy is characterized by an unprecedented level of uncertainty, linked to the specific nature of the current crisis which involves both supply and demand, rendering the tools traditionally at the disposal of the Institutions ineffective.

Figure 7.1. World Uncertainty Index (index) Q1-2000 – Q1-2020. Source: The European House – Ambrosetti elaboration based on European Commission, Economic Forecast data, May 2020

The impacts on the global economy are huge: the International Monetary Fund estimates the worst performance in the last 40 years in 2020, with a negative growth rate of 4.9% compared to the pre-COVID estimates of +3.4%.

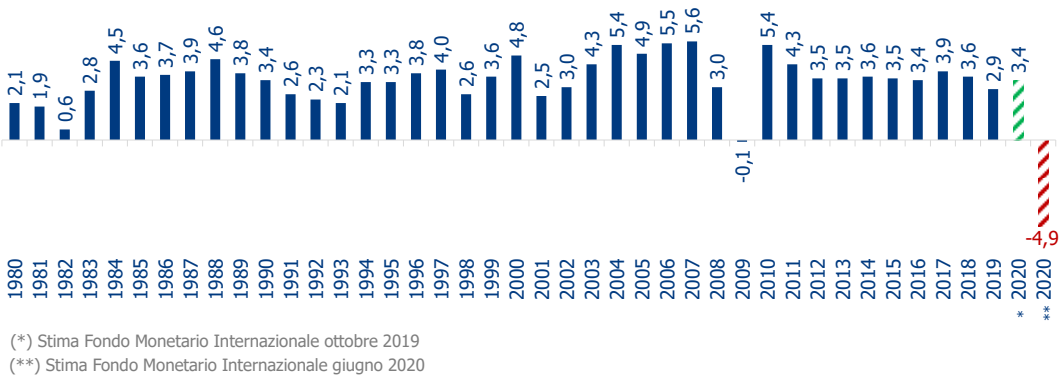


Figure 7.2. Real growth rate of global GDP (% variation), 1980 – 2020e. Source: The European House – Ambrosetti elaboration of IMF data, 2020

The expected downturn in the global economy conceals some highly differentiated performances, with advanced economies appearing to be destined to pay a particularly high price for the current crisis. This data is not surprising, considering the characteristically high level of interconnection, as well as the stricter measures adopted to fight the pandemic.

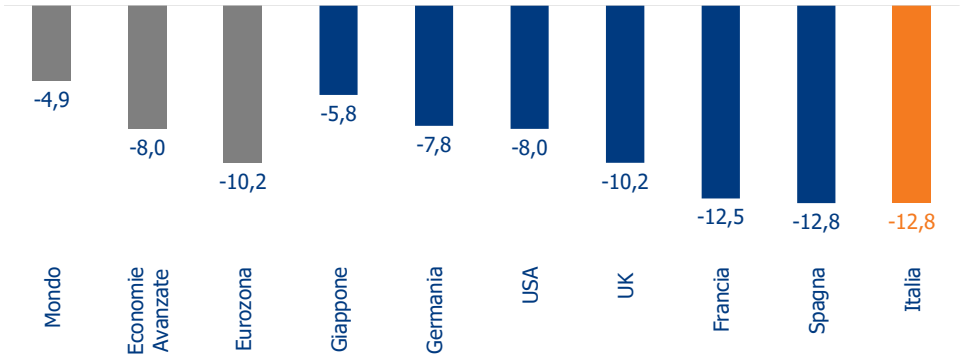


Figure 7.3. Forecast downturn in GDP 2020 by country (percentage values). Source: The European House – Ambrosetti elaboration of IMF data, June 2020.

Among the advanced economies, Italy, which entered this crisis after years of troubled growth, is heading for a particularly serious recession. The European Commission's pre-COVID estimates for Italy were a GDP growth rate of 0.3% in 2020, bottom of the EU27 league table.

The estimation model produced by The European House – Ambrosetti offers a detailed picture of Italy, investigating the impact of the crisis on the main economic sectors, estimating a total impact of -9.1% and returning our GDP to 1998 values[33].

[33] The estimated GDP for 2020 is equal to the real GDP values of 1998, calculated at 2019 prices

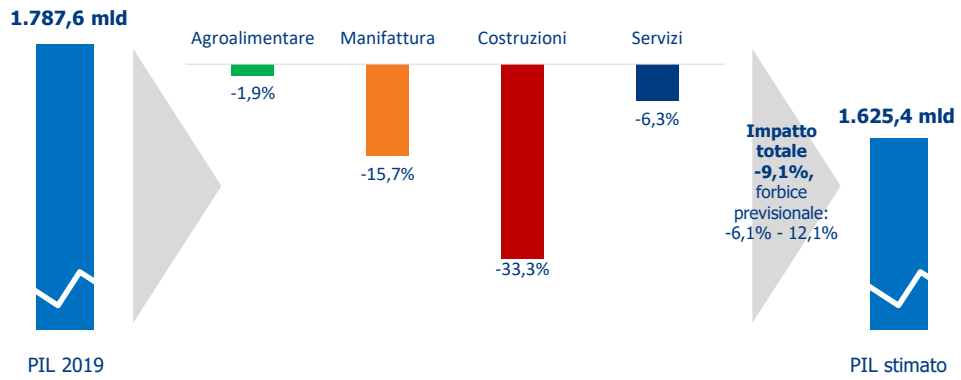


Figure 7.4. Estimated impact on the main economic sectors and reduction in GDP for Italy in 2020. Source: The European House – Ambrosetti data elaboration, 2020.

As shown in the figure, the manufacturing sector will be one of the most penalized by the crisis, dropping 15.7% (second only to the construction sector, with a decrease of 33.3%). In the manufacturing sector, a significant reduction is expected for companies in the automotive supply chain, estimating a loss in turnover of between €30 and €67 billion between 2019 and 2020 and a further decrease of between €1.8 and €18.8 billion between 2020 and 2021[34]. The same source offers a regional breakdown, with a more positive picture for Lombardy than the national average: the Lombardy automotive supply chain - in the base scenario – will record a 19.8% drop in turnover between 2019 and 2020 and a subsequent 26% recovery between 2020 and 2021, and in the pessimistic scenario a 45.3% drop between 2019 and 2020 and a subsequent 63% growth between 2020 and 2021.

The gravity of the crisis and the extraordinary consequences of its impact on Italy's economy are leading to an **acceleration in sourcing investments for guiding innovation processes that can give new impetus to the industrial system**, through a significant repositioning of those supply chains with greatest added value and export potential.

[34] CERVED Industry Forecast "L'impatto del COVID-19 sulla filiera dell'automotive", March 2020

8. The new reference scenario

In view of the description given in the first section of this document, considering the changes occurring due to the global pandemic, the **fundamental characteristics of the new mobility scenario** are as follows:

a. in the automotive sector, the strategic European plan for transition to forms of electric mobility, also as a consequence of the extraordinary investments made to adapt the production system and structure the supply chain needed for electric batteries, is confirmed. In fact, in the last year, research and development initiatives in the hydrogen field have multiplied, understood as the next inevitable step in the path to electrification thanks to the growing production of renewable electricity. Despite this, research is also being conducted to place fuels on the market that have lower environmental impact, to better manage the inevitable transition from internal combustion engines to electric motors;

b. again in the automotive sector, as explained in paragraph 4, we are seeing a transformation of the value chain, with new players entering the field and the products and operations being overturned. The facts show that an epoch-making transformation is underway, driven by major global players waiting to harvest the fruits of the efforts and investments made thanks to increasingly strict regulatory processes penalizing internal combustion vehicles, which are therefore proceeding by forced march to complete the journey undertaken. For these and for the whole system, there is a risk of being stuck in the mud, with expensive multiple technological platforms to manage;

c. generally, there will be an acceleration of "low-hanging-fruit" investments (those offering significant additional benefits for the customer through to use of minor marginal resources) and, on the contrary, a slowdown in the next cycle of investments in research and development. This should enhance the aspects most linked to data management, where there is plenty of room for bringing level-3 autonomous driving to the market on a large scale, as well as other benefits which are popular among customers, above all linked to safety and optimal vehicle management;

d. as already discussed, also due to the post-COVID-19 crisis economic conditions and the relatively weak consumer spending, the CHIPS approach will play a decisive role. It is improbable that the vehicle possession model we have been used to for over a century will bear the full weight of the transformation in progress; more plausibly, there will be a joint effort of families (the purchasers of the vehicle) and businesses, above all active in the rental sector, supported by public governance;

e. certainly, the logics used by Public Authorities to design and manage mobility models will change. The pandemic has reduced much of the potential for use of the current models, offering new challenges which can only be solved with

highly innovative visions. Consequently, consumer needs will change, offering new areas for growth for today's supply chain players and, potentially, for new players much closer to the consumer;

f. having redesigned and optimized the system of private players (OEMs, component manufacturers, players in the telecommunications and services sector) the infra- and info-structures will become fundamental issues to be solved, as these are decisive enabling factors. Electric charging infrastructures, hydrogen management infrastructures (which will lead to the ultimate leap towards "real" environmental sustainability), but also info-structures for V2V, I2V and V2I communications and regulations for managing the safety aspects and the huge amount of data produced.

9. The role of the Lombardy Region

The choices and decisions for mobility innovation are, at one extreme, dominated by countries, also in supranational terms (like the European Union) and, on the other, by businesses which – in compliance with regulatory obligations and guidelines - develop their own industrial and commercial strategies considering their own characteristics and objectives, above all with reference to decisions relating to the innovation processes which are decisive for each company.

The role of local public authorities is however destined to increase, both in the definition of guidelines for the management of public-private mobility ecosystems, to appropriately govern the growing diversification and capillary nature of forms of transport, and in supporting the investment and innovation choices of businesses operating in the region.

The Lombardy Region can play a role in different aspects:

- ensuring the coherence of public policies and interventions in relation to an overall plan of the mobility sector considering national and international constraints and obligations. This also requires the continuous alignment of the technical bodies in charge of the correct operation of the mobility system (Directorates-General for Infrastructure, Transport and Sustainable Mobility, Environment, Climate and Research, Innovation, University, Export and Internationalization, under the direction of the Presidency);
- acting as a connection factor between different levels of regional government (the state, on one hand and the municipalities on the other);
- guaranteeing constant and continuous dialog over time with the major manufacturers in the region, establishing a permanent Smart Mobility & Artificial Intelligence Working Group (meeting annually or every six months), to redefine the needs and priorities of the sector in real time, also in response to external shocks;
- promoting highly innovative development visions, the demands of which can act as a stimulus for supply chains to produce innovation that can potentially be exported to other global contexts, through the research into stimuli (for example leveraging its own Innovation Forum) and their transmission in the region.

10. Project Goals and Methodology

The Lombardy Region has set the **goal of creating a research and innovation hub for mobility of the future** in its territory, promoting the birth and development of experimental projects able to make Lombardy more attractive both nationally and internationally. To achieve this complex and ambitious goal, the Lombardy Region has used a transversal and cooperative approach with the involvement of the three Directorates-General in charge of this issue: the Directorate-General for Research, Innovation, University, Export and Internationalization; the Directorate-General for Environment and Climate; the Directorate-General for Infrastructure, Transport and Sustainable Mobility. The aim of the regional administration is not that of duplicating the facilities and roles already present in the territory. On the contrary, it is a matter of involving all mobility players working in Lombardy (industries and services, Universities, Research Centers and Local authorities), creating synergies and fostering the birth of joint partnerships and projects.

The time frame of the initiative takes into consideration the activities linked to the next European programming cycle (relating to the period 2021-2027). The choice of precisely identifying the projects the Region will focus on, right from the outset, will be able to revolutionize the methods of managing European funds (European Social Fund – ESF and European Regional Development Fund – ERDF) moving from a *historical expenditure* approach to one based *on projects*. The fact of acting early in this phase, even before the start of the programming cycle, will promote the definition of guidelines for accessing the funds which are compatible with the contents of the projects themselves. This intent has been concretely implemented by listening to and involving the stakeholders, engaged thanks to their willingness to identify the needs of the region and the extended automotive supply chain and the potential responses, based on what is already available.

In operational terms, a “Smart Mobility & Artificial Intelligence” Working Group has been established, which has already held three plenary sessions and has also contributed with ideas during individual meetings and interviews to discuss the ideas and issues emerging during the working group meetings.

Figure 10.1. The sequence of meetings of the "Smart Mobility & Artificial Intelligence" Working Group. Source: The European House – Ambrosetti data elaboration, 2019

The sequence of meetings shown in figure 10.1 was functional to the identification and detailed definition of four specific projects which, enhancing the characteristics of the Lombardy region, can contribute to creating a distinctive research and innovation hub that is recognized in Italy, Europe and worldwide.

The first meeting allowed the Region to gather expressions of interest from numerous players.

The second led to the definition of the scope of action of interest to the Lombardy Region, on the basis of its characteristics and the perceived competitive advantage over other areas (the significant presence of automotive component manufacturers and its medium-high technology manufacturing vocation).

The third meeting allowed the precise, joint identification of the projects to implement in Lombardy in the coming years, enhancing the assets and distinctive competences of the region.

As explained, the plenary meetings of the Working Group were accompanied by a series of individual conversations with the participants, aiming to investigate issues of particular interest for each interlocutor.

The companies and institutions participating in the Working Group meetings, contributing with their ideas and expertise, were: Altran, Autodromo di Monza, Brembo, the Lombardy Mobility Cluster (CLM), Concessioni Autostradali Lombarde (CAL), CNH Industrial, Daimler, Dallara, FCA – Fiat Chrysler Automobiles, Ford, Joint Research Center – Ispra, Magneti Marelli, OMR Automotive, Pirelli, Politecnico di Milano, Roborace, Saipem, Streparava, Tesla, Tom Tom, Toyota, Vodafone.

The works of the Working Group, the individual conversations with businesses and institutions and the studies conducted by the The European House –

Ambrosetti Working Group[35], led to the identification of four projects which constitute the priorities of the Lombardy Region in the mobility field, relating both to the allocation of the funds available and the creation of a regulatory and normative framework to support their implementation. The project areas, described in detail in Chapter 11 of this document, are: Connectivity/Data with reference to the digital evolution of mobility services; Experimental hub for driver assistance and self-driving; Support to supply chains in the transition towards new powertrains; Reactivity of the component supply chains.

If the four projects are officially validated, in future, as an additional step towards their concrete implementation, through a more detailed operational description of the concepts in question, it may be decided to establish four working groups, one for each project, with the participation of the businesses and institutional players that can contribute with their expertise and experience in the specific field.

[35] The The European House-Ambrosetti Working Group that contributed to the drafting of this document consists of Alessandro De Biasio, Nevia Andrisani, Guglielmo Auricchio, Riccardo Maria Barchiesi, Monica Mantovani and Alessandro Viviani.

11. Description of the four Projects

a. Connectivity / Data

1. Nature of the intervention

This aims to **create the conditions for a more structured knowledge of mobility dynamics and their reasons**, in order to:

- exponentially increase the capacity, over time, of the Lombardy Region (and other public authorities) in the management of public mobility services and the creation and provision of innovative services, starting from the creation of forms of public-private intermodality and the promotion and management of initiatives in a clean & smart mobility logic;
- create an environment favorable to experimentation and innovation in which to promote private initiative and public-private cooperation for the development of new mobility services (including digital services), incentivizing the convergence between the physical (products and services) and digital world.

2. Reference scenario

As observed in Chapter 2 of this document, one of the mega-trends which will have an impact on all spheres of social and economic life in the coming years is the spread of connectivity and Big Data. The digital evolution of mobility services configures the transition towards "smart mobility", a concept that sums up a whole series of elements: technology, mobility infrastructures (car parks, charging networks, signposting, vehicles), mobility solutions (including new mobility models) and people. Smart mobility aims to offer a continuous mobility experience, from the first to the last mile, that is integrated, safe, *on demand* and cost-effective.

Urban mobility can be innovated through new mobile technologies and applications that integrate public transport, better infrastructure and all forms of vehicle sharing (car pooling, car sharing, etc.). Smart Mobility also embodies the concept of environmentally sustainable mobility through the spread of vehicles with alternative powertrains, cycle paths, non-polluting means of transport such as bicycles and electric scooters.

The ultimate goal of the introduction of smart mobility in our cities is to **reduce traffic and pollution, create continuous, intelligent flows** and strengthen economies of scale, to promote mobility that is accessible to all.

In this context, work can be done in two fields, even at the same time: on one hand, reducing the impact of individual vehicles through the use of alternative powertrains and non-polluting means of transport, and on the other reducing

the number of vehicles in circulation, promoting the use of local public transport (LPT). And LPT, through recourse to technology and digital means, can play a fundamental role in the development of Smart Mobility. By nature, multi-modal transport implies a certain number of connections to cover the planned route, and the easier, faster and cheaper these connections, above all in terms of time, the more attractive they become. The range of public transport services moving in this direction, guaranteeing the adaptability of the frequency and capacity of the vehicles to the traffic conditions and demands of citizens in real time, is certainly an essential step in the construction of a smart mobility ecosystem.

The concrete implementation of Smart Mobility **cannot be separated from the intensive and extensive use of the data generated**, at the time of use of the mobility services, by vehicles, people and infrastructure. In this scenario, every object becomes a source of data which, once aggregated and related through the use of artificial intelligence systems, can be provided as a service, both in historical terms (describing what happened in the past) and in real time, allowing us to know the status of some services (presence of traffic, availability of public transport, availability of vehicles on a sharing basis, calculation of the route allowing people to reach their destination in the shortest possible time or in the cheapest way). Some of the many services already available on the market, or being tested and validated, may be mentioned as an example.

The Spanish company Urbiotica, founded in 2008, runs an app that allows people to find free parking spaces, recognized as such thanks to sensors, thus reducing traffic congestion and air pollution.

In the Netherlands, on the N205 motorway Noord-Holland, near Amsterdam, the traffic lights communicate in real time with the drivers through an app, and provide information and traffic condition warnings and give priority to certain groups of drivers. Furthermore, smart traffic lights were installed in an urban context in 2016, adjusting the duration of the green light according to the traffic needs at that moment.

Looking to the future, in May 2018 MOBI[36] was born in the United States, aiming to understand how blockchain technology can contribute to implementing safer and more effective transport systems, at the same time reducing congestion and pollution.

To ensure that this vision can be implemented, **the data produced by different subjects must be brought together**, overcoming existing

[36] Mobility Open Blockchain Initiative (MOBI) is a consortium of over 90 members from the automotive and technology worlds.

barriers (by which each mobility player manages its own data without sharing them in forms guaranteeing inter-operability).

Another aspect linked to data management that must be tackled and resolved for the implementation of Smart Mobility relates to the safety and privacy of the individuals generating the data. In relation to this issue, the role of the regulator becomes essential, in order to create a context in which data can be shared while guaranteeing their effective protection.

3. The project concept

The possibility to share mobility-related information and data in an open manner able to grow over time is one of the great game-changers in the life of territories, facilitating the management of public mobility services, the creation of innovative services, the birth of an environment that is favorable for experimenting innovation in the mobility field. In this regard, it should be underlined that the Lombardy Region is already working in this direction as it:

- has already set up an accurate, broad database, made available to sector players, constituting the starting point for the creation of the first experimental services. Among these are:
  - "Muoversi in Lombardia" (Getting around Lombardy), a database of open data, updated annually, mapping the public transport routes and timetables. In relation to commercial travel planners, it has the advantage of covering the whole region, including the areas with lower transit densities;
  - "Matrice origine/destinazione dei passeggeri" (Passenger Origin-Destination Matrix), a database containing information on all the habitual and occasional movements in and around Lombardy.
- therefore it owns a database that can be made available to businesses deciding to add their own proprietary data, using the methods already tested with the E015 platform, thus allowing the creation of experimental services for the population, with a virtuous dynamic for businesses interested in sharing their own data, with the possibility to "enrich" them using data of public origin or from other businesses. Launching a project like the one described above can have positive repercussions also for the regional administration, through agreements involving access to the data of private players, aiming to improve the regional mobility planning activities.

Various factors hinder the open sharing of large, significant databases. The issue of connected mobility is difficult to implement for a number of reasons, including:

- the ownership of existing data by parties that are not interested (or not incentivized) to sell/make available their databases;
- the lack of (economic and other) stimuli to create new databases that can potentially be generated using technologies already in use in the market;

– the difficulty in creating a regional context to facilitate the development of services based on the utilization of data;
– the lack of open data-sharing platforms.

The absence of these pre-conditions significantly affects the birth of potential services, in fact determining a failure in the market: those who own the data have difficulty in sharing them. At the same time, it is only the possibility to "enrich" the data, basing them on a common factor, that can generate a true prospect for creating economic value.

The Lombardy Region can intervene in this field, incentivizing the availability of information platforms organized according to the principles already experimented in the E015 ecosystem, promoting the generation of new databases.

In relation to the role of the Lombardy Region in this project, two phases can be envisaged:

– experimentation and testing, required to understand the real value of the data the technology can collect. In this phase, the Lombardy Region holds the role of owner of the initiative, guiding the creation of services for the population on the basis of the needs of the region;
– operation. In this second phase, the Lombardy Region, on the basis of the outcome of the experimentation, creates the conditions for the creation of B2X services, according to market logics.

The definition of an intervention plan and the methods of engagement of the Lombardy Region in this project must necessarily pass through the understanding:

– of the type of data the Lombardy Region could need for the organization/promotion of services in the region;
– of the type of existing data held by different owners and their willingness to share them;
– of the potential for generating new databases;
– of any leverage that can be enabled by the Lombardy Region to promote the availability of databases (exchange, purchase, regulatory requirements, various incentives, etc.).

4. Project features and activities

To launch this project operation, the following are needed:

– mapping of the regional data already examined and available in the mobility field (database), checking the technological requirements (database and platforms) for structured sharing and for the use of analytics, as well as the methods of continuous updating;

- identification of the main requirements linked to the possible creation of innovative smart mobility services, starting from the needs of the area, identifying both the quick-wins (to enable a virtuous cycle of sharing) and the long-term development plans;
- setting up experimentation tenders, to select and involve the companies working in this field on the basis of technical and financial proposals, in order to test the services for the population in the involved fields;
- foster regulatory adjustment to enable the adoption of new business models;
- transpose the results of the experiments and define open protocols or specific service tenders to apply the new services solutions to the market;
- promote the birth of innovative B2X services, starting from the vision and requirements for development, through dialog with the interested operators and trade associations, and the enhancement of the Lombardy Open Innovation platform.

5. The Roadmap

Also with reference to the following projects, in order to concretely implement the project concept Connectivity/Data and provide additional elements in relation to the activities to be implemented and their time frame for completion, a general roadmap was drafted, but should be interpreted as purely indicative.

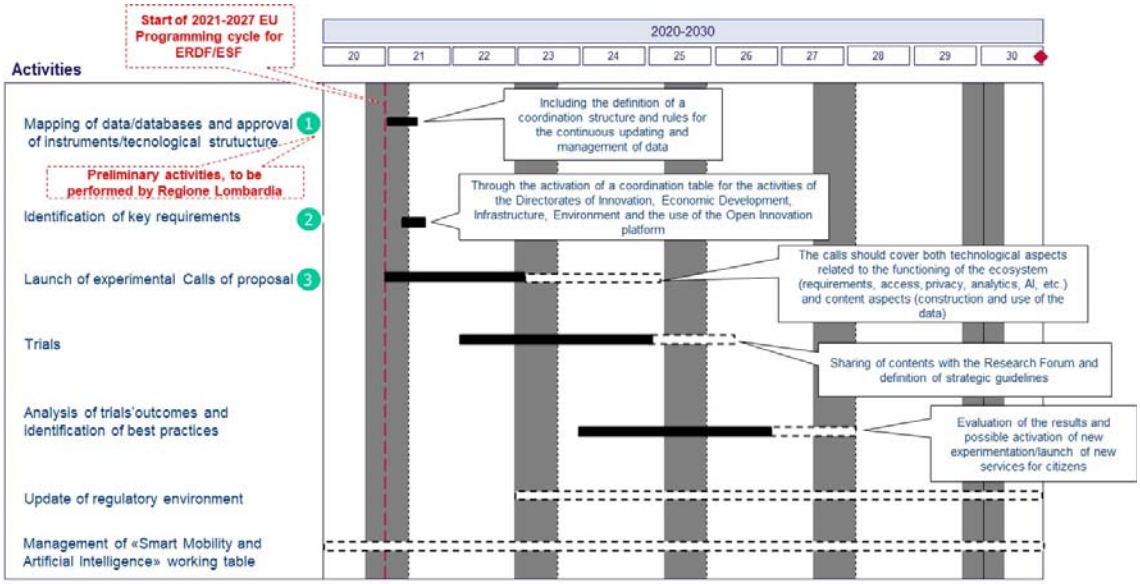


Figure 11.1. Indicative roadmap of the activities required for the implementation of the Connectivity/Data project concept. Source: The European House – Ambrosetti data elaboration, 2019

What is measured in this context, more than the start and end dates of the activities, is the envisaged logical sequence of the activities and the duration of each one.

b. Experimental Hub for driver assistance and self-driving (and other forms of experimentation in controlled contexts)

1. Nature of the intervention

This involves the creation, in Lombardy, of an international excellence hub for the research and experimentation of **assisted and self-driving mobility solutions**, through access to specific facilities and the range of services for the experimentation of innovative solutions applied to vehicles and infrastructures, ensuring the necessary variety of articulated spaces, tools and infrastructures.

Accompanying the experimental activities most closely linked to driver assistance and self-driving are other test areas in which the testing facilities may be useful.

Potential users of this set of experimental facilities are not only the vehicle manufacturers, many of which in fact have their own facilities, but also the vast world of component manufacturers and support technology manufacturers who, on the contrary, have difficulty in accessing appropriate testing facilities today.

2. Reference scenario

2.1. Technological developments

A self-driving car, also known as autonomous vehicle (AV), connected and autonomous vehicle (CAV), driverless car, robo-car or robotic car, is a vehicle that is able to drive with less input from the driver, due to its ability to exchange information with the surrounding environment.

In fact, whether these are cruise control, lane departure warning systems, distance measurement or emergency brake assist, already the cars placed on the market today are increasingly equipped with driving assistance systems that increase the level of safety on the roads for drivers, pedestrians and the drivers of other vehicles (bicycles and motorbikes). However, these are still driving assistance systems, with very little autonomy.

Autonomous vehicles scan the environment using a variety of techniques, including radar, lidar, GNSS and artificial vision. Advanced control systems interpret the information received to identify appropriate routes, obstacles and important signposting. By definition, autonomous vehicles are able to update their maps according to sensory inputs, allowing the vehicles to track their own position even when the conditions change or when they enter unexplored environments.

The standard classification adopted internationally[37] identifies six different **levels of autonomy** (on a scale of 0 to 5):

- level 0: no autonomy; the driver performs all the driving tasks;
- level 1 (driver assistance). This is the base value of autonomous driving, the standard common to many cars on the road today, where the vehicle is controlled by the driver but some driving assist features are installed to control the vehicle. Examples are systems in which the driver controls the steering and the automated system controls the engine power to maintain the set speed (cruise control) or engine and braking power to maintain or vary the speed (adaptive cruise control or ACC), or park assistance, in which the steering is automated while the speed is controlled manually. Type II Lane Keeping Assistance (LKA) is a further example of Level 1 autonomous driving. Automatic emergency braking, warning the driver of an accident and ensuring full braking capacity is another level 1 function;
- level 2 (partial automation)**.** Some cars are already able to drive semi-autonomously in some contexts, for example on the motorway or in areas in which heavy traffic makes driving particularly slow. In these cases, the automated system takes full control over the vehicle (acceleration, braking and steering), while the driver monitors the situation and is ready to take back control of the vehicle when necessary. In this way the driver can relax the legs and hands, but the level of attention must remain high, just in case they have to intervene promptly;
- level 3 (conditional automation)**.** Cars with this level of automation can drive autonomously in well-defined situations, such as on motorways or in heavy traffic, even without the driver having to monitor the situation. In this case, the person in the driver's seat can also take their eyes off the road. An additional feature of this type of car is that they can communicate with each other. Also in these cases, the driver must in any case be ready to intervene within a limited period of time, specified by the manufacturer, when required;
- level 4 (high automation). The vehicle is able to manage complex situations without the intervention of the driver. The driver always sits in the driver's seat but no attention is required;
- level 5 (full automation)**.** This is the highest level of autonomous driving, with intelligent vehicles, connected to infrastructures and with other vehicles, and do not require a driver.

[37] According to the international standard J3016 published in 2014 by SEA International, an aerospace and vehicle industry standardization body with headquarters in Michigan (USA).

More complex experiments include the management of rakes of vehicles for freight transport, as in the case of platooning, in which a whole rake can be controlled using forms of artificial intelligence.

Today the level achieved by vehicles in series already present on the market is level 2, although some manufacturers have already developed level 3 solutions. Prototypes are being experimented for levels 4 and 5.

While there are still highly challenging obstacles to overcome to implement level 3 or higher solutions on the road, mainly linked to safety aspects, above all in complex urban contexts, there are encouraging factors linked to the very nature of the technology used, including: digitalized information, presenting the same format whatever the source (lidar, radar, GPS, sensors); the availability on the market of increasingly advanced connectivity solutions (5G); the use of artificial intelligence software based on machine learning models, allowing upgrades and continuous learning.

The set of these elements allows us to imagine the possibility of extremely significant developments in this branch of technology, aware however that the development time frame could still be very long and, also in future, not all the real conditions could adapt to level 4 and 5 autonomous driving solutions.

We can easily predict that in the coming years, thanks to the extensive investments in recent years, level 3 technologies will tend to become standard equipment, drastically increasing safety levels on the road. These two characteristics (the significant investments already made and the high potential benefit for vehicle drivers) will lead to accelerated development in this field, at a time in which vehicle manufacturers need significant innovations to propose to their customers to sustain consumer dynamics which have slowed down over a period of at least three years.

Furthermore, where flexibly designed, the facilities set up to experiment self-driving and driver assistance solutions can also be used to test solutions in other fields (for example braking systems), guaranteeing access to facilities suitable for the development of a wider range of technologies.

It is worth pointing out that Lombardy represents a context particularly connected with the world of motor sports. Not only Lombardy hosts the Monza circuit, but it also sees the presence of several **industrial players with a strong vocation for sustainable motorsport**, which in turn triggered the building of structured industrial supply chains. This factor constitutes a distinctive feature that, also in perspective, can be cultivated with the aim of pushing the entire Lombardy mobility system on the frontier of innovation and contributing to the international visibility of the entire sector.

2.2. Regulation

The Decree of the Italian Ministry of Infrastructures and Transport of 28 February 2018 ("Implementing methods and operational tools for road testing of Smart Road, connected and automatic driving solutions") has regulated the testing of autonomous vehicles on the road.

Applicants are required to submit to the Ministry of Transport an application for authorization for road testing automatic driving vehicles on the road, supported by a detailed set of information (including "the documentation demonstrating that, for each stretch of road proposed, authorization has already been obtained from the road owner to conduct the testing" and the proof that "experiments have already been performed with automatic vehicles, also other than those for which the authorization is requested, under simulated conditions in the laboratory, using driving simulators, or in other protected environments, covering at least three thousand kilometers").

The testing may start on receipt of the authorization, complying with some general safety requirements.

The Decree, which filled a regulatory gap, has been criticized in some respects, particularly due to some "obstacles" that seem to exclude start-ups and small businesses from the testing (including, in article 14, the requirement that, "if the application is submitted by a party other than the manufacturer", the applicant also has to submit the "testing authorization issued by the vehicle manufacturer". The Antitrust Authority noted that the above-mentioned law restricts competition, as it reduces the possibility for independent developers to compete, to the advantage of the car manufacturers which are already highly active in this rapidly developing sector.

2.3. Possible use cases

If we look at the issue of autonomous and connected driving in terms of use cases, the first element we have to focus on is: "Where will self-driving vehicles operate?"[38] There are many hardware and software requirements for driving in urban environments compared to motorways. The second element is: "Who owns these vehicles?" Will they be owned by individuals or by private fleets? This is important, as the operational and business models will be very different. The final element is: "What do they carry?" Passengers or different types of goods? Depending on the answers to these questions, we will see a completely different set of applications and use cases implemented in the coming years.

[38] Autonomous-driving disruption: Technology, Use Cases, and Opportunities, McKinsey & Company, 2017.

For example, if we talk of urban passenger transport owned by a fleet management company rather than a private subject, we talk of the use case of robo-taxis.

Other examples of use cases are the application of autonomous driving to long-haul freight transport systems on the motorway. We talk of "platoons" where in a rake of trucks only the first has a driver, while the others brake and accelerate autonomously in line with the one at the front. This can lead to significant cost savings.

2.4 Significant investment programs and key players

Many car makers have already launched significant development programs focusing on autonomous and connected vehicles. Among these, the most important in terms of activity are Waymo, BMW, Nissan, Ford, General Motors, Delphi Automotive Systems, Tesla, Mercedes-Benz, Bosch and Volkswagen.

The world's most advanced research centers working on self-driving include the Carnegie Mellon University (USA), the Massachusetts Institute of Technology (USA), the Center for Automotive Research of Stanford (USA), the Oxford Robotics Institute (UK) and the Department of Automotive Engineering of Tsinghua University (CHN).

In addition to the various manufacturers' test centers, adapted to the needs of autonomous driving, testing facilities are being built in numerous countries around the world. One interesting example is Zalazone, a newly built facility for testing autonomous and connected driving solutions near Budapest, Hungary.

3. The project concept

The aim is to create a **unique context for experimenting self-driving and driver assistance for different technology readiness levels (TRL)**, with a broad scope of intervention, running from vehicles to single components, as well as all other "extra-vehicle" technologies (i.e. signposting, field sensors, antennas, etc.), with expected benefits not only for the private sector but also for public transport, and, in future, widespread positive consequences also for local citizens.

This is made possible:

– by the possibility to systematize different types of assets with a synergic value in the various test phases, able to create an integrated range that can respond to the needs of component and car manufacturers:
  - *digital assets* (already today, the simulator developed by Politecnico di Milano, for the first digital testing phases);
  - "*closed" physical assets* (Autodromo di Monza);

- *urban and extra-urban contexts* with ad-hoc infrastructures for testing in real and/or controlled conditions (in particular, the Expo Area / Mind[39] and the Città della Salute[40]; the Joint Research Center in Ispra[41]; stretches of roads and motorways managed by CAL[42], which have already independently launched project initiatives for the development of advanced infrastructures for electric vehicle charging, including the innovative Electrical Road System[43]; the Aci-Sara Safe Driving Center in Lainate[44], already covered today by the 5G mobile network).

– by the ability to create synergies and coordination, promoting a unitary regional proposal, possibly with a single party able to systematize the different fields;

– by the definition of a precise plan for infrastructure adaptation and the provision of ancillary services, placing the players involved in the conditions to provide the services required for testing;

– by the support of figures of excellence in academic research, with scientific activities conducted firstly by Politecnico di Milano and thereafter by other

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[39] MIND – Milan Innovation District stands on the site measuring over one million square meters which hosted Expo Milano 2015 and represents an international innovation district. Arexpo is the company that owns the site, in partnership with Lendlease, leading group in the infrastructure and real estate sector that operates in four continents.

[40] The Città della Salute will become the new site of the National Cancer Institute and Besta Neurological Institute, creating a public healthcare research hub to enhance the experience of the IRCCSs (treatment and research institutes). The site will be set up in Sesto San Giovanni, in the former Falck and Railway Yard area.

[41] The Joint Research Center in Ispra is the European Commission's internal scientific research center. It provides support to the EU decision-making process through independent scientific consulting and research in different fields: sustainable mobility, space, safety, migration, climate change, innovation, consumer health and safety.

[42] Concessioni Autostradali Lombarde S.p.A. is a public limited company jointly participated by Infrastrutture Lombarde S.p.A. and ANAS S.p.A. The roads managed by CAL include: The A35 BreBeMi motorway ("Brescia-Bergamo-Milano"), the Pedemontana Lombarda motorway (A36) and the Milan Eastern External Ring Road (A58 TEEM).

[43] Internationally, there is significant interest in dynamic charging systems (ERS), which directly power the vehicles as they travel. Currently there are 3 types of electric roads: conductive (with overhead lines - "eHighways" or with rails on the road) and induction (wireless). CAL, with the Concessionaire of the A35 Brebemi and with the support of the Lombardy Region, has launched a Pilot Project in 3 macro-phases on ERS technologies with Politecnico di Milano, involving the identification and analysis of the most promising ERS technological solutions to be tested on the A35.

[44] The Aci-Sara Safe Driving Center in Lainate (Milan) is a cutting-edge training center for motorbike, car, truck and heavy goods vehicle drivers. The Center has four areas where all hazardous situations can be reproduced, such as aquaplaning, driving in slippery conditions, management of oversteering and understeering.

key regional bodies (including the Bocconi University, which has set up its own "Observatory on sustainable urban mobility");

– by the enhancement of a fabric of nationally and internationally renowned businesses active in the mobility (particular automotive components), telecommunications and data management sectors, which, where appropriately guided and incentivized, can find it advantageous to allocate part of their research activities and their resources to co-support the project.

In order words, it is a matter of structuring a project within a **joint group of independent parties who become co-entrepreneurs under the direction of the Lombardy Region**, which acts as the project promoter.

In a competitive context where other initiatives with similar characteristics, as already explained, are being developed, the Lombardy Region is in a - in some aspects unique - position of boasting not only the objective presence in the area of all the elements required to launch the initiative, but also the necessary coordination skills for its activation.

In this light, the timing of the operation is particularly important, as the possibility to implement the operation in a short time frame is one of the necessary conditions for its success.

4. Project features and activities

To launch the HUB project operations, the following are required:

– gathering of the **preliminary willingness of the various parties involved**, based on an initial draft industrial plan for the initiative (containing detailed technical, economic and financial elements relating to the establishment and operations of the HUB). The industrial plan must address and specify clearly a number of elements, including the following:
  - size of the potential market;
  - detail of the customer needs system;
  - investments;
  - technical and organizational facilities;
  - economic, financial and return-on-investment forecasts.

– checking, in particular, the **infra/info-structuring** and **technical skills** required in the various fields, as well as the investments needed to guarantee excellence in the testing contexts. In particular, an appropriate level of connectivity and coverage (5G), the required vehicle fleet, fixed and mobile furnishings, along with all the necessary infrastructure;

– definition of **calls for European funding to attract investments** (funding and co-funding) to start the operation, in particular with reference to the necessary investments; where possible these should be applied for

jointly by the infrastructure manager and the industrial party interested in testing, in order to better channel investments into assets;

- production of **protocols of understanding with the university world** (first and foremost, Politecnico di Milano, for access to the simulator) and any other key third parties (research centers, engineering companies, test labs, etc.);
- definition of an **economic model for access to and use of the facilities**, with forms of advantage/agreements for companies working in Lombardy and for the local public sector;
- identification of a **public or private body in charge of the** initiative communications campaign and the commercial development of the HUB. While respecting the autonomy of all the parties involved, it would in fact appear appropriate to ensure forms of coordination in this field.

5. The Roadmap

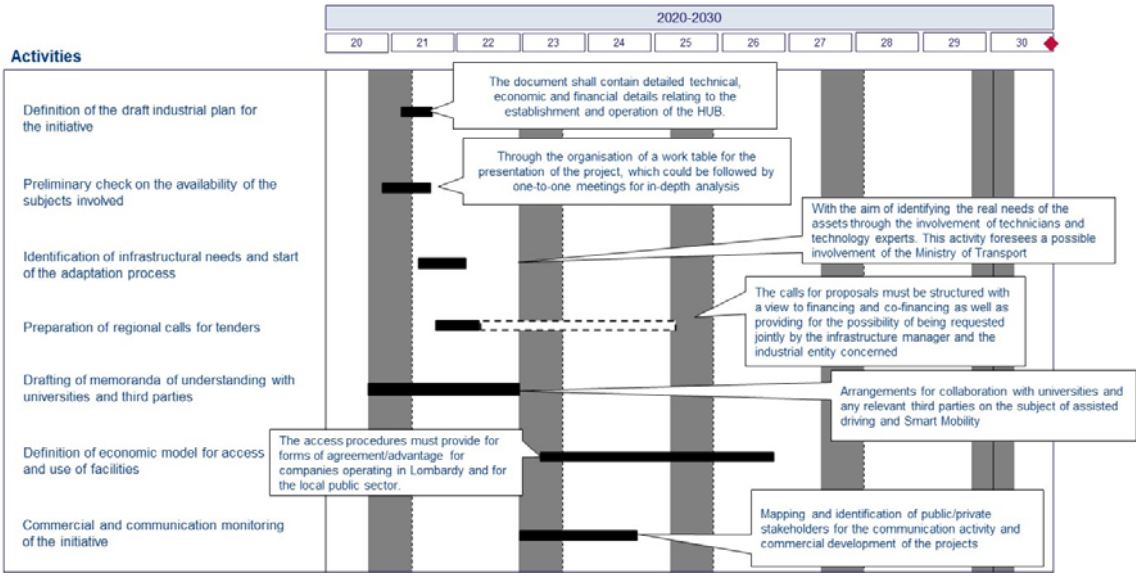

Figure 11.2. Indicative roadmap of the activities required for the implementation of the Experimental Hub for driver assistance and self-driving project concept. Source: The European House – Ambrosetti data elaboration, 2019

c. Support to supply chains in the transition towards new powertrains

1. Nature of the intervention

Supporting the **Lombardy industrial mobility system in general repositioning** within the renewed context of industrial supply chains in the automotive sector, the result of the transformation underway, providing support in the implementation of fundamental research and development activities to redesign products, manage new technologies and new materials. This need is even more immediately clear if we consider the impacts of the COVID-19 emergency, which have certainly significantly increased the already high levels of stress to which the automotive supply chain is subjected, further accelerating the transition process.

Today's specific complexity of the component supply chain also depends on the fact that, while it must continue to invest in existing technologies in order to maintain the acquired technological advantage, it is at the same time forced to lay the foundations for future competitiveness through extensive investments in emerging technologies.

2. Reference scenario

As a consequence of the regulatory changes promoted both in Europe and in other parts of the world, the result of a renewed environmental sensitivity, significantly changing the reference framework for vehicle manufacturers, the component supply chains are having to cope with an operational framework that is different from the past, even though still under transition, characterized by:

- increasing investment volumes required to develop a wider portfolio of technologies and new products;
- strong pressure to accelerate the time-to-market of the products, combined with high levels of uncertainty for the market acceptance of vehicles with innovative powertrains (pure electric, in particular);
- fragmented production batches and uncertainties over the future market volumes, also in relation to the current economic crisis;
- less visibility of the multi-annual activity plans of car & truck manufacturers, with consequent difficulties in planning the related investments;
- the need to expand the system of corporate skills, above all with reference to the ability to manage a broader portfolio of technologies, having to produce increasing volumes of research and development activities in-house.

In very concrete terms, it is possible to imagine **a number of important consequences for the component manufacturer cluster**, with differentiated impacts depending on the product segments. For example, it should be noted that ADAS (Advanced Driver Assistance Systems), vision sensors

(lidars and cameras) and the consequent changes to suspension, steering and braking systems will change the vehicle chassis, and we will see the introduction of new (plastic and other) materials aiming to reduce vehicle weight. Inside the vehicle we will see the progressive development of infotainment and display systems (with the relative increase in on-board electronics) and the introduction of new materials to guarantee increased vehicle soundproofing.

In other words, the vehicle structure will change, with very significant impacts on the whole automotive supply chain. In this context, the concept of supply chain must be understood in its broadest sense, including even repair shops that need to work on vehicles that are structured in a completely different way to the past, and which therefore have to undergo their own transition in terms of human resource skills.

Bearing witness to the fact that this is not a contingent phase are the structural reasons underlying the current process of change:

- increasingly widespread sensitivity to the issues of sustainability and environmental protection:
  - in cultural terms, sustainability is attracting increasing attention, and worldwide people are demonstrating greater consideration of these aspects, which is reflected in their purchasing choices;
  - emission limits are being progressively reduced. New regulations focus on the reduction of CO_2, with NO_x emission limits close to zero, and increasing attention to particulate;
  - worldwide, the need is increasingly to find an alternative to "only diesel and petrol" vehicles, and OEMs are seeking rapid, efficient and competitive solutions for replacing them.
- new technologies being developed and to a good extent already available:
  - the development of new powertrain technologies (Hybrid, BEV, CNG-LNG, biomethane, hydrogen / fuel cells) has seen extraordinary acceleration in the last three years, associated to vehicle digitalization;
  - the new laws and the attention to TCO[45] are “forcing” the adoption of alternative powertrains, which will become increasingly more important;
  - the adaptation of the underlying infrastructures, which will be decisive for triggering the process of adoption of the new powertrains;
- key factors in the adoption of new technologies:

[45] TCO (Total Cost of Ownership) is the calculation of the cost of an asset considering not only the purchase price but also the related operating costs throughout the product life cycle. This value includes all phases of the ownership cycle: purchase, running and variable purchase and management costs. For cars, this indicator is calculated over a time frame of 5 years.

- the development of infrastructures for supporting the new vehicles, although today still limited, is expected to grow in the coming years to support the go-to-market of these new powertrains;
- the promotion of public investments (including the recent European Commission program launched to develop electric batteries[46]) to support the new powertrains bears witness to the desire of policy makers to inspire powertrain innovation without any second thoughts;

– the effect of the transformation on the car value chain:
  - OEMs must cope with a higher level of investments in research and development, with the risk of a strong impact on profitability, with greater pressure on supplier margins;
  - the success factors for suppliers will be the power to innovate and add value to the OEMs, implementing a lower operating cost base.

Here, the Lombardy Region mobility cluster has already launched an initiative aiming to understand which products, technologies and materials will become obsolete after the new powertrains make their mark on the market. This mapping will be able to guide the research into the related products, technologies and materials of the future, coding the fundamental skills required for their management.

3. **The project concept**

This involves supporting the **repositioning of the Lombardy component supply chains** in the transition to new vehicle types, particularly all forms of electric vehicles (hybrid, BEV and, in future, hydrogen). The following issues characterize the project physiognomy:

– even in a scenario of increasing electrification, internal combustion engines will continue to be widely used in close synergy with the development of hybrid solutions. It is therefore necessary to proactively promote a coherent development of the components supplied today in new fields of application, also leveraging their increasingly digitalization and connectivity, as well as other features such as the light weight and use of new materials. The aim is to promote continuing industrial leadership in these components, without forcing a less realistic switch to electrical components, which must in any case also be supported with a view to development;
– at the same time, the region boasts numerous excellences in the electrical field (production of motors, inverters), developed mostly in sectors other than the automotive. From this standpoint it is necessary to promote a cross-industry

[46] The "European Battery Alliance" promoted by the European Union involves the funding of research projects, including the "Research project: the next generation of batteries".

convergence of the existing electrical technology supply chains towards the development of electric mobility solutions;

- for this purpose, a development vision of the various forms of mobility must be defined, at the same time identifying which supply chains within this vision can be supported, promoting the concentration of the resources available towards development lines identified according to market-based concepts;
- finally, new global competition spaces are being created in early-stage technologies which can significantly influence the development of the industry beyond 2025-2030. In this sense, it becomes strategic to incentivize the birth of new supply chains in fields with high innovation and technology contents. In this regard, two areas of intervention have been identified:
  - *hydrogen*, for which the value chain must be mapped in order to understand its size and dynamics, establishing partnerships with international research centers, promoting the first processes of industrialization in the development of new products, and incentivizing infrastructural innovations. In this area, it is also fundamental to promote innovation approaches within a global system logic, in which testing is not limited to individual components but is extended to the whole hydrogen chain, thus also covering production and distribution systems, where possible fostering circular economy approaches even on a small scale;
  - *new materials* (above all with a view to reducing vehicle weight), specifically identifying the areas of greatest value, defining forms of research incentives[47].

4. **Project features and activities**

The possibility to connect basic and applied research to industrial activities is one of the strengths of more advanced industrial systems (just think of Germany and the extraordinary Fraunhofer Institute). In Italy, for several – also historical – reasons, this connection has had difficulty developing. Even though the framework has improved in recent years, still today it is quite hard to establish relations between Italian companies and the most accredited international universities and research centers.

In Lombardy, the situation is still different, and better, due to the presence of several international universities. The nature of the challenge to be tackled by the Lombardy mobility system however **demands extraordinary interventions** to facilitate access by businesses to the knowledge and development of a wide range of innovation projects.

[47] Refer to the studies conducted by the *Tavolo Tematico sull'Alleggerimento* (Lightening Thematic Group) of the Lombardy Mobility Cluster

For this reason, the establishment of a Committee of Experts from universities, businesses and other subjects in the region, including the technology clusters, is envisaged in order to facilitate research activities by managing specific initiatives that are worthy of particular attention. In this case, to launch the operations related to supply chain repositioning, the following must be done:

- selection and establishment of a Committee of Experts able to identify the areas of technological development and the related TRL (Technology Readiness Level) in which to select the requests for support;
- identification of the industrial sectors which could find opportunities for development in the new automotive supply chains (for example, electric technologies in white goods) and awareness raising activities towards them, supporting their adaptation to stricter quality and performance requirements;
- definition of the project evaluation process, with the direct involvement of the above-mentioned committee of experts;
- identification and design of financial support tools (funds, guarantees, co-participation) in close cooperation with the process of defining the guidelines for the European funds, programming the Lombardy Region Open Innovation platform and other regional tools/facilities;
- promotion of the participation of the private finance world in development programs, involving them in the process of defining strategic lines and selection procedures, as well as organizing road-shows on key selected initiatives;
- identification of functions and processes used by the Lombardy Region to be proactive in identifying and promoting development projects in close cooperation with companies, where necessary providing appropriate levels of support for participation in calls, definition of business cases, etc.;
- organization of seminars for sector companies with international experts;
- promotion of university training courses, facilitating the access to companies to certain technical profiles;
- promotion of re-skilling and up-skilling among employed workers and technicians;
- definition, together with institutions and businesses (concessionaires and the market) involved, of infrastructure plans aiming to promote, in these contexts, the acceleration of the go-to-market of these new technologies, overcoming the so-called “chicken-egg” situations in the market.

Where effective, over time this initially “light” formula could develop towards the definition of a more structured form, with the characteristics of an independent (public-private) research center serving the Lombardy mobility sector. In this regard, one particularly effective European example is the Fraunhofer-Gesellschaft which aims to develop crucial technologies for the future and

organize their commercial exploitation by companies, therefore playing a central role in the promotion of innovation processes. In terms of internal structure, the Fraunhofer-Gesellschaft is organized into multidisciplinary teams that work with businesses and public institutions to fill the gap between basic and applied research and promote research projects with systemic importance. There is space today for an Italian institute (based in Lombardy) with similar characteristics devoted to mobility issues which could become a catalyst for public and private investments and could permanently act as a bridge between the needs of businesses and the needs of the territory.

5. The Roadmap

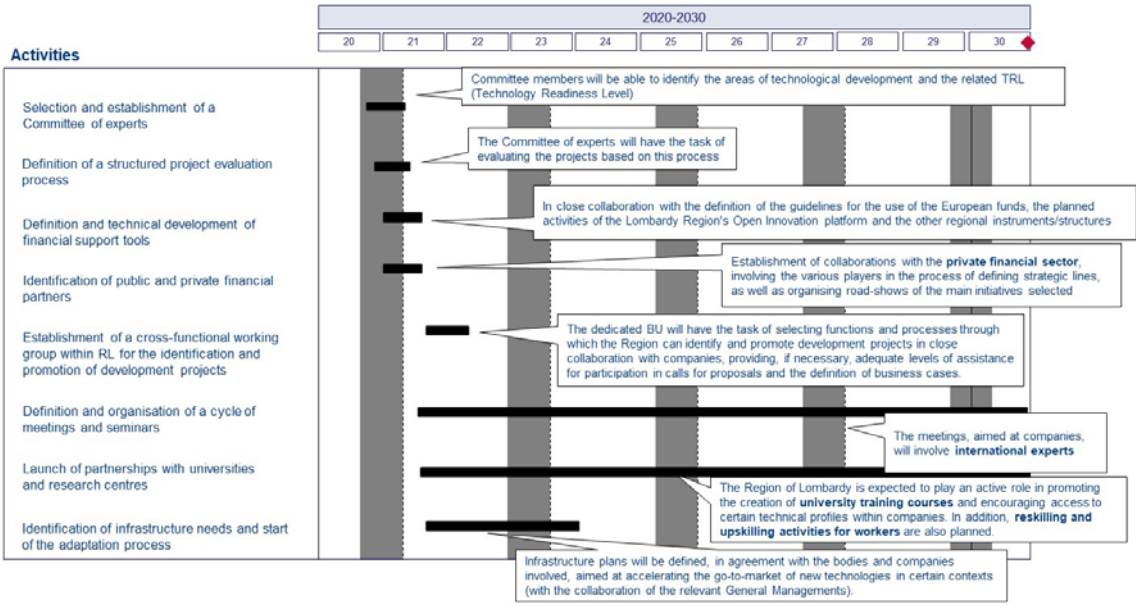

Figure 11.3. Indicative roadmap of the activities required for the implementation of the Repositioning the supply chains project concept. Source: The European House – Ambrosetti data elaboration, 2019

d. Reactivity of the component supply chains

1. Nature of the intervention

This is a matter of promoting the **adaptation of the operational model of automotive component manufacturers**, aiming to increase the degree of flexibility in their production and industrial organization, in order to manage the greater complexity/volatility and above all the speed of the market. It is also necessary to support component manufacturers in their efforts to reposition their business within the supply chains, thanks to their growing innovation skills, not only in relation to products but also to mobility models and solutions. On one hand, this implies aspects relating to know-how (access to specialist knowledge of operations and legal fields), access and use of software (to overcome the high cost of licenses and above all the long times for development of "internal" solutions) and investments in new production technologies. On the other, the companies must change their very nature, evolving in terms of relations, vicinity to the market and ability to anticipate the needs of their customers in a proactive logic towards operators further down the supply chain. This implies a gradual accompaniment of mass-market production logics towards high flexibility in both development and production.

Furthermore, it explores the broad area of requalification of human capital, which today is crucial for a very large number of companies in the sector.

2. Reference scenario

The reference scenario is that described for project C, and represents the second impact on the Lombardy component manufacturing system. While the first impact is related to the product and technologies area, the second concerns production processes.

3. The project concept

The reasons supporting the aim of pursuing the purpose described above are the following:

– the needs for development are influenced by:
  - long go-to-market times (3-5 years), but with the frequent release of new products, which lead to a short-lived competitive advantage. New technologies could represent a major driver for accelerating the go-to-market times, and above all for reducing investments in the development of new products and their industrialization;
  - increasingly capital-intensive innovation programs, in some cases with prohibitive investment costs for individual SMEs;
  - high costs and times for the reconfiguration of the production process;

- need to manage new technologies in relation to past production processes (e.g.: digital components, sensors, etc.);
- uncertainty over the effective response from the market in relation to the costly innovations/developments proposed, also due to the significant uncertainty of the OEM development programs;
- growing opportunities coming from cross-industry contamination;
- fragmented needs of end users due to the rapidly changing mobility models met also by players other than OEMs (so-called delayed OEM).

In this context, it is fundamental for component industries to be able to adopt lean, fast and efficient development and production reconfiguration approaches, optimizing the following aspects:

– product, process and processing design and engineering;
– integration of the supply chains, also on a local basis;
– capacity for proactive participation in innovation processes (in both products and models) and lean prototyping;
– increased production flexibility;
– faster go-to-market (above all in terms of testing and type-approval).

To achieve this goal, companies must necessarily have access to process/industrialization skills and above all simulation tools (software and computing power) which today are hard for small and medium enterprises to access at sustainable costs.

With the due proportions, what considered for component manufacturers is also valid for companies working in vehicle maintenance & repair. These companies will also have to work on structurally different vehicles, and will therefore need to update their skills and knowledge in order to be able to accompany the market changes.

4. **Project features and activities**

The proposed intervention to support the automotive supply chain by the Lombardy Region can be activated in two different ways, parallel to each other:

– promotion by the Lombardy Region of a **(development and industrialization) skills center**, developed by some key players already working in the automotive sector, in cooperation with specialized engineering firms and/or software-houses. In this case the Center could be developed on a para-consortium model among the various players in the supply chain, with the involvement of the universities. An economic model for access to and use of the services must then be defined, with forms of advantage/agreements for companies working in Lombardy and for the local public sector;

– promotion of visions for the development of disruptive and scalable mobility models able to stimulate innovation among members of the supply chain;
– furthermore, the Lombardy Region can intervene through the **definition of interventions worthy of support** (categories of software, development of research and development activities, access to specific consulting services), through the submission of applications to access European funds (also with recourse, to select the most interesting initiatives, to the committee of experts described in point C).

5. The Roadmap

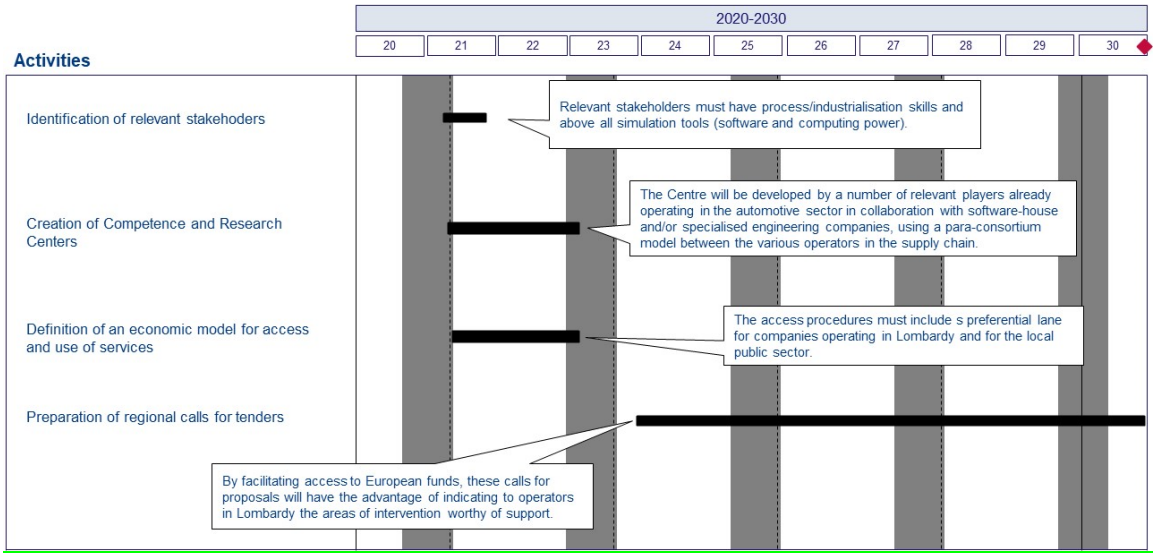

Figure 11.4. Indicative roadmap of the activities required for the implementation of the Supply chain reactivity project concept. Source: The European House – Ambrosetti data elaboration, 2019

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