MOTUS-E

Report on transformations in the Italian automotive ecosystem

14 DECEMBER 2022

CAMI
Center for Automotive & Mobility Innovation

About us

CAMI
Center for Automotive & Mobility Innovation

CAMI (Centre for Automotive and Mobility Innovation) is a network of researchers consisting of academics and experts in the field of automotive and sustainable mobility.

Its mission is to produce scientific evidence and disseminate the results among its stakeholders.

MOTUS-E

Motus-E is the first Italian association set up at the instigation of the main industrial operators, academia, environmental movements and opinion leaders to foster the transition of Italy's transport sector towards the mass adoption of sustainable vehicles, by promoting electric mobility and publicising the benefits for the environment.

Introduction

The automotive sector has always played a **central role in Italy's industrial and social history.**.

The automotive sector has always played a central role in Italy's industrial and social history. Over the last century, this industry has made an enormous contribution, both in terms of employment and research, boosting regional growth and the development of an important production chain.

Globalisation, **climate challenges** and the emergence of **new mobility technologies** have, on the one hand, reduced the attractiveness of cars, which are becoming increasingly standardised, while on the other, companies have been forced to become giants in order to achieve the economies of scale they need in order to survive.

In this context, Italy has seen **a major decline in its industrial capacity** for car manufacturing, partly offset by an increasing exposure to foreign markets of the component supply chain.

The last twenty years have further accelerated this process, mainly due to the **pressing climate issues** that require the automotive industry to address what is perhaps the most radical technological change in its history, **moving away from fossil-fuel-based propulsion** in favour of more sustainable technologies.

In this context, we believe that to date, **electrification is the technology** best placed to reduce the environmental impact of mass private mobility.

Introduction

In this context, we believe that at present,
electrification is the most mature technology
for mass private mobility.

This profound change is certainly a destabilising factor for dozens of small and medium-sized companies that have based their businesses on vehicles powered by IC engines and, to a large extent, on the powertrain itself. But this **transition towards a new mobility paradigm could be an opportunity for Italy**. European countries with a well-developed automotive sector have already embarked on this new path, which in some ways is far removed from the traditional car industry. Italy, too, must accelerate this transition by attracting new supply chains, supporting reconversion and facilitating the adoption of new technologies; otherwise, the entire industry and the country itself will lose competitiveness.

At present, a structured picture of the transition and its effects on Italy's industrial fabric is lacking. This work presents **new scientific evidence** with the aim of offering stakeholders and policymakers a detailed and empirically based representation of the effects of the technological transition on Italy's automotive ecosystem.

The hope is that knowledge of the state of the art will drive actions that will make it possible to seize the opportunities offered by any industrial transition.

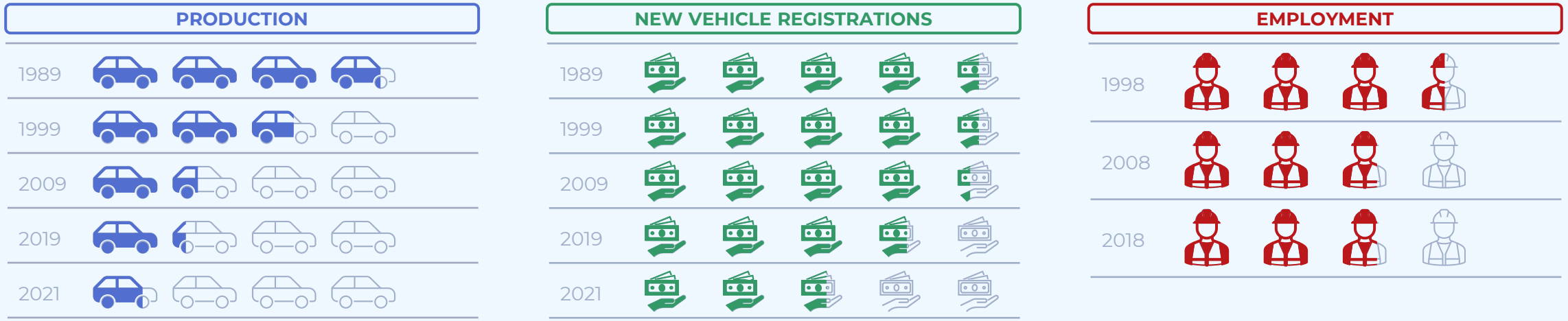
The Board of Motus-E

Executive Summary

Italy's automotive supply chain

The pandemic, the Russia-Ukraine conflict and the shortage of raw materials have dealt a severe blow to Italy's automotive supply chain, and have played a part in **accelerating existing trends** and highlighting the vulnerabilities resulting from the corporate shake-up of the country's only (now ex) major car manufacturer.

From a market perspective, it is clear that the recent crisis in Italy's car industry has amplified the ten-year decline in **production**, **new vehicle registrations** and **employment**.



= 0.5 million = 0.5 million = 50,000

Executive Summary

The need for a more analytical methodology

The energy transition, with the consequent decarbonisation of consumption and reduction of climate-changing emissions, is also having an impact on vehicles, which will have to comply with increasingly stringent limits.
According to various studies, this transition towards e-mobility is the death knell for Italy's automotive industry, which is apparently set to lose between 50 and 120 thousand jobs over the next 15 years.

For various reasons, the picture painted by the studies currently available is biased. These studies:

01 → **Focus exclusively on automotive components** without considering that e-mobility is opening the way to other businesses and skills;

02 → **Sometimes use ATECO codes [Classification of Economic Activity - Italy's version of the European NACE classification system] to define companies in the automotive world.** In this industry, these codes are notorious for not giving a realistic outline of the supply chain stakeholders;

03 → Tend to **confuse the effects of the economic situation and automotive trends with those related to electrification.**

For these reasons, **the studies currently available are unable to isolate the effects of job losses** effectively linked to technological factors.

To fill this knowledge gap, the study we propose introduces a methodology that starts with a **definition of 19 macro areas typical of the automotive ecosystem, which are linked to 127 core parts**. Using this as a framework, the study outlines the product portfolio of the individual companies and then defines a risk indicator to measure each company's exposure to the electric powertrain. This indicator then makes it possible to estimate the risk level of each company based on the compatibility of its product portfolio with the design and production of electric vehicles.

Executive Summary

Early results

- Creation of a new dataset comprising **2,400 companies**;
- Geographical and dimensional analysis of the 2,400 companies employing **280,000 people**;
- As was easily predictable, the picture that emerges is an extreme **polarisation of enterprises and employment in the North-West regions (over 60%) with a majority of small businesses (over one-third have a turnover of less than €5 million)**.

The database was then queried in order to **identify companies offering parts for ICE vehicles,** which were then categorised according to the type of impact they would be exposed to:

- **HIGH TECHNOLOGICAL IMPACT** → companies producing only components for IC engines;
- **LOW TECHNOLOGICAL IMPACT** → companies whose product portfolio includes components that are invariant or dedicated to EVs.

The results of this query are as follows:

199

There are **199** companies producing at least one component for the ICE powertrain;

14,000

These companies employ **43,000** people, **14,000** of whom are employed in businesses whose production is entirely dedicated to ICE vehicles and, therefore, at higher risk;

40%

About **40%** of the workers at risk are employed by large companies.

Executive Summary

The employment contribution of new activities

Once the companies and, consequently, the employees impacted by the transition to electric vehicles had been identified, **the impact of companies engaged in the electric powertrain segment was also analysed**.

A total of 107 companies dealing with new components for electric mobility **employing 22,000 people** were identified. Of course, this is an initial result, which by its nature is incomplete. However, it could increase following more in-depth analyses of new production trends and, above all, of companies already investing in new activities.

However, new jobs are not only limited to those who are already part of the e-mobility ecosystem. It is **also important to consider the businesses that will be created to serve this new mobility**. Some manufacturing activities, if developed, could contribute significantly to the number of new jobs and could also ensure a stronger supply chain by reducing dependence on non-EU suppliers. By way of example, we have estimated that 4,000 new jobs could be created to serve the battery production plants already planned in Italy.

Of course, batteries are just one of the **sub-chains** that could benefit from the impetus of e-mobility, but there are many others, such as materials processing and recycling.

We have not yet mapped the positive effect of these new operations, and it is quite clear that their impact could disappear entirely if Italy fails to put in place enabling conditions to attract investment at the expense of competing countries.

Executive Summary

Predicting 2030 scenarios

In order **to isolate the effect of the electric transition on Italy's automotive workforce** and make the analysis comparable with other existing studies, the findings of the BCG report on **IHS Markit/S&P data projected to 2030** were used to parametrise:

- The responsiveness of workers employed in the production of parts for IC and other engines;
- Total production and the European market;
- The production of electric vehicles in Europe.

These assumptions **were supplemented with the following hypotheses**:

- An even distribution of workers among the products in each company's portfolio;
- A direct proportionality between the business risk and the number of parts for ICE vehicles;
- No change in the exposure of Italy's component supply chain to its European customers;
- The contribution made to employment rates by the infrastructure and energy sectors was excluded.

These hypotheses were applied to the companies listed in the database **and provided an estimate of workforce responsiveness** not only at company level, but also in terms of individual products.

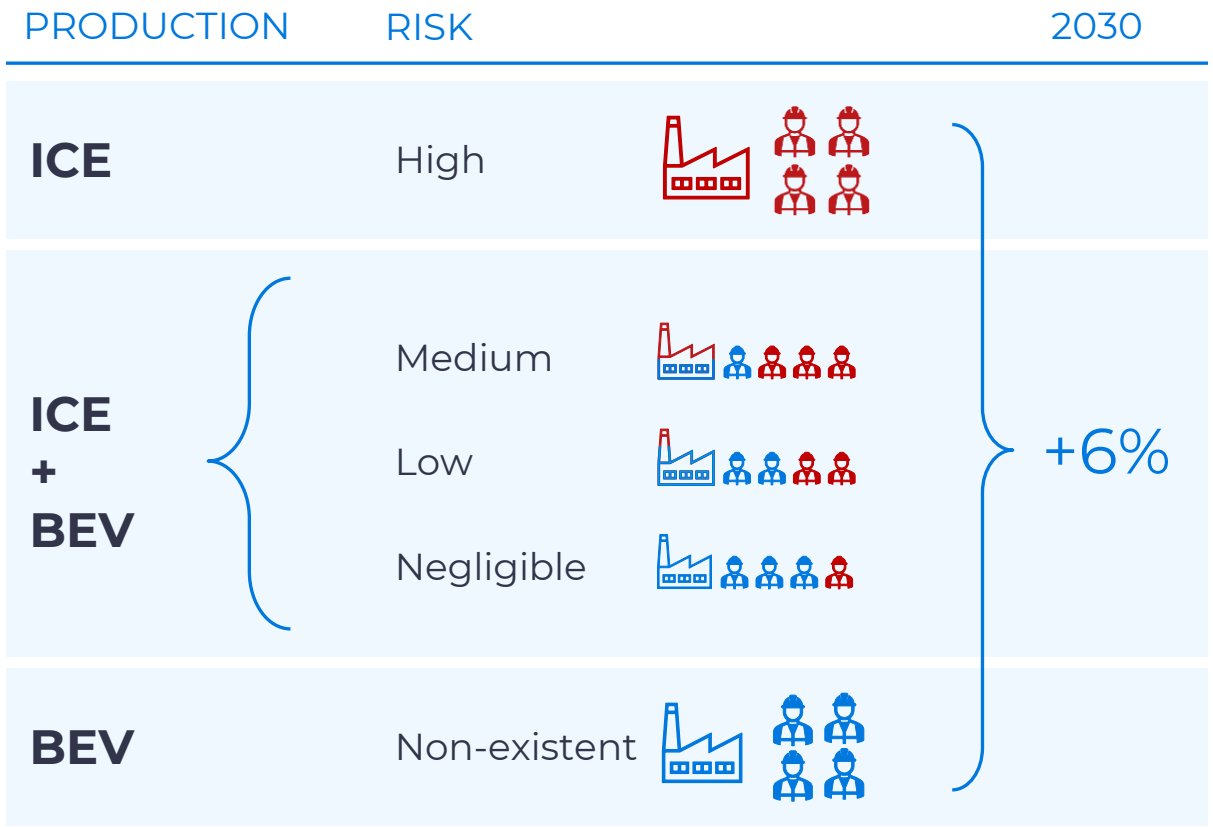
Considering that three-quarters of the employees are dedicated to non-exclusive production for the IC powertrain, even a marginal increase in their number by 2030 would almost be sufficient to compensate the halving of the number of workers producing parts exclusively for IC engines.

Executive Summary

Predicting 2030 scenarios

Based on these responsiveness assumptions, **the impact on jobs between now and 2030 is actually positive, entailing an increase of 6% in the number of workers**.

The analysis of this scenario shows that even today, a minority of automotive workers are employed in the production of parts intended exclusively for the IC powertrain. The **greatest risk**, therefore, is not so much linked to the impact of the new traction technology, but that of **a major reduction in the market and vehicle production in Europe.**



Workers producing components:

exclusive to ICE

common to ICE & BEV or exclusively for BEV

Executive Summary

Two types of impact to be addressed

This report is thus intended to highlight the need to address the transition by focusing on the manufacturing sector, **from two perspectives**:

TYPE OF IMPACT	ACTIONS NEEDED TO ADDRESS THE IMPACT
The **technological impact**, which affects companies producing IC components; this impact is augmented according to the increase in production lines specific to this powertrain.	It is necessary to draw up a comprehensive map of the workforce in terms of age and skills, and of companies' assets, in order to propose support for the R&D of new products and for the training of those workers who will still be active in 2030.
The **impact on competitiveness**, which affects companies that already produce compatible or specific components for electric vehicles.	Support is vital, both to help deal with the risks of a possible decline in production and demand and also to put these companies on a level playing field with their European and international competitors (for example by scaling up in size, through mergers and acquisitions, by developing collaborations with other firms and by facilitating internationalisation).

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Our recommendations

Regardless of the type of impact addressed, we consider it essential **to implement certain actions at Italian and European level**, to facilitate the transition of companies towards the new mobility.

AT EUROPEAN LEVEL

We believe it is essential to discuss:

- The preferential allocation of the Just Transition Fund to Italy;
- The extension of the temporary framework for the automotive sector, in order to use measures derogating from the European rule on state aid;
- Eliminate the territorial constraints on European state aid which are heavily focused on depressed areas.

AT ITALIAN LEVEL

We believe it is crucial to address the issue of training and skills by:

- Updating the skills database used by the Ministry of Employment;
- Launching industrial postgraduate schemes to incentivise employment at the end of the study programme;
- Supporting technical colleges (ITS – Istituto Tecnico Superiore) and vocational schools, both for the training of new workers and the reskilling of employees looking to retrain;
- Providing tax incentives to attract into Italy expert workers who are currently employed abroad.

Executive Summary

Conclusions

The technological changes facing the automotive industry are unprecedented in the history of this sector, which spans more than a century. No less important will be **the way that countries manage to organise and industrialise these technologies** in order to achieve the objective, now a priority, of minimising the industry's exposure to foreign countries.

It is certainly important to discuss the numbers, all the more so when the statistics conceal people who may be struggling to find work, but we must avoid the mistake of considering these figures as the only data worth talking about. The concept we want to stress further is that no study takes the view that it is possible to reduce the impact on jobs by opposing a technological transition in a global market.

On the contrary, everyone believes that everything must be done to **support change through training, guiding companies towards the new mobility paradigms** and creating the conditions for the industrial ecosystem to grow organically and sustainably.

There is no easy way to do this. Nevertheless, we are firmly convinced that a holistic view is essential if we are to fully understand the causes behind the choices we will or will not make and the effects that will reverberate over the next few decades, influencing the fate of Italy's automotive industry.

It is precisely with this aim in mind that we want to propose **a new approach to the study of this supply chain** by applying a methodology accompanied by survey and analysis tools that are flexible, updatable and scientifically validated.

Executive Summary

Conclusions

With the conclusion of this work, this research activity will be passed on to a new entity, the **Observatory on the Transformations of the Italian Automotive Ecosystem**, created with the aim of taking charge of the method and assets developed and then implementing them with the support and guidance of qualified partners who can direct its efforts.

We are convinced of the soundness of what has been achieved so far and are confident that with the care and expertise of those who continue the work, we will create a tool that will help stakeholders and policymakers to make best use of all the opportunities that this technological revolution offers to this industrial ecosystem.

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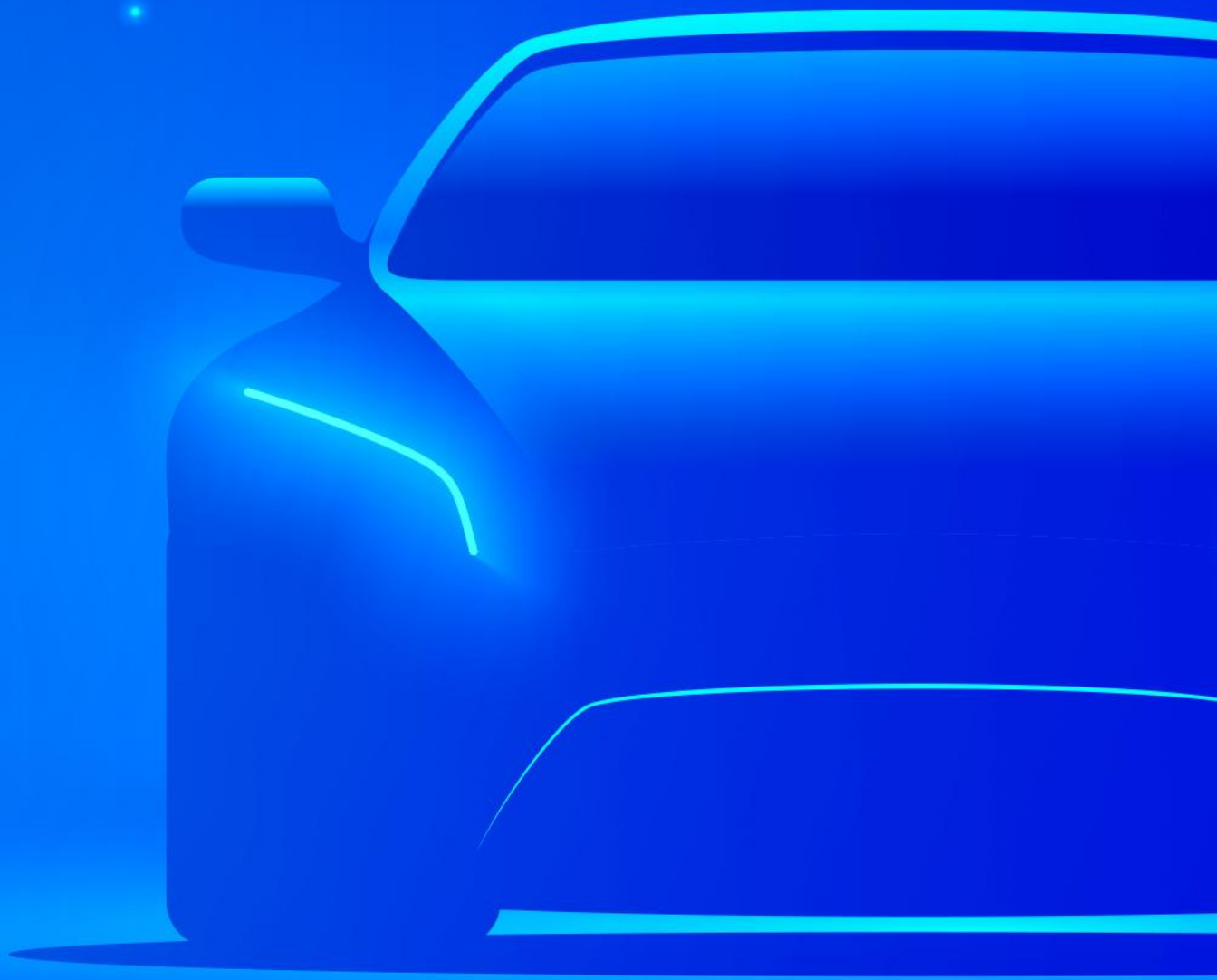
Context and reason for the study



A supply chain in decline for decades

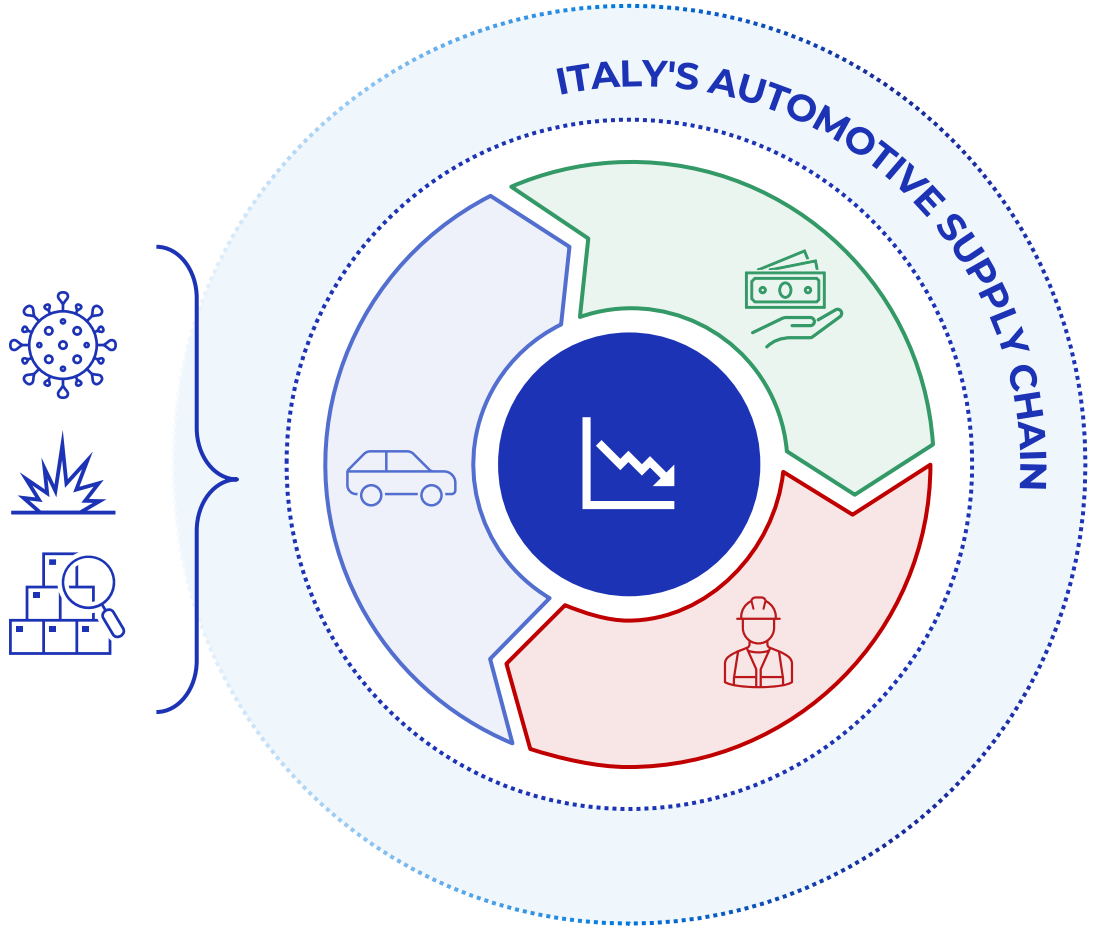
The pandemic, the Russia-Ukraine conflict and the shortage of raw materials have dealt a severe blow to Italy's automotive supply chain, contributing to **the acceleration of existing trends** and also highlighting the vulnerabilities inherent in the corporate shake-up of Italy's only (now ex) major car manufacturer.

From a market perspective, it is clear that the recent crisis in Italy's car industry has amplified the ten-year decline in:

PRODUCTION

NEW VEHICLE REGISTRATIONS

EMPLOYMENT



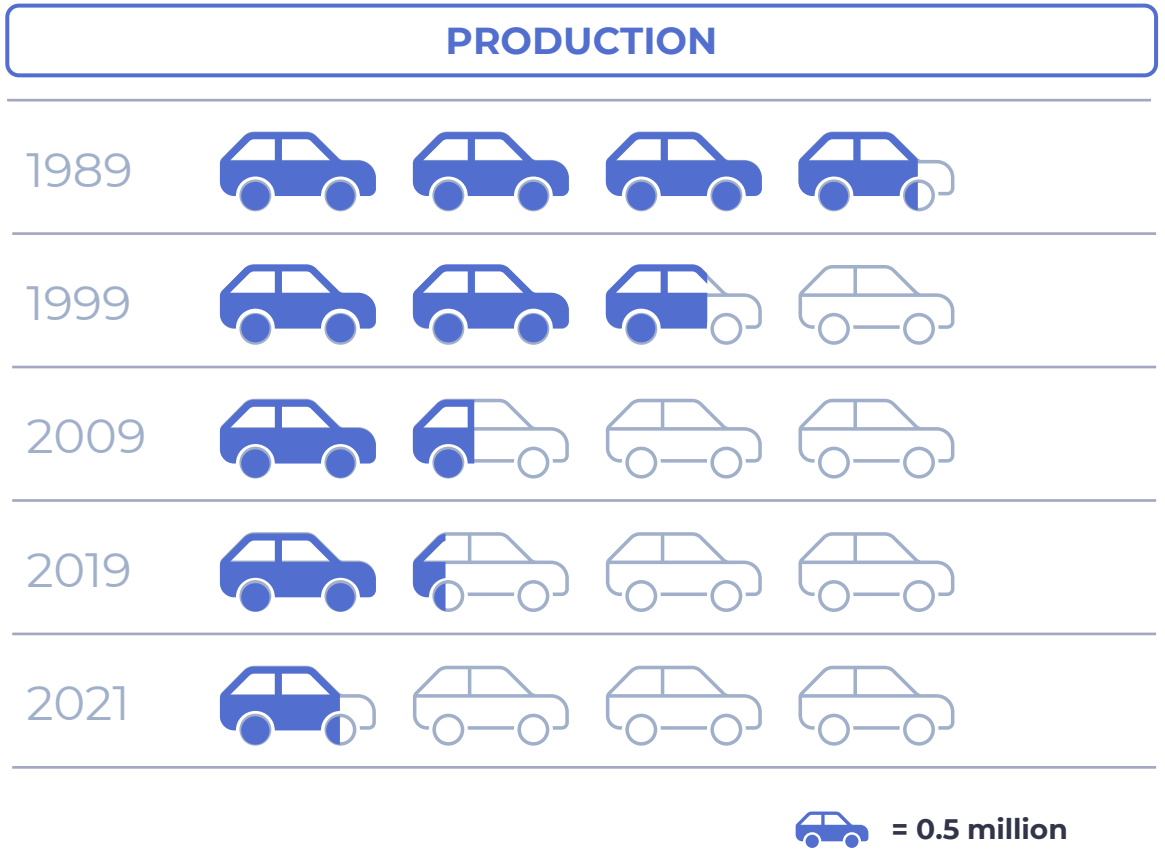
1.5 million cars lost in 20 years

Historically, the production of motor vehicles in Italy has largely come from the factories of **the only major car manufacturer**, which today is part of an international group with a portfolio of 14 brands and industrial operations in around 30 countries.

The corporate revolution faced by the now ex-Fiat group over the last 30 years has led to a downsizing of **car production in Italy, which fell by around 78% between 1989 and 2021**.

At present, it is difficult to foresee a reversal of this trend, considering that the lifecycles of Italy's top-selling vehicles, which are also the models produced in the largest numbers, could come to an end on foreign production lines.

Source: ANFIA

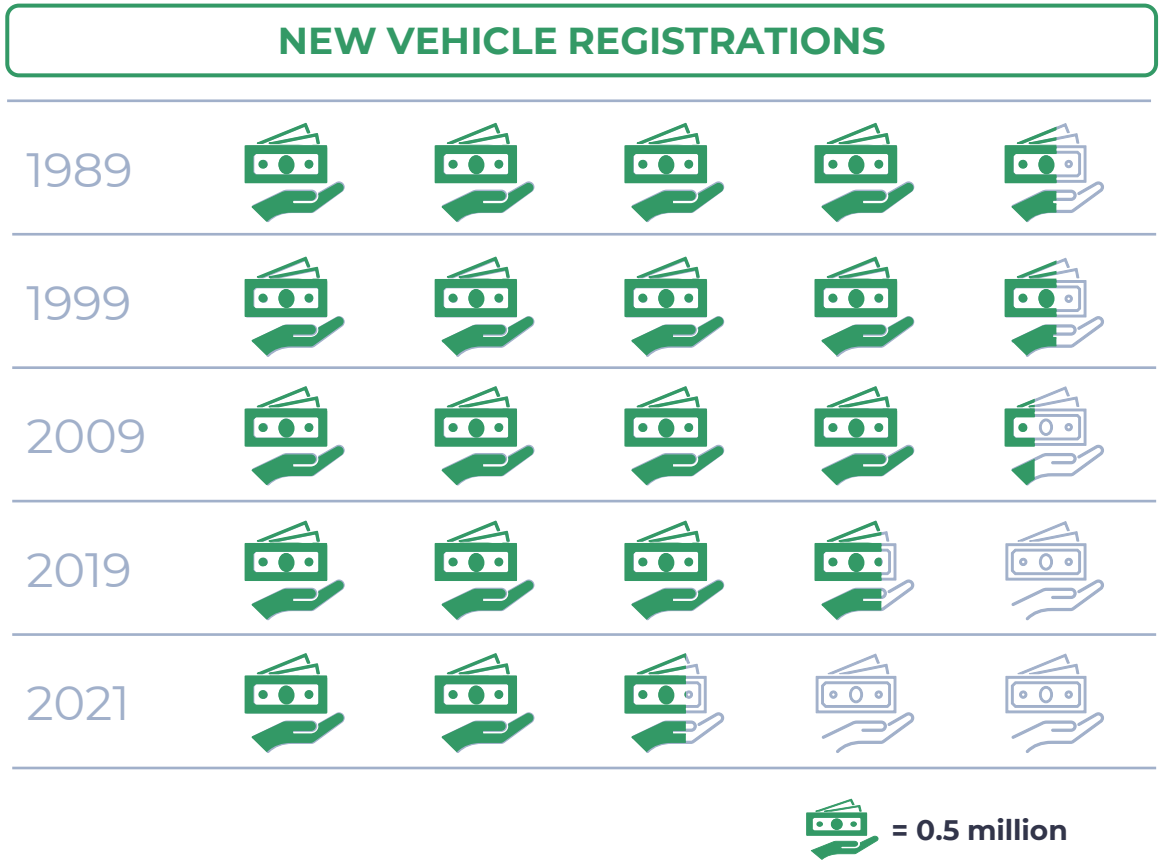


A 25% decline in new registrations over the last two years

New vehicle registrations showed a less pronounced decline, **with an approximate drop of 16% over the thirty years between 1989 and 2019**. Compared to 2020 levels, the impact of Covid, the semiconductor crisis and the war in Ukraine have exacerbated the decline in domestic demand, which has dropped by 25%.

In recent years, with the aim of encouraging demand, especially for the replacement of heavier-polluting vehicles with low or zero-emission models, the government has introduced **purchase incentives**, with varying degrees of success. The latest versions of these schemes, by reducing their scope, the maximum value of the eligible vehicles and crucially the pool of potential beneficiaries, have not yielded the hoped-for results - especially when it comes to purchases of zero-emissions vehicles.

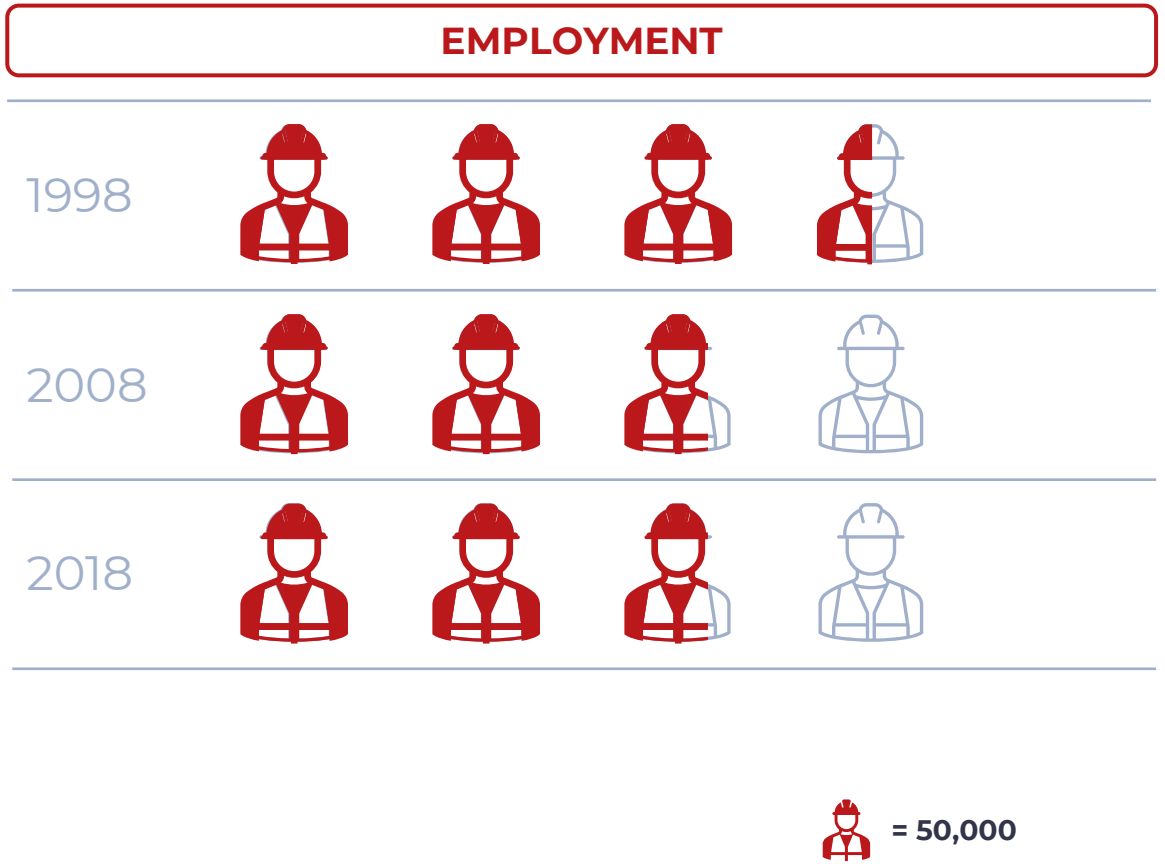
Source: ANFIA



Sector employment has dropped by 20% in 20 years

From an employment perspective, it is interesting to note that over the **20-year period between 1998 and 2018, the reduction in jobs was about one-third of that of motor vehicle production** over the same period.

We examined jobs in companies with historically most significant automotive ATECO codes, namely: vehicle manufacture (29.1), bodywork manufacture (29.2) and manufacture of parts and accessories (29.3). Out of a total of around **36,000 fewer jobs in** the last two decades, the number of jobs lost in the vehicle manufacturing sector (29.1) is even higher, amounting to 38,000. The bodywork manufacturing sector (29.2), despite a loss of more than 30%, contributes to the decrease with 4,500 fewer jobs, while the **manufacture of parts and accessories** (29.3), in contrast, increased by almost 9% creating **6,000 new jobs**.

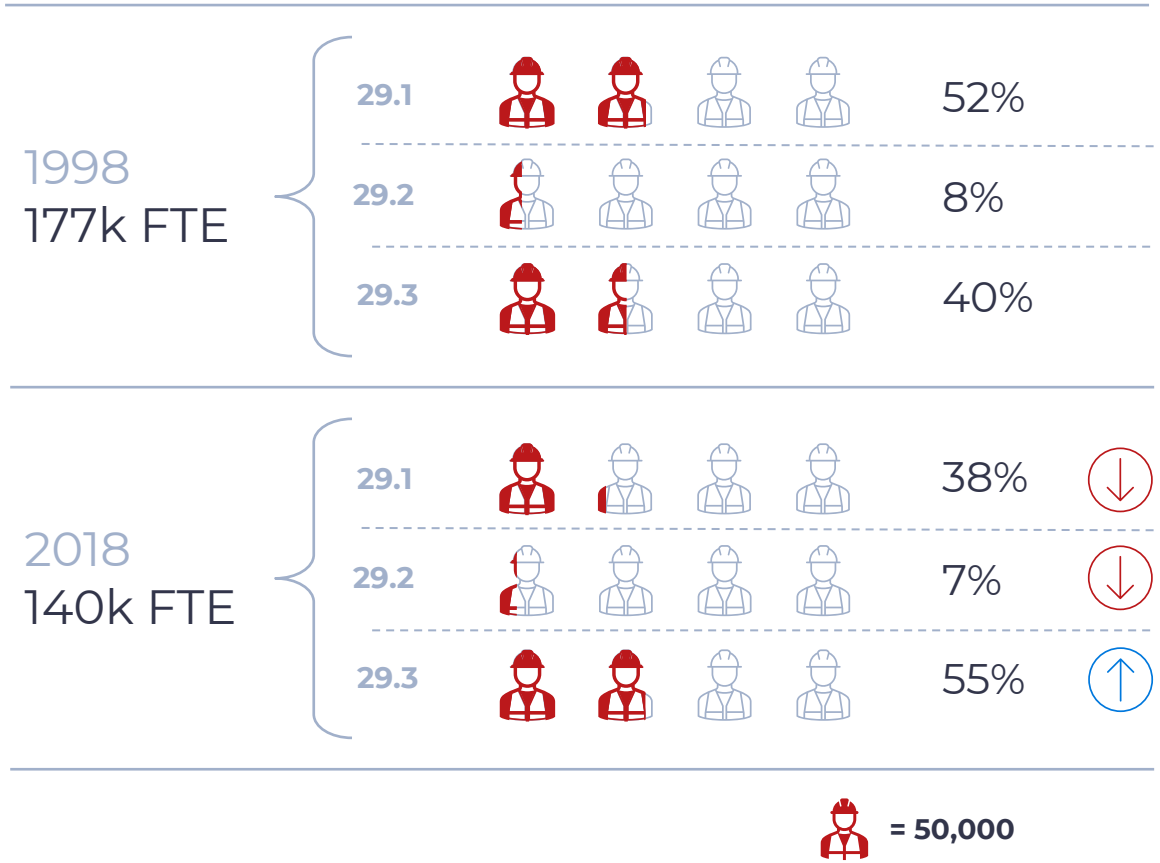


Source: Gaddi M. – Italian automotive sector and its transition to green vehicles, in The need for Transformation, challenges for the international automotive sector, Rosa Luxemburg Stiftung 2021

The component sector is counter-trending

It is evident that the **component supply chain has reacted relatively well** to this reduction in production.

This phenomenon is indicative of the solidity and adaptability of the companies that comprise it, capable of absorbing the reduction in national production volumes with an internationalisation process that has reduced **dependence on the domestic market**, taking more than 50% of the components produced in Italy across borders.



Source: Gaddi M. – Italian automotive sector and its transition to green vehicles, in The need for Transformation, challenges for the international automotive sector, Rosa Luxemburg Stiftung 2021

The reason for this study

The automotive industry has undergone major changes in the last century from an organisational and technological standpoint, while remaining closely anchored to IC technology. The **technological continuity of the powertrain** is one of the reasons why all the studies in this sector have mainly taken into account the following manufacturing segment:

- 29.1 Manufacture of automotive vehicles
- 29.2 Manufacture of bodies for automotive vehicles, trailers and semitrailers
- 29.3 Manufacture of other parts and accessories for automotive vehicles and motors

However, the technological evolution of recent years is affecting vehicle engines, which will be subject to radical changes starting from the **abandonment of fuels** that have been used since the beginning. In such a scenario, it is no longer sufficient to continue analysing the "traditional supply chain", but a broader analysis is required that takes into account the entire **mobility ecosystem**.

Electric mobility as an alternative

Electric mobility is, as of today, the **most mature technology** capable of replacing the ICE and will entail

CHANGE

A **radical change in the technological base** due to profound developments in powertrain technology, which will abandon many of the components present in IC vehicles (pistons, valves, transmission, etc.) but add others (batteries, inverters, dedicated software, etc.).

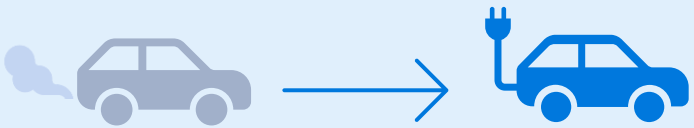
EXPANSION

An **expansion of the boundaries of the automotive supply chain**; this shall involve digitisation and services necessary to ensure a better driving experience and to offer new forms of use alternative to the exclusive ownership of the car as a personal good.

DEVELOMPENT

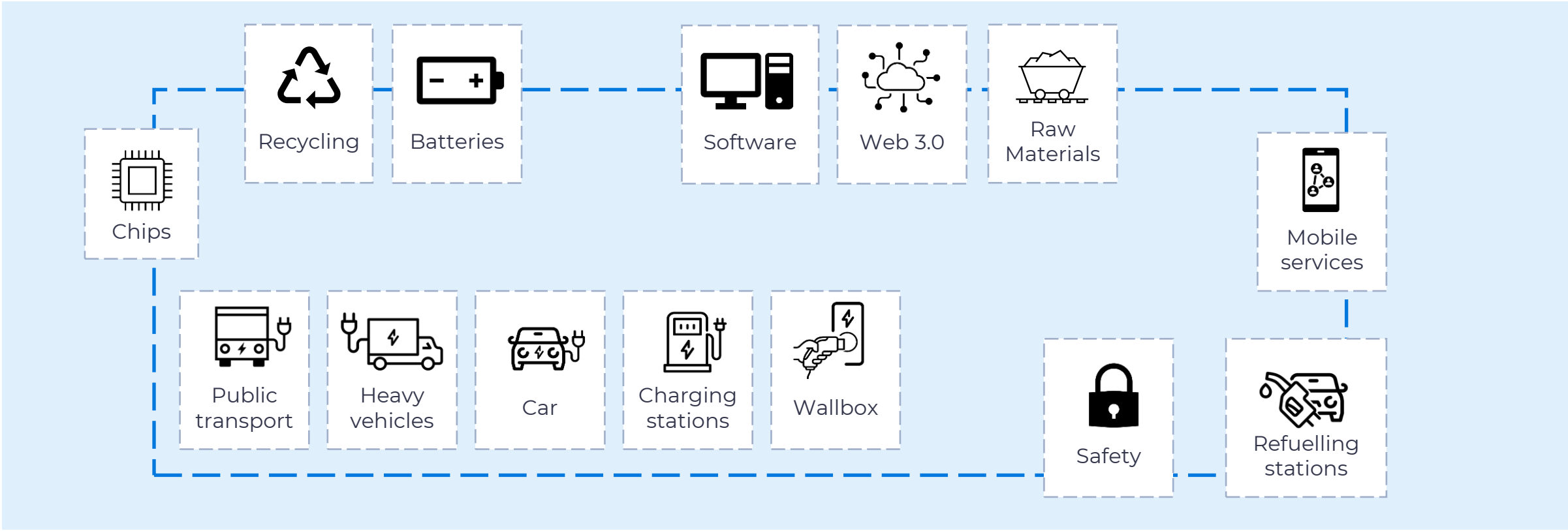
The need for the **development of complementary assets** required by the vehicle itself, such as batteries, and refuelling systems, such as public and private charging infrastructure. The inherent innovation and technological discontinuity of these assets will drive the development of new industrial sectors.

For these reasons, the study of the automotive industry today, and in the future, requires the analysis of a real **ecosystem resulting from the aggregation of sub-sectors**, some of which are already known and some to be studied.



The electric mobility ecosystem

As already pointed out, for a comprehensive study of the economic and employment impact of e-mobility, it is necessary to analyse **all** the **sub-sectors** that contribute fully or partially to the ecosystem:



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Methodological approach and difficulty of empirical analysis

Problems with existing studies

The methodological approaches that have been used in the past to study the automotive supply chain are no longer comprehensive in a context of profound technological changes stemming from the shift away from internal combustion. **The critical issues mainly relate to**:

CLASSIFICATION CRITERIA

The study of sector codes historically considered significant for the automotive industry is insufficient because:

- There are no codes for e-mobility
- Companies that have been in business for many years are often matched to ATECO codes that bear little relevance to their activity
- Companies operating on multiple product lines are often only matched to the main product code

SCOPE

Electric mobility is strongly reflected in supply chains not historically connected, or connected in a limited way, to endothermic mobility. Clearly, disregarding the sub-chains related to charging infrastructure, batteries and related services distorts the analytical findings.

BREAKDOWN OF THE ANALYSIS

The companies have been analysed as if their operations and total workforce were only relative to the automotive market. Many companies produce not only for the automotive supply chain, but also for the benefit of other sectors. It is therefore necessary to approach these analyses by pinpointing the products and services each company offers.

Proposed methodological approach

Our proposed approach to **overcoming these critical issues** is as follows:

CLASSIFICATION CRITERIA

We should not limit ourselves to individual ATECO codes, but instead **get to know the companies** that are already investing and working in e-mobility. We should then map their connectivity networks and study the related value chains.

SCOPE

A **deeper understanding of the industrial supply chains** of components, modules and systems for cars (eventually for all types of vehicles) and for charging infrastructure, batteries and related services.

BREAKDOWN OF THE ANALYSIS

An **analysis of the product portfolios** of the mapped companies, assigning codes that categorise each product according to a specific area of e-mobility.

Defining, classifying and estimating the ecosystem

This approach is instrumental, first of all, to the **definition of a database** that can:

ACTIONS

DEFINE → **CLASSIFY** → **ESTIMATE**

Define the scope of the supply chain for the e-mobility industry

Classify and categorise companies in the mobility chain, taking into account information about activities and skills

Estimate the net employment balance, based on development scenarios regarding exogenous variables

IN ORDER TO DEFINE:

- **Employment**-related weighting of electric mobility supply chain in relation to the total activities carried out
- **Turnover**-related weighting of electric mobility supply chain in relation to the total activities carried out

An electric mobility correlation indicator

From a methodological standpoint, we have created an **indicator** that, for each company, summarises its risk profile for the electric transition:

RISK INDICATOR

MODULES

Based on a review of specialist literature and international industry reports and subsequent verification by industry experts, we have **defined the macro modules** into which a vehicle can be divided, regardless of the powertrain used (e.g. brake system, interior, transmission, motor/engine)

COMPONENTS

Each module was then exploded into multiple **components** (e.g. cylinders, pistons and camshafts are components of the engine module)

CLASSIFICATION

For each component, its relevance to electric vehicles was then established and marked as*:

- **Y**: for components also present in electric vehicles (e.g. braking system)
- **N**: for components not present in electric vehicles (e.g. spark plugs)
- **Y–NEW**: new components specific to electric vehicles (e.g. battery units)

ATTRIBUTION

The companies in the database are then **assigned one or more codes** that identify the product(s) or component(s)

The purpose of the database

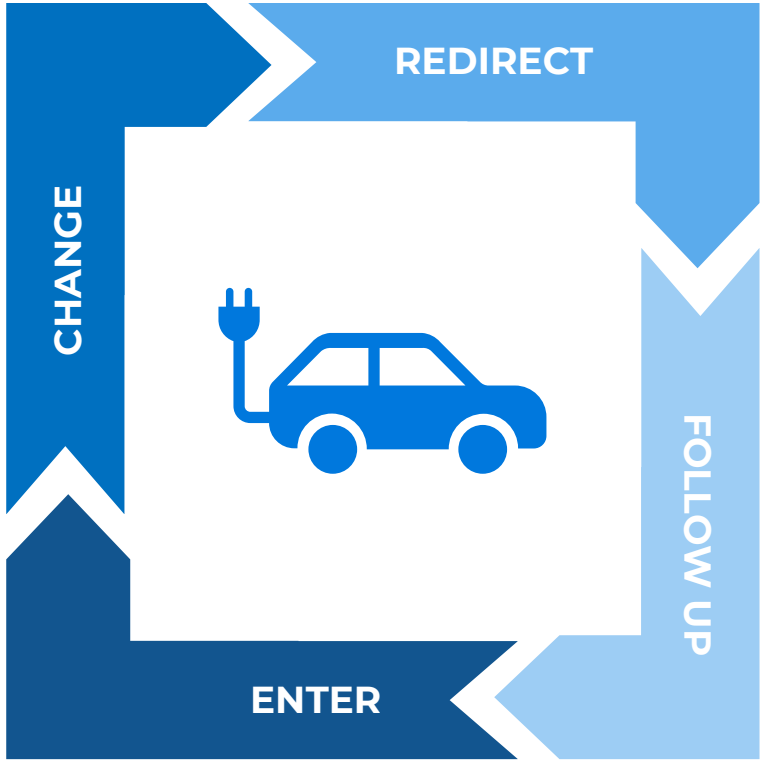
The database enables us to **analyse companies in depth**. By way of example, analysing the relevance of their activity with the electric mobility could lead us to:

CHANGE

Understand who, in the long run, will have to **change** their current business to avoid being closed out of the market

ENTER

Understand who are the **new entrants** in the automotive supply chain, whose business is solely aimed at electric mobility.



REDIRECT

Understand which of the players already partially involved in e-mobility today, will increasingly have to **redirect** the centre of gravity of their business towards this technology

FOLLOW UP

Understand who needs **more in-depth studies** aimed at defining the actual dependence on IC engines.

The role of classic modules and components...

In order to carry out a proper classification of the companies, we decided to **define** 19 modules composed of 127 **components**. These components are then split between parts intended exclusively for IC vehicles, parts also used in EVs, and parts dedicated solely to EVs. The next step was to **analyse the activity of the mapped companies** and assign one or more components to each, according to our classification.

For the IC supply chain, the classification was based on Italian and European studies, which led to the definition of technically significant aggregates that also reflected the actual extent of their presence within the Italian industrial framework.

MODULES

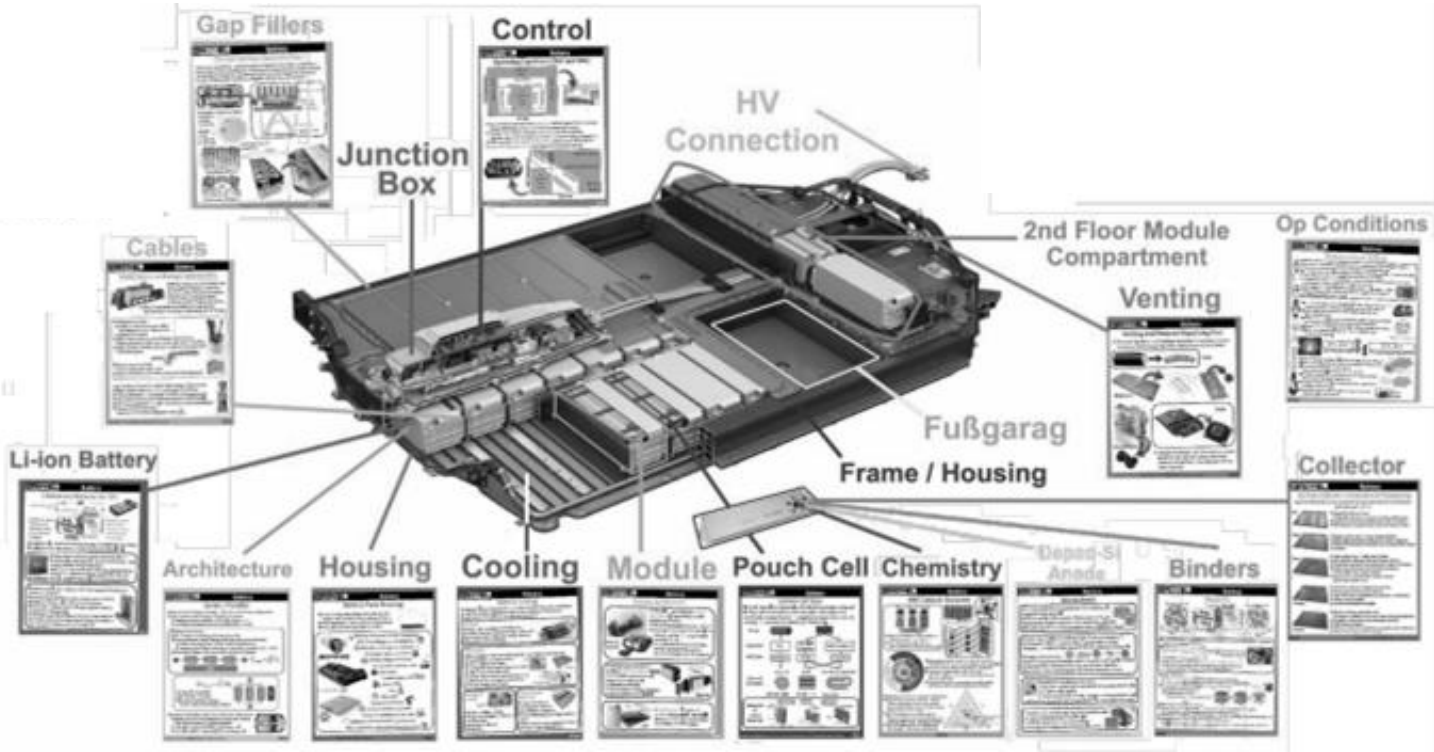
- Auxiliary systems
- Brakes
- Electric generator
- Electric traction motor
- Electrical
- Energy management system
- Energy storage system and fuel/energy delivery system
- Engine
- Fuel cell
- Aftermarket
- Inverter-converter module
- Suspension steering and braking systems
- Transmission
- Wiring harness
- Mechanics, machining, raw materials
- Fabrics, acoustics, lights and accessories
- IT and industrial automation
- Engineering and design
- Infrastructure

… and that of the new

As for the e-vehicle supply chain, we tried to provide **as much analytical detail as possible**, especially with regard to battery parts.

This level of detail enables us, in the currently emerging national context, **to map all the companies connected to battery production**, which will hopefully grow in the coming years.

The classification enables us to **filter the database by component** and obtain, for example, the financial and employment data of companies that are already focused solely on production for electric vehicles.



Source: www.orovel.net

Components as an elementary detail, both for IC vehicles...

The purpose of the modules is to group the products of the mapped companies into macro-categories. Each module is made up of **components** whose detail is, on the one hand, representative of the **complexity** of the module itself and, on the other hand, also indicative of the **industries actually involved** in that activity in Italy.

For example, with regard to the "ICE" module, the components we mapped are those that are industrially relevant but which are also found in Italian companies. Clearly, the components in this module are for the most part solely used in ICE vehicles, although some, such as filtering systems, are also used in EVs.

INTERNAL COMBUSTION ENGINE

- Engine block
- Cylinder
- Piston
- Flywheel
- Valve
- Drive shaft
- Camshaft
- LPG/CNG components
- Air/liquid filters
- Ignition system
- Spark plugs
- Ignition coil
- Distributor
- Starter
- Fuel injection system: injector

… and electric vehicles

As far as **new components** are concerned, we have so far been able to map **around 35** which can be linked to various modules and are not necessarily specific to electric vehicles.

Probably the **module with the greatest specific relevance** to this new powertrain is the **electric traction motor**, although it comprises parts such as bearings, which are also used in IC vehicles.

As with the database, **this classification will also be continuously updated** to ensure it is always in line with the specifics of the new powertrain and the evolution of the national automotive industry.

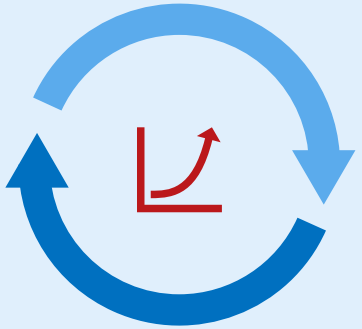
ELECTRIC TRACTION MOTOR

- Rotor
- Bearings
- Stator
- Switch
- E-axles
- Electric motor + inverter
- Electronic traction motors

Applying the risk indicator to the database

The categorisation of companies achieved by applying the described indicator enabled us to also assess the level of risk involved in terms of addressing the technological transition. We can deduce a **direct proportionality between the number of components dedicated exclusively to IC vehicles and the risk exposure of the business** and therefore of its workers.

Obviously, in addition to estimating the number of companies facing the highest risk because they are entirely dedicated to producing parts for IC vehicles, and those with the lowest risk as they produce parts for EVs or invariants, we can also estimate all the cases between these two extremes. In fact, a large proportion of the workforce is employed in companies that already produce components not exclusively intended for either the IC or electric segments.



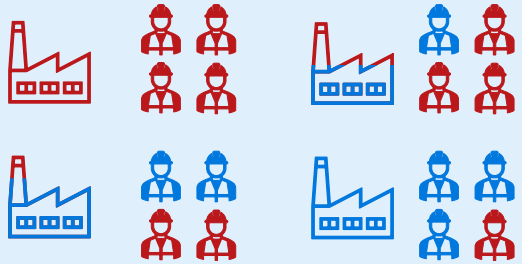
number of components dedicated exclusively to IC vehicles

business risk

As it stands, our database also allows us **to estimate the impact on companies operating in the infrastructure and energy sectors**. This detail, so far limited to the sector mentioned above, will gradually be extended to include all those sectors that are currently absent but are impacted by the transition.

The three clusters

By classifying each company using our risk indicator, we can group them into three main clusters:



Companies that totally, or partially, produce ICE-specific components whose workers are **impacted by the technology transition** to BEVs

Companies that produce BEV-specific components or components shared with the ICE segment whose workers **are not impacted by the technology transition** to BEVs

Companies in the infrastructure and energy sector where jobs will be **positively impacted** by the **technology** transition to BEVs

Workers producing components:

exclusive to ICE

common to ICE & BEV or exclusively for BEV

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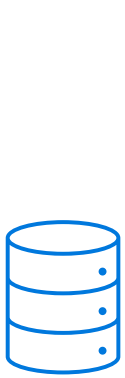
Descriptives of the new ecosystem

How we created the database

In operational terms, the database comprises **more than 2,400 companies** and was assembled as follows:



STEP 1

We queried public databases starting with the main ATECO codes

STEP 2

We **conducted interviews and ran surveys** aimed at mapping the companies in the e-mobility ecosystem

STEP 3

To each company, we assigned a field that establishes the **relevance of its business to electric mobility**

STEP 4

To each company, we attributed **more than 100 records for the purpose of this analysis**

Potentials and limitations

As a survey tool, the database can already provide interesting insights by cross-referencing all the various dimensions assigned to the surveyed companies.

Clearly, as the database is a tool intended to reflect the evolution of the Italian automotive ecosystem, which, as we have repeatedly stated, is in a phase of profound transformation, it must be regularly updated to ensure its reliability. The task of maintaining and expanding the database will be assigned to a new body, which will be specifically set up to collate all the new findings as they emerge.

Having said that, we must highlight two limitations that currently impact the data we collect but do not compromise the accuracy of our analysis:

LIMITATIONS

- **The companies have been mapped according to their declared primary location**. Therefore, we have no data pertaining to secondary sites, unless the relevant information is included in the data for the primary location;
- When several products are involved, **it is not possible to precisely allocate the number of workers assigned to each individual production line.**

Nevertheless, we believe that these circumstances do not engender significant distortions in the overall results.

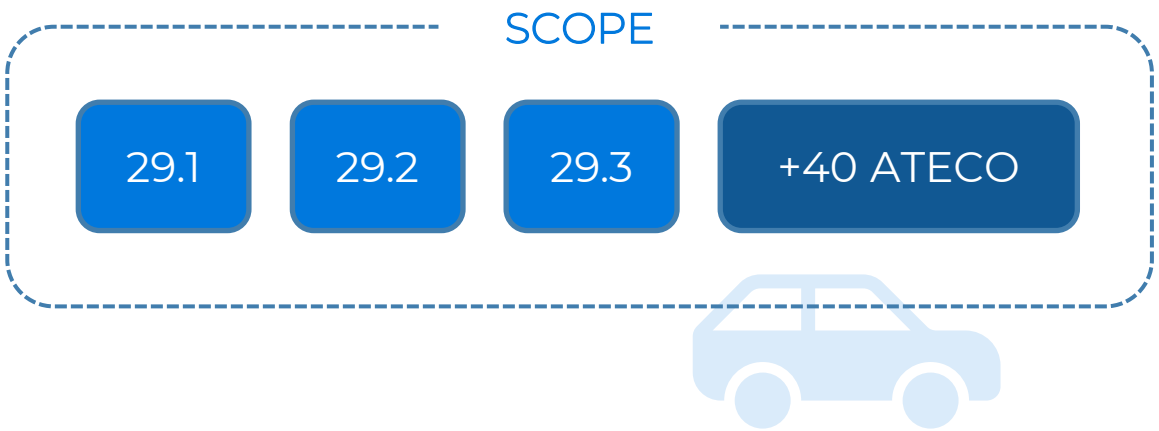
Scope of the study

Any study of the automotive sector must begin by **defining the scope** of investigation. While it is clear that certain well-defined ATECO codes do in fact cover the manufacturers directly involved in the automotive industry, the upstream and downstream supply chains can extend much further.

As previously stated, **we started with the three specific automotive codes (29.1 29.2 and 29.3)** but our database supplementation work enabled us to add companies identified with a **further 40 ATECO codes**, among which those in class 25 (manufacture of cutlery, tools and hardware items) are particularly relevant.

What we have defined is, however, only an initial scope that forms a basis for an investigation that will broaden its spectrum to encompass the various supply chains centred on the automotive industry in the strict sense.

As an illustrative but not exhaustive example, our **current database does not include OEM** or, upstream, the **automotive equipment supply chains** or the battery-related **chemical industry**. Equally, with regard to the downstream chains, it does not yet accurately include the players working on the development of **charging software** and infrastructure installation, or the **after-sales network**.



Early findings

Workforce
the total number of employees is 280,000

Companies by workforce
approximately 60% have fewer than 50 employees

Companies by turnover
approximately 35% have a turnover not exceeding €5 million

Companies by geographical distribution
more than 60% are concentrated in Lombardy and Piedmont

93 companies whose production is **solely dedicated** to the ICE powertrain

107 companies whose production is dedicated to the electric powertrain

164 companies producing **at least one module** exclusively dedicated to e-mobility

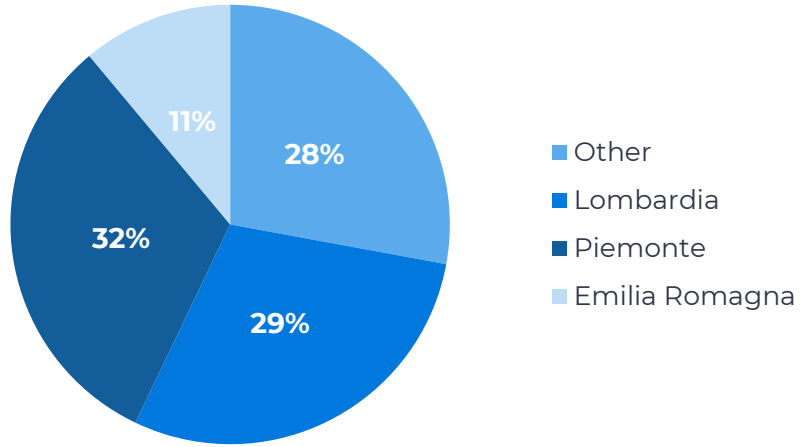
28 companies producing **multiple modules** with a minority of products compatible with the IC powertrain

A small-business ecosystem

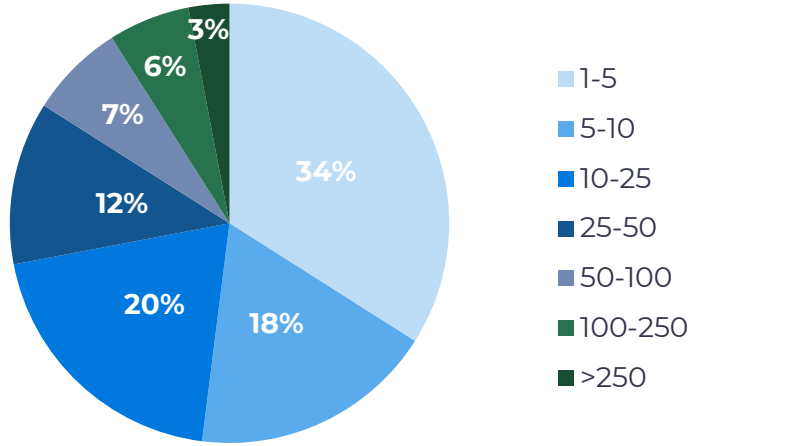
To analyse the number of companies on the basis of 2020 turnover, we first grouped them by **region** of residence and then aggregated them according to their 2020 **turnover** into €/million, defining 7 clusters. On aggregate, **Piedmont and Lombardy are the regions with the largest number of automotive companies.** Piedmont is in the lead for companies within €10 million of turnover, while Lombardy has more companies in the over-€50 million bracket.

In domestic terms, our analysis confirms that the Italian industrial fabric is predominantly made up of SMEs, with more than **one-third of the companies not exceeding €5 million in turnover**; if we were also to include companies under €1 million, almost half of the total would not exceed turnover levels of €5 million.

GEOGRAPHICAL DISTRIBUTION OF COMPANIES



TURNOVER (MILLIONS)



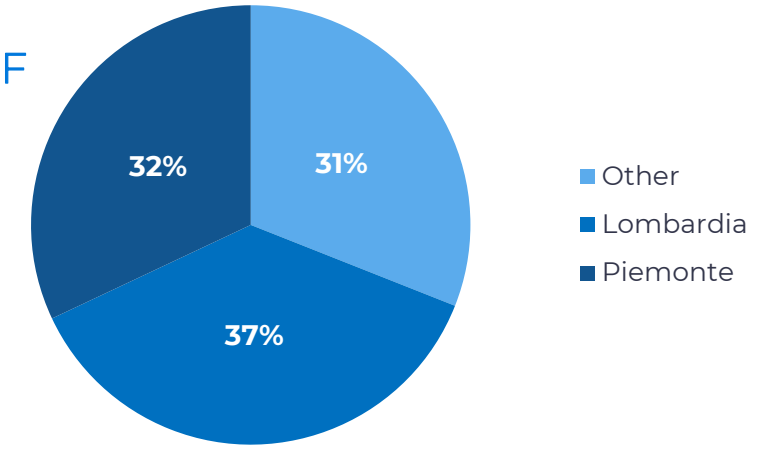
Source: data elaborated by Motus-E & CAMI

Two out of three businesses have fewer than 50 employees

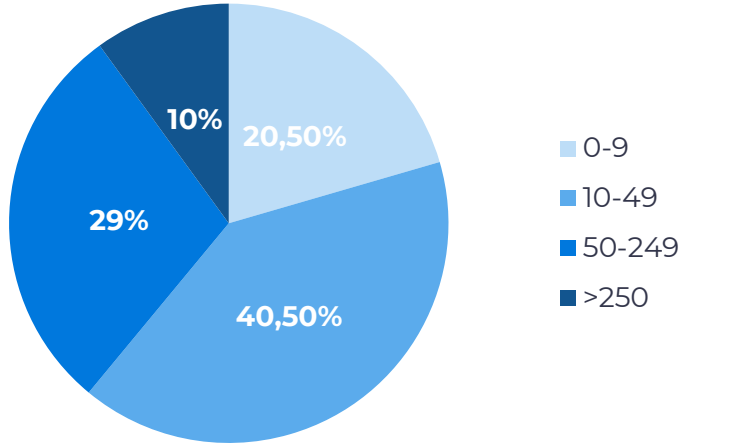
To analyse the company population in terms of **workers employed** in 2020, we proceeded in a similar way by grouping them by **region**, aggregating them according to the number of employees in 2020 and defining 4 clusters. On aggregate, **Piedmont and Lombardy are the regions with the highest number of automotive jobs**, with a very similar distribution among the defined clusters; other regions worthy of mention are Emilia-Romagna and Veneto, which together employ about 13% of the total workers.

At national level, the employment data is consistent with that of turnover, with almost **two-thirds of the companies having less than 50 employees**; this confirms the existence of a supply chain composed mainly of small and medium-sized companies.

GEOGRAPHICAL DISTRIBUTION OF WORKERS



NUMBER OF EMPLOYEES

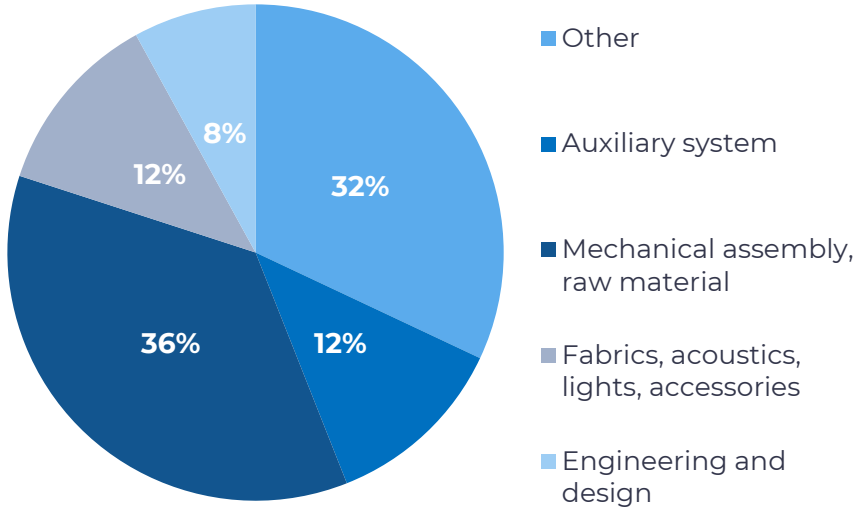


Source: data elaborated by Motus-E & CAMI

Strong growth in infrastructures

An analysis of the companies according to their attributed production module reveals that **36% of them deal with mechanical assembly and raw material processing**. Other modules with individual significance are "vehicle auxiliary systems", which include fluid sensors and lubrication systems, and "textiles, acoustics, lights and accessories", which comprises many of the components used in vehicle interiors.

Insignificant in percentage terms, but relevant for the accurate correct demarcation of the ecosystem is the "**infrastructure**" module, which includes 107 companies. Clearly, the companies involved in this and other new activities will enjoy much faster annual growth than their counterparts in consolidated segments; the best illustration of this is that Italian targets are aiming at a minimum of 3.2 million domestic charging stations as well as 110,000 with public access - this will generate strong demand for both infrastructure and installation services.



Source: data elaborated by Motus-E & CAMI

The impact of the transition on jobs

Having analysed the industrial fabric of the Italian automotive ecosystem from the standpoints of turnover and employment, we decided to take a closer look at the **indicator** that summarises the risk profile of each company in relation to the electric transition.

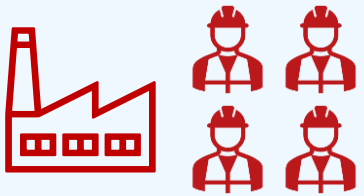
One of the most interesting insights is undoubtedly the **employment impact** of the transition to electric mobility, in light of the obvious technological discontinuities compared to ICE vehicles. In this context, we wanted to determine the number of workers involved, according to the intended use of the components produced (ICE, EVs or invariants).

As previously mentioned, **the possibility of precisely analysing the companies' production** enables us to also parameterise the risk in all those cases where their product ranges include both components totally dedicated to ICE vehicles as well as components compatible with, or specific to, electric motors.

To allow for more comparable analyses in the future, we decided not to include the contribution of all the workers employed in the infrastructure and energy industries.

The impact of the transition on jobs

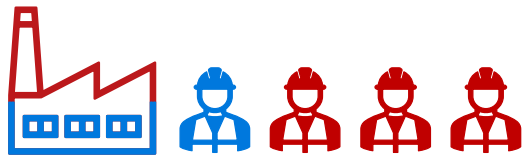
14,000 jobs



100% dedicated to ICE
High risk

43,000 jobs

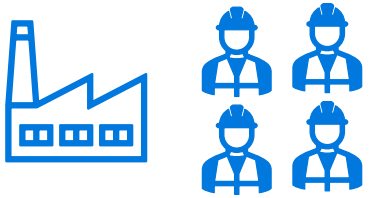
< = 50% dedicated to ICE
At least one BEV-exclusive component
Negligible risk



> 50% dedicated to ICE
Medium risk

< = 50% dedicated to ICE
Low risk

215,000 jobs



0% dedicated to ICE
No risk

Workers producing components:

 exclusive to ICE

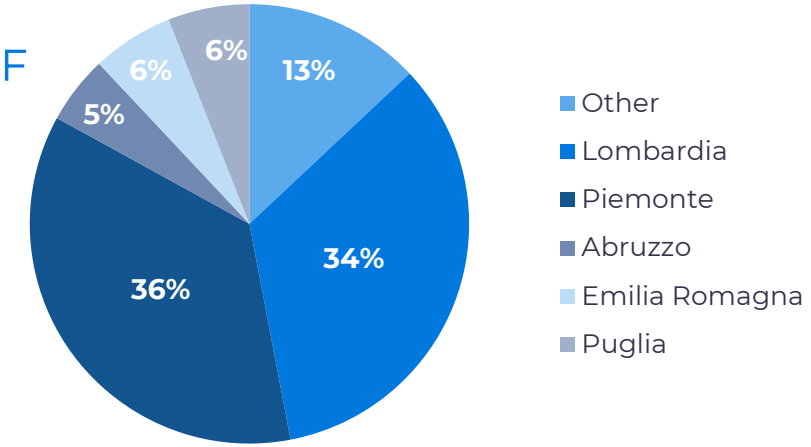
 common to ICE & BEV or exclusively for BEV

The biggest impact is on large companies.

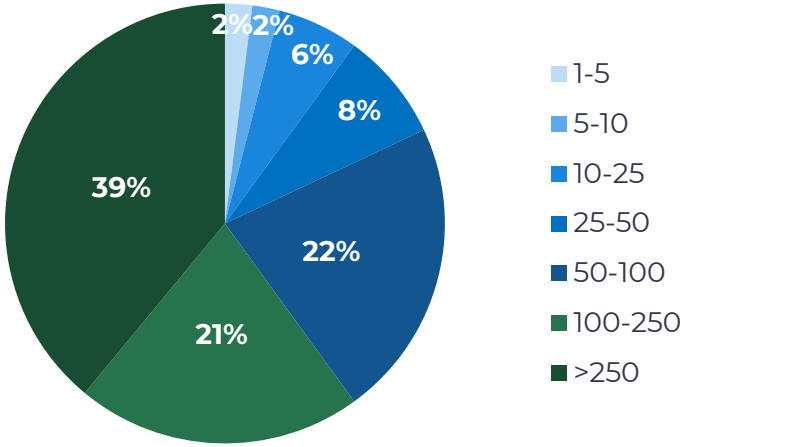
A detailed examination of the composition of the approximately **43,000** workers employed by companies producing at least one ICE-specific component predictably reveals a concentration of two-thirds in Piedmont and Lombardy. Analysing the 199 companies involved from a dimensional standpoint reveals that almost 40% of jobs are in companies with a turnover exceeding €250 million, confirming that the **most critical situations pertain to a limited number of companies**.

In terms of turnover, the 199 companies producing at least one specific component for IC vehicles had generated a total turnover of almost €11 billion by 2020.

GEOGRAPHICAL DISTRIBUTION OF WORKERS



TURNOVER (MILLIONS)



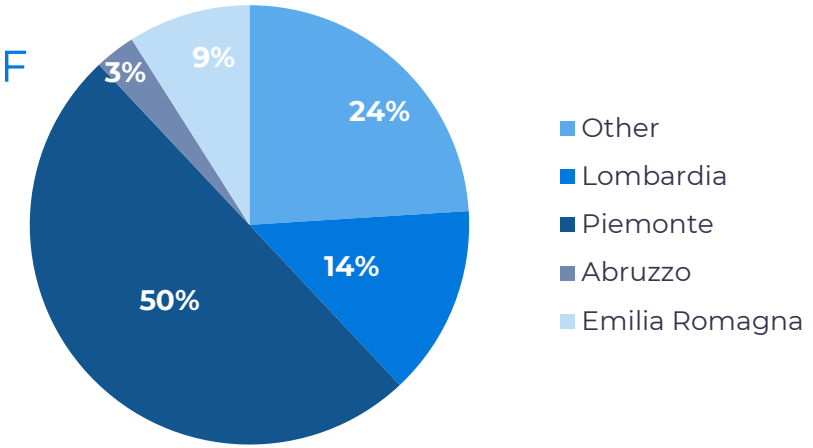
Source: data elaborated by Motus-E & CAMI

Half of the impacted jobs are in Piedmont...

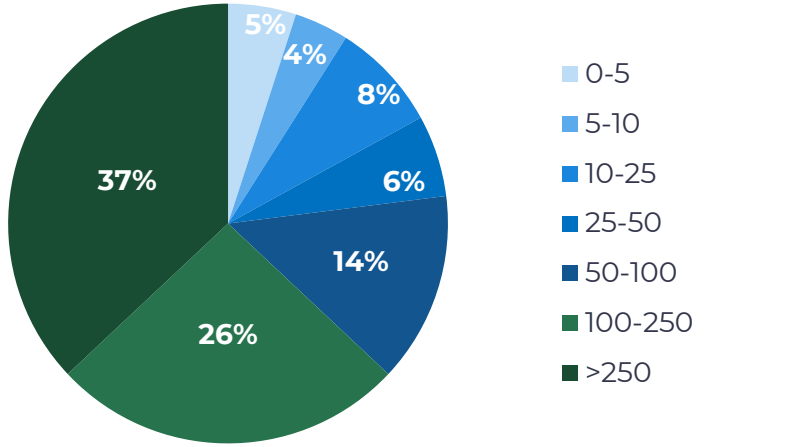
Drilling down further and analysing the **14,000 workers employed by companies operating entirely in the ICE segment**, we noted a sharp reduction in the concentration of workers impacted in Lombardy. This was offset by a more consistent increase in the remaining regions, and above all by **Piedmont, which accounts for half of the workers at risk**.

More than 60% of the at-risk employees in this perimeter are employed in companies with a turnover of more than €100 million; this distribution is very similar to that shown for the previous grouping, revealing a reduction only in the €50-100 million bracket.

GEOGRAPHICAL DISTRIBUTION OF WORKERS



TURNOVER (MILLIONS)



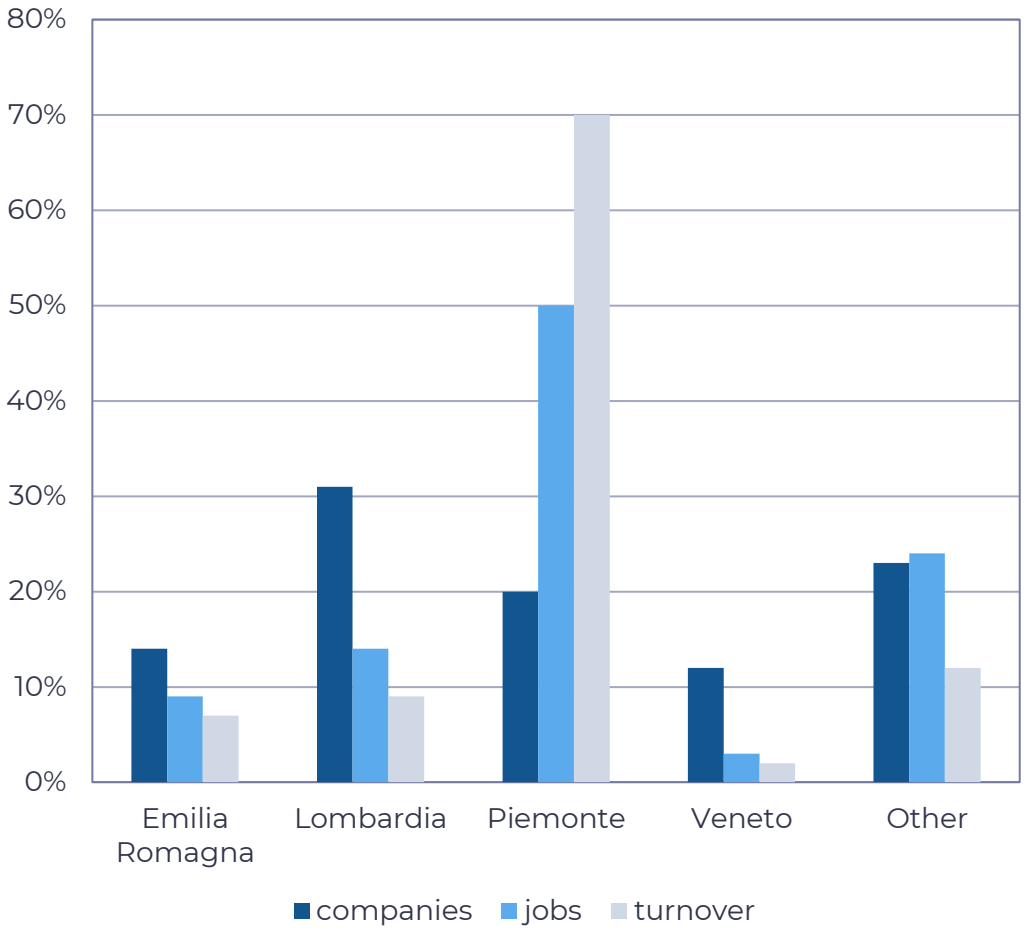
Source: data elaborated by Motus-E & CAMI

… where 70% of the turnover base is at risk

For the sake of completeness, we also **added the turnover data to the two dimensions already analysed, in order to highlight the types of companies impacted**. It is evident that the companies considered at risk in Piedmont, although numerically 30% fewer than those in Lombardy, generate 8 times more turnover with 3.5 times the number of employees of the latter.

Specifically, the Piedmont companies present the following characteristics:

19 at-risk companies
7,070 total employees
2.9 billions of turnover



Source: data elaborated by Motus-E & CAMI

New employment paradigms

Understanding the risks of a transition that most believe willchange the automotive sector more in the next 10 years than it did in its first 100, is a priority.

For an exhaustive picture of the future ecosystem, we must also **understand what all the future new developments will bring**.

In terms of jobs, this means understanding the positive effects engendered by this new technology, which will create **new supply chains** and give existing companies that have never worked in the automotive sector the opportunity to provide new goods or services.

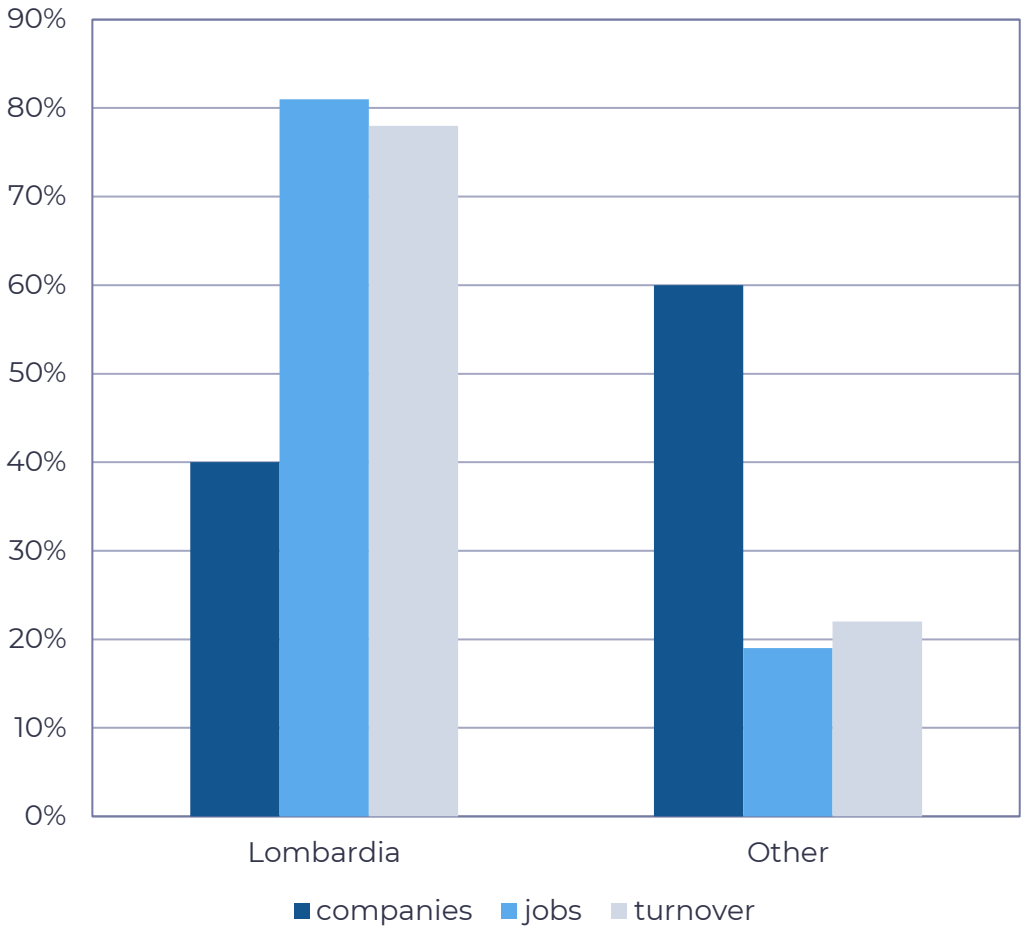
To this end, we analysed the pool of companies involved at various levels in e-mobility infrastructure. We then supplemented this data by also considering those **companies that already produce a specific good or service for electric vehicles.**.

Lombardy, driver of new enterprise

By supplementing the data of all the companies we had classified in the **infrastructure sub-sector** with the data of all the "traditional" automotive companies that today produce e-mobility goods or services, it emerged that these firms are very heavily concentrated within **Lombardy**, which, in terms of jobs and turnover, accounts for almost all of them.

43 companies
18,000 jobs

With **43 companies out of 107 and 18,000 workers**, at present this region is certainly the leader in transformation investment, far outstripping even regions with a traditional vocation for car manufacturing, such as Piedmont.



Source: data elaborated by Motus-E & CAMI

The importance of empirical analysis

Obviously, like the assessment of the companies at risk, our findings, albeit grounded in a rigorous analytical approach, can still be improved and further refined.

It would be advantageous to start with these findings and undertake **empirical analyses on real samples of companies** in order to understand, of all those that seem to have emerged to ride the electric transition bandwagon, which ones are really new and which ones have simply converted, totally or partially, to the production of new components.

To ensure results that are as robust as possible, such a study should be carried out with the cooperation of representatives from the companies concerned and should contain an understanding of their business models and strategies, their past investments and those they plan to make in the coming years.

The ensuing results would represent the flip side of the employment risk assessments, and they could be used to highlight success stories capable of inspiring other companies to embrace this change.

The pivotal role of batteries

One of the **key components** of electric vehicles, in terms of value and complexity, is certainly the **battery**.

The battery value chain is very complex, starting with the extraction of raw materials and ending with the assembly of the finished product. Gigafactories - industrial complexes that assemble core components for batteries - certainly play a central role in all these stages. **Gigafactories** require significant investments and, because of their crucial importance, their presence should not be concentrated only in certain areas of the globe.

Gigafactories require significant investments and, because of their crucial importance, their presence should not be concentrated only in certain areas of the globe. All the automotive manufacturers therefore agree that **having control of gigafactories close to production sites is strategically vital** to reduce the industrial risks associated with the supply of this critical component.

In terms of jobs, gigafactories require considerable numbers of **human resources with specific skills**. Hence, in order to most accurately convey the employment impact of the electric transition, we should also consider how many jobs will be created in Italy in connection with this new activity, both directly (employees in the gigafactories) and indirectly (battery assembly machinery, chemical components etc.).

Dozens of factories planned across Europe

EUROPEAN GIGAFACTORIES

At present, there are only a few gigafactories in operation outside of Asia, although several industrial groups are announcing the **construction of battery assembly plants in Europe**, including three in Italy.

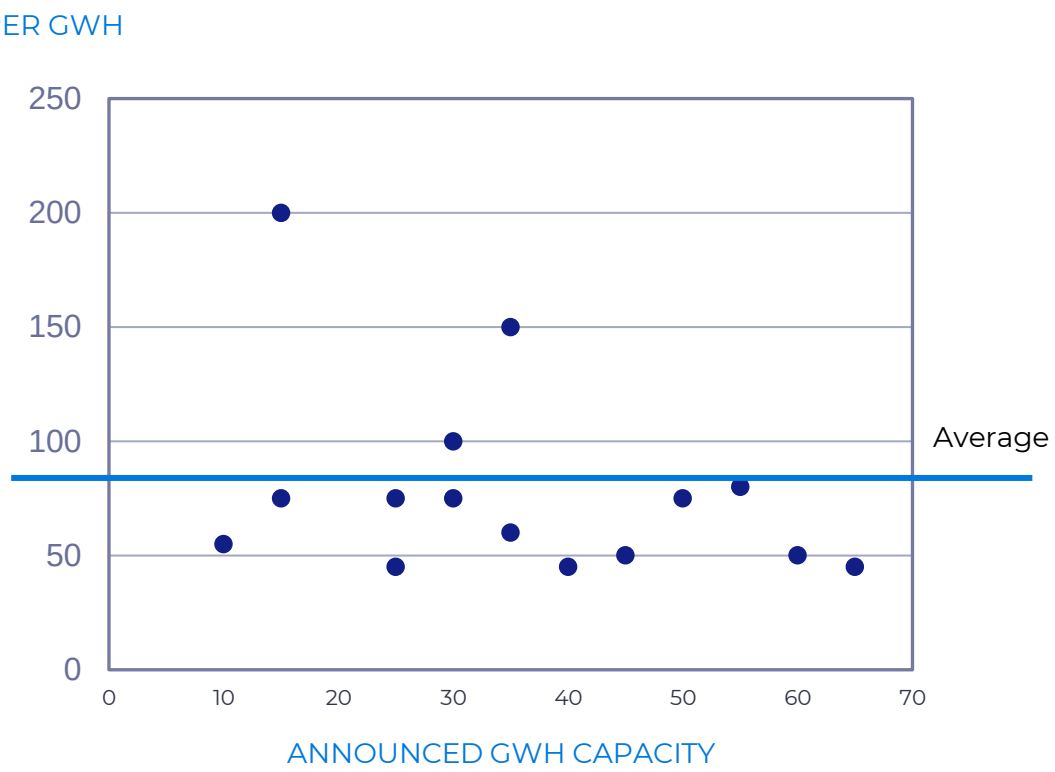
Figure: European gigafactories
Analysis by CIC energiGUE – 09.2022

Source: CIC energi GUNE

Gigafactories and their impact on jobs

Based on the various statements thus far and the knowledge of current announcements, we can collate employment data and draw some comparisons. Apart from a few cases, most of the findings reveal an average employment datum of between **40 and 100 employees per GWh of production**.

Matching these values with the declared production targets of the gigafactories planned for Italy - whose total estimated production when fully operational will be approximately 100 GWh, prudently keeping to the lower limit of jobs per GWh -indicates the potential for **at least 4,000 new direct jobs**.



Source: CIC Energi GUNE data elaborated by Motus-E

The battery – more complex than expected

When talking about electric vehicles, the battery is normally referred to as if it were a single elementary component. In reality, the **battery is an assembly of modules, each in turn composed of hundreds of cells**.

Module production involves diverse industrial stages, and these are frequently distributed among different countries separated by long distances. Breaking down production costs reveals that almost 50% is concentrated in the cathode alone, which determines the power and capacity of the battery. Decreasing in order of importance, we have the production phases related to the module, the anode, the separators, the electrolyte and, lastly, the metal structure, which houses the entire battery pack.

It is evident, therefore, how **streamlined procurement** of the raw materials necessary for cathode production is essential to having control over battery costs. These materials (many of which are critical) have historically been obtained from mines, mainly in African or South American countries, although deposits have also been found in Europe.

Source: https://www.visualcapitalist.com/breaking-down-the-cost-of-an-ev-battery-cell/

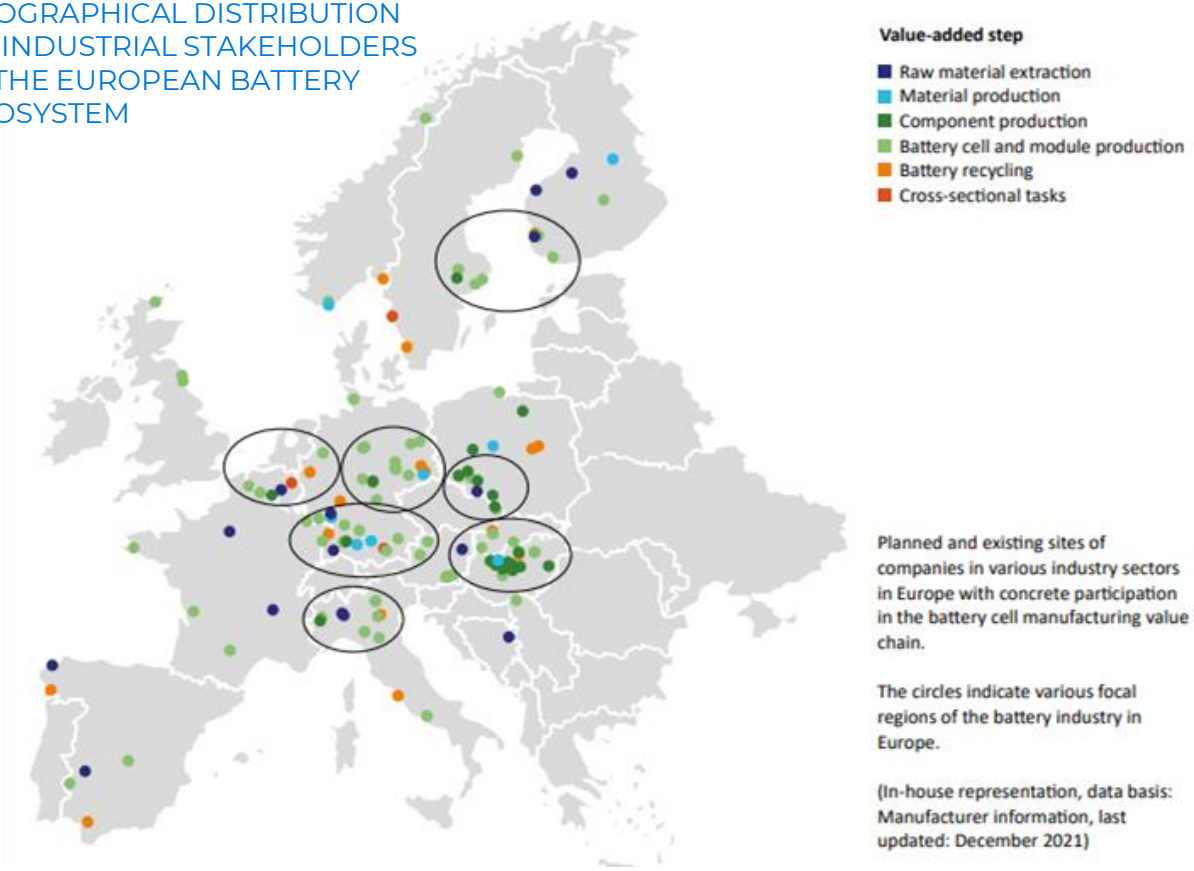
The battery supply chain, upstream and downstream

Historically, the battery supply chain has been **concentrated in Asia**, where large companies own and process the raw materials.

In Europe, however, the necessary raw materials are present, albeit to a lesser extent than in other countries, and there is certainly the expertise to process and recycle them.

The challenge for the future will therefore be to mine the materials sustainably, so that **an integrated battery supply chain can be established in Europe**, covering the battery's entire life cycle up to recycling, which will be crucial for the recovery of such valuable materials.

GEOGRAPHICAL DISTRIBUTION OF INDUSTRIAL STAKEHOLDERS IN THE EUROPEAN BATTERY ECOSYSTEM



Source: The importance of regional value creation structures in the battery industry - VDI/VDE Innovation + Technik GmbH - 2022

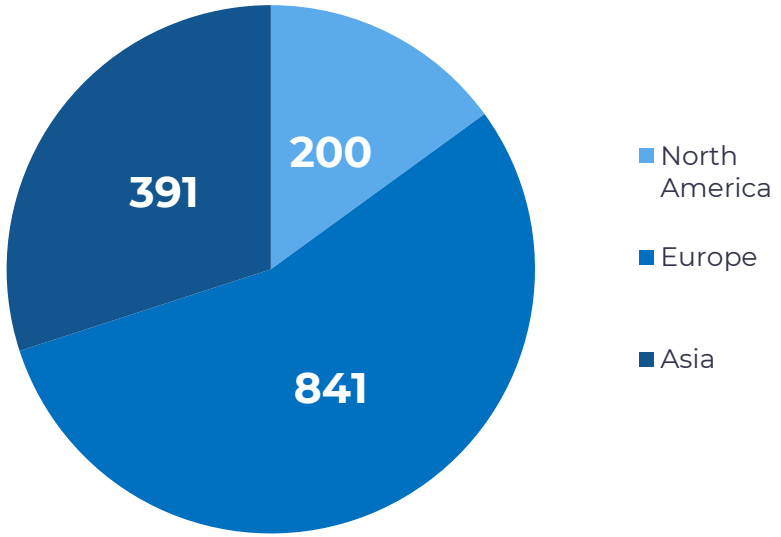
The growth of gigafactories in Europe

Although technically possible in terms of resources and expertise, the creation of an integrated European battery supply chain is not immediately feasible.

However, looking at a shorter time horizon, it is noteworthy that even the Asian industries with the largest market shares are already setting up battery production plants in Europe, or have expressed the intention to do so. This is certainly of relevance for employment and challenges the narrative which claims that the turnover- and employment-related value of the e-vehicle industry is concentrated outside Europe.

In this regard, it is also important to note that **60% of the planned battery production in Europe is accounted for by companies with a European parent company.**

HOME COUNTRIES OF COMPANIES COMMITTED TO SETTING UP BATTERY PRODUCTION FACILITIES IN THE EU (DIMENSIONS IN GWh)



Source: Battery Atlas 2022 - SHAPING THE EUROPEAN LITHIUM-ION BATTERY INDUSTRY - Heiner Heimes (editor), 1st edition

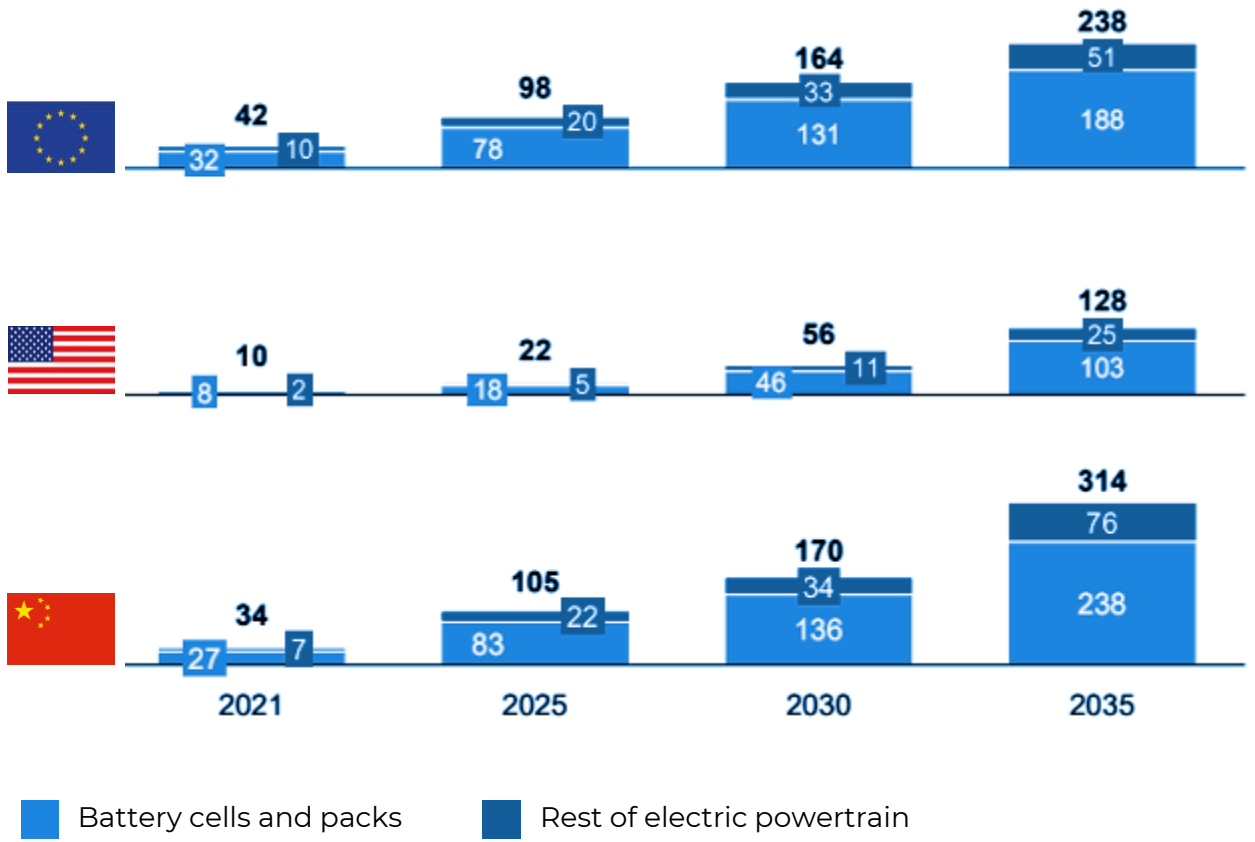
What revenue levels can we expect?

It is certainly not an easy exercise to speculate on what revenues the battery supply chain might generate, especially in a context of great technological change and geopolitical instability.

We can refer to the latest version of the **Digital Auto Report by Strategy&**, which points to a major increase in revenues from the electric powertrain and batteries between now and 2035. It is clear that in **Europe** we expect to see a marked development of this market, and **revenues almost double those of the USA, with around 80% of them concentrated in batteries**.

Obviously, these projections may change radically as a result of actions taken by individual countries to attract foreign investment, such as the US Inflation Reduction Act.

POTENTIAL REVENUES ($ BILLION)



Source: Strategy& - Digital Auto Report 2021/22, accelerating towards the "New Normal"

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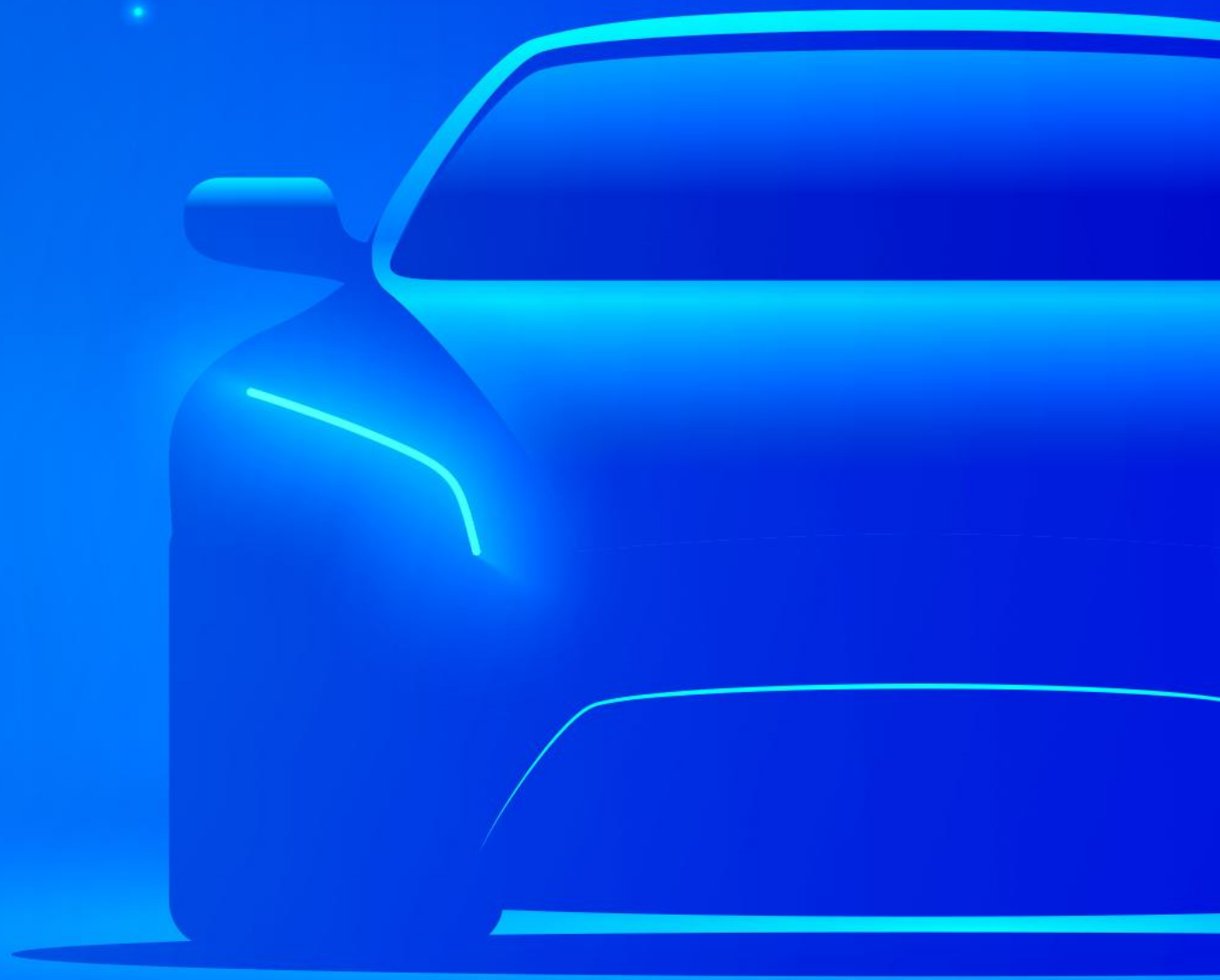
Scenarios up to 2030



Predicting 2030 scenarios

Having defined the methodology and analysed the current scenario based on the findings from our database, we proceeded to develop scenarios to calculate the impact on employment.

In order to isolate the effect of the electric transition on jobs in the Italian automotive industry and render the study comparable to other studies in the field, we used prediction data to 2030 from the IHS Markit/S&P **BCG report**:

-42%
+10%
ICE jobs will decrease by about **42%**, **non-ICE** jobs will increase by about **10%** including the risk of market contraction and technological automation;

-4%
-8%
European production will fall by 4% and **sales** by 8%;

59%
The share **of BEVs produced in Europe** will be **59%**.

We supplemented these assumptions with hypotheses applied to the results extracted from the database:

- Multi-component companies (ICE and BEV) equally split their **workforce** between the products in their portfolios;
- The greater the number of ICE components, the greater the company's risk;
- **Italian suppliers** will maintain the **same exposure to the European supply chain**;
- Changes in employment in the **infrastructure and energy** sector are not taken into account.

Source: Boston Consulting Group – E-mobility: A green boost for European automotive jobs?

Predicting 2030 scenarios

PRODUCTION	RISK	2020	RESPONSIVENESS	2030	CHANGE
ICE	High	**14,139**	-42%	**8,285**	-41%
ICE + BEV	Medium	**9,893**	-42%	**7,863**	-21%
	Low	**10,883**	-42%	**10,232**	-6%
	Negligible	**8,596**	+10%	**7,729**	-10%
BEV	Non-existent	**214,998**	+10%	**239,819**	+11%*

Workers producing components: **exclusive to ICE** **common to ICE & BEV or exclusively for BEV**

* A further 1% increase due to the increased growth of new components:

Predicting 2030 scenarios

It is quite evident that, in line with current market variables, **the impact on jobs attributable to the e-transition is not a negative one**. This is due to the low number of workers employed by companies whose production is totally dedicated to the ICE powertrain. A responsiveness of -42% on jobs dedicated to the production of ICE-only components is more than compensated for by the 10% increase relative to workers employed to produce parts that are compatible with, or exclusively designed for EVs.

For simplicity, we have not included the **positive contribution of jobs in the infrastructure and energy sector**, which according to BCG data will see an increase of 30% by 2030, with the creation of about 7,000 new jobs.

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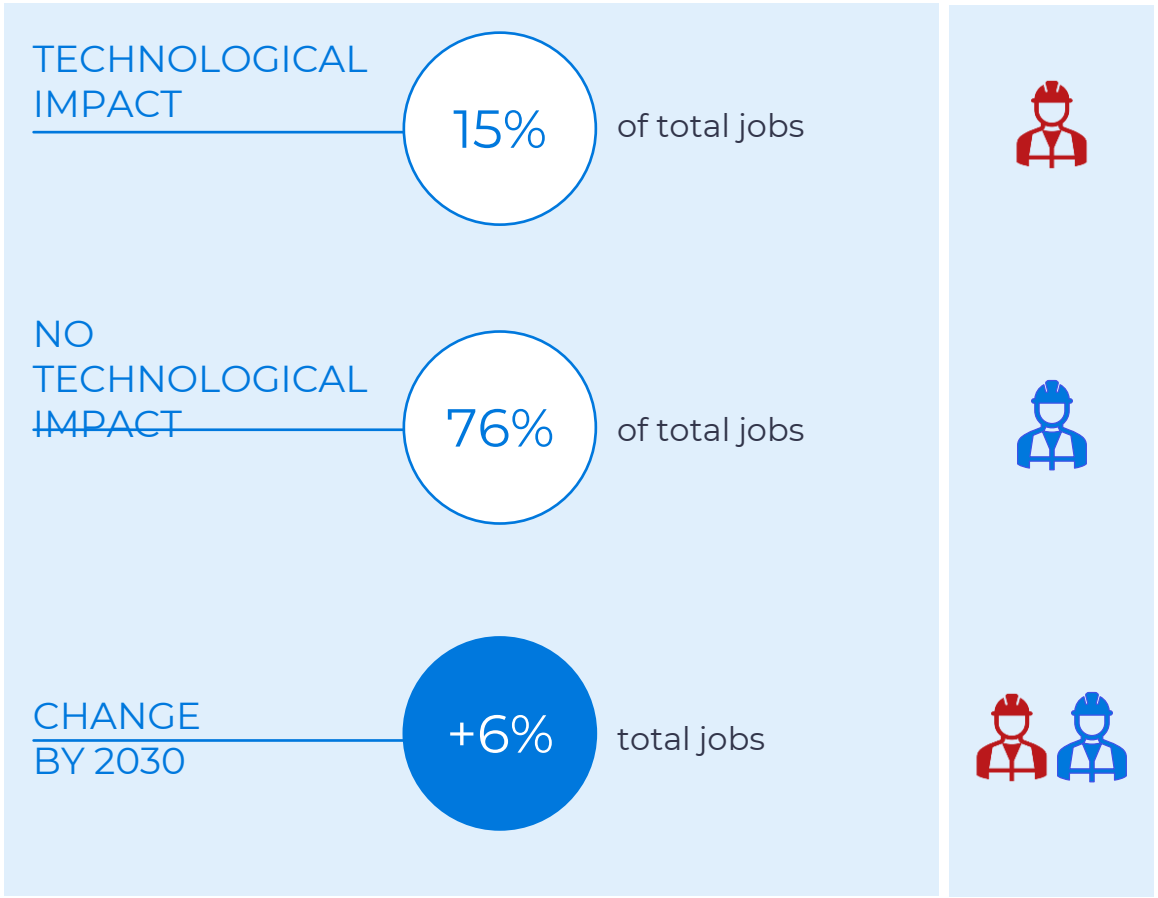


We must address two types of impact...

Apart from the net employment balance, in our view what is of most interest is to highlight how the companies analysed can be divided into **two groups according to the type of immediate impact** they will face:

TECHNOLOGICAL IMPACT

The greater a company's exposure to the production of IC vehicle components, the more it is subject to negative employment impacts should it fail to cope effectively with the transition to new technologies;

IMPACT ON COMPETITIVENESS

The more a company is exposed to the production of dedicated or compatible components for electric vehicles, the more it will be exposed to negative employment impacts if there is a decline in European production and demand and/or there is a rise in competition from foreign competitors.

Obviously, only in borderline cases will a company be exposed to only one of these risks, and in most cases, there will be a combination of the two; however, this does not affect the **need to address them separately and with dedicated actions**.

… and understand how to mitigate them

Companies most exposed to a technological impact should be prioritised when it comes to in-depth analysis aimed at understanding **the necessary actions for a conversion** to new lines of production. Some of the focal points could be, for example:

- Precise analysis of the number of workers;
- Analysis of the average age in the workforce;
- Analysis of workforce skills and support for reskilling;
- Analysis of company assets;
- Ideas for industrial transition to new production;
- How to facilitate the use of support policies.

The goal of this in-depth study is to **understand the re-utilisation potential of the factors of production owned by companies in the automotive supply chain of the future**, in order to define the transformation actions that each high-risk company will have to put in place to effectively exploit the industrial opportunities of the technological transformation.

On the other hand, companies that are already more heavily involved in the production of components dedicated to, or compatible with EVs will primarily be impacted by **changes in market dynamics**. In this context, we believe it is crucial to focus on:

- Supporting dimensional growth;
- Supporting the creation of industrial districts;
- Supporting internationalisation;
- Supporting research and development;
- How to facilitate the use of support policies.

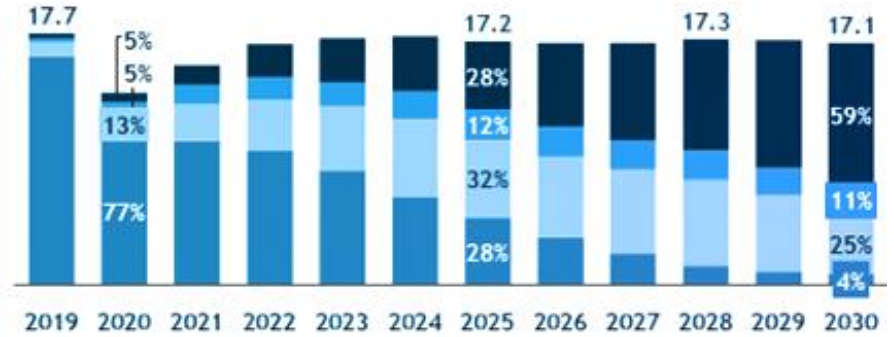
For this type of enterprise, it is crucial that the state help to **create the necessary conditions for competitiveness in the European context** by aiding their development.

The future market is influencing today's decisions

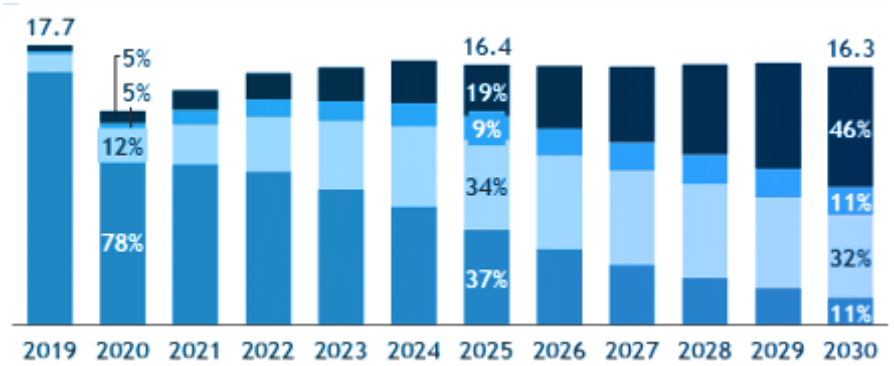
Regardless of the impact considered, the BCG data clearly shows how the **evolution of the market in terms of production and sales is paramount**.

By the time the **2030** scenarios materialise, **EVs will account for almost 50% of sales and production at European level**; it is thus crucial to start creating the conditions today that will enable Italian companies to meet the demand that this technological change will entail. If, on the one hand, we can imagine the entire component supply chain at the service of OEMs, on the other hand, we must not ignore the specific issues posed by after-sales services such as maintenance, the end-of-life management of batteries and their recycling.

VEHICLE PRODUCTION (Millions of cars)



VEHICLE SALES (Millions of cars)



Fully electric cars
Plug-in electric cars
Hybrid electric cars
ICE cars

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Recommendations and next steps

Recommendations

1/2

During the preparation of this study, we had numerous discussions with both industrial and institutional stakeholders and this helped us to focus on the major critical issues that are currently slowing down the transition. We thus wanted to briefly mention a **few topics that we consider to be of key importance**, while also proposing suggestions and actions that we believe can help us to seize all the opportunities of this change.

Undoubtedly, the most precise knowledge possible of the ecosystem is crucial to the implementation of effective actions which, at the political level, cannot ignore the contribution obtainable from the European Community.

KNOWLEDGE OF THE SUPPLY CHAIN

- **Mapping the automotive ecosystem** to understand the risks and opportunities at company and worker level;
- Quantifying the use of **support tools**;
- Learning about initiatives by **universities and research centres** working on e-mobility.

EUROPEAN POLICY

- Preferential allocation to Italy of the **Just Transition Fund**;
- Extending the **temporary framework** to operate in derogation of state aid rules;
- Removing **territorial constraints** on European state aid to support also industrialised regions in need of conversion;
- Creating a **re-shoring policy for currently delocalised supply chains**.

Recommendations

2/2

As important as it is to act at EU level, with the aim of achieving greater flexibility in the use of funds, reducing existing restrictions on their use and boosting actions that attract non-EU investments, it is equally important to act at national level. Therefore, a **review of existing support schemes must be undertaken with a view to facilitating their use and, above all, supporting small companies in accessing them.**

At the same time, it is imperative to provide policymakers with tools that highlight the skills required for this transition and, consequently, take actions to revise existing training courses and create the conditions for attracting skills from abroad.

SUPPORT SCHEMES

- Simplify access to **Development Contracts** by rewarding intercompany collaboration projects;
- Revise the tendering rules for **Innovation Agreements** by giving more weight to the quality of projects;
- Create a **permanent panel** that includes all stakeholders and gives strong support to companies by steering them towards transformation;
- Review aid in the form of **tax credits**, which are often unattractive to small companies that are not yet significant taxpayers.

TRAINING AND SKILLS

- Update the **skills database** in the light of new technologies;
- Offer incentives to companies funding **industrial PhDs** on electric mobility;
- Involve technical colleges and vocational schools in **re-skilling** activities;
- Incentivise the **return to Italy of Italian experts** employed abroad and make it attractive for foreign experts to work in Italian industries.

The future of this study and the next steps

The main aim of this report is not to precisely quantify the employment impact that the phase-out of ICE vehicles will entail. The priority goal we have set ourselves is to define a **reliable and shared method** that lays the foundations for a much more ambitious project.

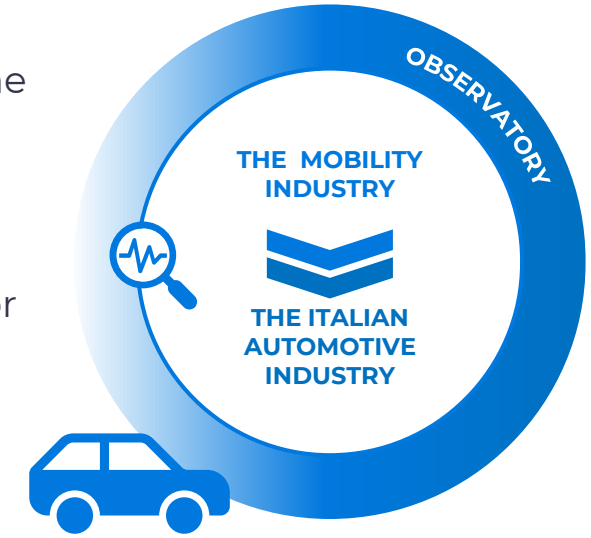
These results, although significant in their own right, can be improved by **extending the analysis to all the supply chains not yet considered** and by directly involving the companies surveyed, through interviews.

To make full use of the work done so far and, at the same time allocate the necessary resources to manage future research, we have set up an **Observatory** with the aim of producing scientific evidence on the impact that the current transition in the mobility industry will have on the structure of Italy's automotive industry and its evolution.

OBSERVATORY ON THE TRANSFORMATIONS OF THE ITALIAN AUTOMOTIVE ECOSYSTEM

The Observatory, whose founders are Motus-E and CAMI of the Ca' Foscari University of Venice, starting from the findings of this report and having access to the developed database, will **expand the scope of the research from a qualitative and quantitative perspective**. The first activities will be aimed at enriching the database:

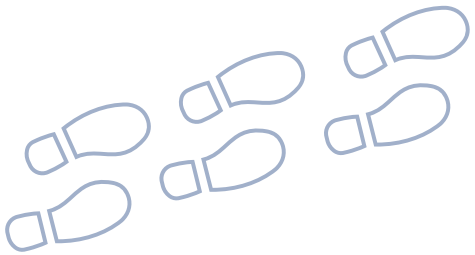
- Increasing the number of companies operating in the infrastructure sector;
- Increasing the number of companies producing components exclusively for EVs.



The future of this study and the next steps

After increasing the number of companies surveyed in these two sectors of the database, it will be important, **through direct contact with the companies**, to obtain detailed information on:

- **Distribution** of personnel across the various production areas;
- **Average age** of personnel dedicated to the various productions;
- **Skills** possessed by the personnel;
- **Allocation of turnover** across the various production areas;
- **Research and development projects** planned for the future.



The Observatory will focus on **broadening the scope of the database to include companies from automotive-related supply chains** working in manufacturing and services, such as

- OEMs;
- Bus and truck manufacturers;
- Industrial machinery companies;
- Chemical supply chain companies;
- Two-wheeler and soft mobility companies;
- After-sales companies;
- Infrastructure installation companies;
- Recycling companies.

These actions will enable us on the one hand to **enhance the quality of the data extracted** and on the other, to broaden the scope and produce increasingly comprehensive results.

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