LUISS

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Chair of Managerial Decision Making

# Made in China 2025

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**MADE IN CHINA 2025**

## Introduction: The path to Made in China

*"It does not matter whether the cat is black or white, as long as it catches mice"*.

This is how the main leader Deng Xiaoping speaks to Chinese people in 1978. On the background there is one of the poorest and most backward countries of the world, emerging from a decade of extreme poverty: the income per capita reaches the equivalent of $150 per year, and has grown by only 2.3% per year over the past 30 years.

With a series of structural reforms Xiaoping wants to give a direction to the Chinese people, who are struggling to find a way to face the new industrial world (Shenggen Fan, 2000). The result was that if in the 1970 food production and suppliers were insufficient to support a population of over 965 million of inhabitants, at the beginning of 2012, the People's Republic of China becomes the number one leader in the manufacturing operations and the second strongest economic power in the world (Li, The path to Made-in-China: How this was done and future prospects, 2013).

China has succeeded in making one of the most significant manufacturing miracles since the industrial revolution began in Great Britain in the eighteenth century, to the point that in the country was produced 90% of computers around the world, 70% of mobile phones, 80% of energy-saving lamps and air conditioners (chinadaily.com.cn, 2015).

Towards the end of the 70s the goal was to emerge from a resounding poverty and improve the general condition of the country, but now, as a result of deep changes and at the peak of the fourth industrial revolution, challenges and opportunities have dramatically increased. Global industry is undergoing an epochal change due to an unprecedented technological revolution.

The use of big data, the internet of things, cloud computing, intelligent machines and modern communication are interweaving more and more with industrial production and in this new dimension governments and industries are aware that this innovation reality is rewriting the dynamics of the global market.

The challenge for China is to transform the industry from a labor-intensive production to an intensive manufacturing that integrates all the features above, managing to become competitive worldwide (Xu, Xu, & Li, 2018).
In this scenario the Party and leader Xi Jinping himself intends to achieve an audacious goal: become a global leader in manufacturing high quality and high-tech products and substitute Chinese technology for foreign versions on domestic and global markets, all this, by the first half of the 21st century, through the "MIC25" plan.

The extraordinariness of the nature of the program resides in the name itself.
The perception that comes to mind hearing about “Made in China” is in fact a mass product, often relatively cheap, that is not associated with high quality: there is an effective consistent need for Chinese manufacturer to improve the product quality over almost all product lines (Marc J. Schniederjans, 2004).
In this regard through "MIC25" there’s the opportunity to innovate the entire manufacturing industry, acquiring the ability to create highly innovative products, build internationally well-known high quality brand, thus re-evaluating the image of Made in China, by conferring quality and luster, reinforcing the perception of Chinese products.

The strategy defines, as stated in the official document of European Chamber “China Manufacturing 2025”, putting industry policy ahead of market forces”, ten high-tech core industries targets that strongly contribute to economic growth in advanced economies: next-generation IT, Biomedicine & high-performance medical equipment, new materials, telecommunication equipment, high end computerized machine & robots, aviation & space equipment, maritime engineering equipment & high tech ships, advanced railway transportation equipment, energy savings & new energy vehicles, energy equipment.

The aim of the thesis is to analyze specifically the plan of the Chinese government, understand its margins of feasibility, strategies, factors that can and cannot contribute to the success of the Leader Xi Jinping, taking into account the results obtained five years after the announcement of the plan. The analysis also revolves around the measures taken by the Chinese government, which with the use of a top down strategy, is the real driver behind the development of the project. There will also be a focus on the effects that the plan has had

worldwide, as other countries have welcomed this ambitious project and what are the countermeasures that have taken the major powers worldwide.

# 1 – MADE IN CHINA 2025: FACTORS INVOLVED

The analysis of MIC25 must start by taking into consideration the factors behind the project. The first step is to understand the scope and nature of smart manufacturing, the core factor for the development of the plan. Next, the analysis will identify the main drivers behind the implementation and possibly the success of the plan, analyzing the characteristics and above all, the impact they had from 2002 to the present, making a forecast on future developments of the plan. Finally, the analysis will consider the biggest difference that the Chinese industrial revolution has with the rest of the world: the central role of politics.

## 1.1 - Smart Manufacturing

The realization of the "China Dream" and therefore the achievement of resulting goals revolve around "smart manufacturing". But could its correct application really be so impactful?

The S.M., as well as the internet of things and industry 4.0 is not something that can be learned and involved into the production process. It is in fact about a series of technological features such as automation and digitization, which combined, affect the organization and industrial production. The scale and the great impact they may have is justified by the fact that it is in all respects an industrial revolution: in the past the great technological innovations have always led to a complete reversal of the market structure, causing radical changes in the global economy. Mckinsey has predicted that by 2025, IoT applications could have 11$ trillion total impact (Manyika & Chui, 2015).

Specifically, smart manufacturing means a production characterized by the interconnection between machines, people and data. The data returned by the machines are used and analyzed to optimize energy consumption and production processes. This type of production, much more complex, was born with the need to adapt to the extremely dynamic nature of the market,

allowing industries to respond quickly to market demands, adopting an approach no longer predictive, but reactive (Davis, 2012).

The outcomes for smart manufacturing are many and fully justify their implementation in industries around the world. The effective application of a smart and virtual plants allows companies to acquire agility in the production process, allowing to intervene easily on the production process and consequently to respond quickly to changes in customer demand. Another important benefit is the resource efficiency. Smart processes allow to accurately identify energy consumption, facilitating predictive maintenance in order to reduce waste and production errors, allowing businesses to runway more efficiently in terms of time and money. This in turn leads to a minimization of environmental impact, improving sustainability in the sectors considered most critical. Additional benefits include reduced maintenance costs, improved safety and traceability and, above all, the emergence of a new manufacturing workforce with different and advanced skills (SMLC, 2011).

It is therefore clear that industry 4.0 has reshaped the competition for manufacturing leadership. If before the competitive advantage could have been obtained with unskilled low-cost labor and quantity-focused production, now to achieve the global leadership the prerogatives are changed.

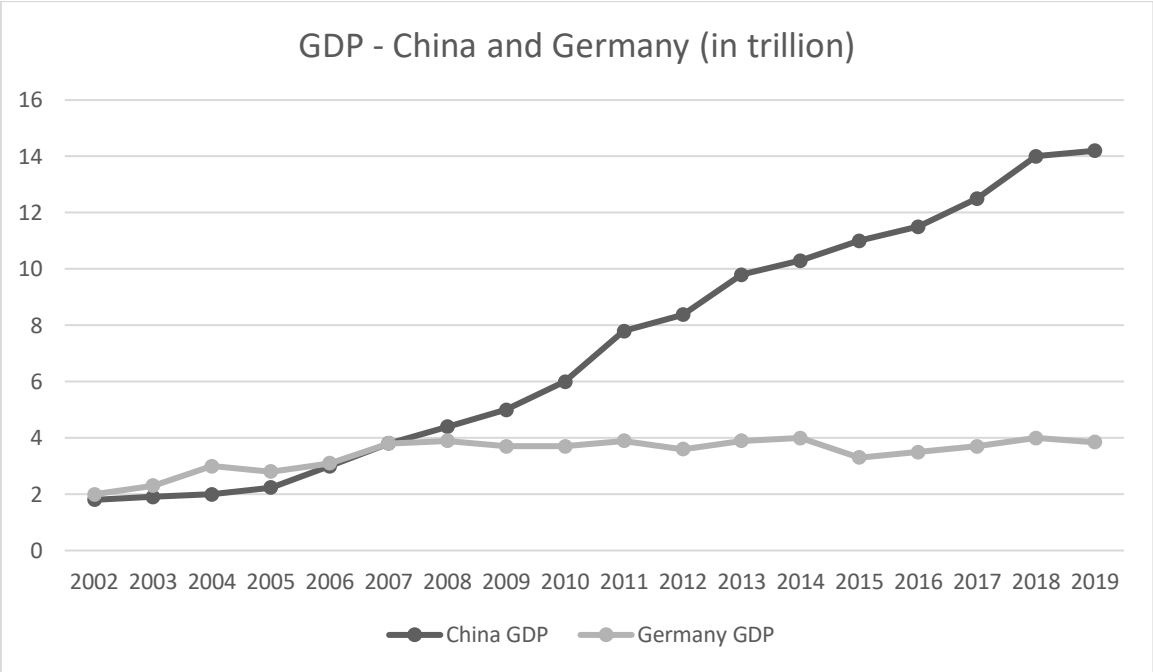
Manufacturing capability remains one of the fundamental aspects, but major investments in R&D are increasingly assuming importance in order to maintain high technological competence, the same goes for the high presence of FDI and especially for the training of skilled workers. With regard to this last point, most of the manufacturing executives are of the opinion that a skilled workforce is the most critical driver in the production process, to the point of being evaluated 20 points higher than any other driver: a team of highly skilled workers would appear to affect more than labor, energy or material costs. It is also true that even the most advanced countries report a shortage of qualified employees, since the education must be reshaped in order to match the skills and features requested by the new manufacturing era (Nosbusch & Wince-Smith, 2011).

## 1.2 – Critical Drivers

Chinese plan assumes much more shades considering that the goal is not only to create a "made in China", but, following Germany and US experience in the past, is the creation of a "designed and innovated in China". Building a solid manufacturing capability through the technological development becomes therefore necessary for Xi Jinping and in this sense, according to this thesis, the fundamental drivers that could mark the success are the manufacturing capability, the R&D investments and the human capital. The reason for this choice lies on the fact that these are the quantities to consider for a successful implementation of the plan. At the basis of a smart manufacturing production in fact, there is primarily the ability of the country to produce both for domestic demand and for the foreign market. Next, it is clearly very important to have an advanced technological level, possible thanks to adequate R&D, and finally, to be able to manage these new skills, highly skilled workers are strongly needed. Through the data and information found on World Bank Data, STATISTA and China's National Bureau of Statistic, it is possible to assess how these factors have so far influenced the development of the MIC and how they could in the future guide the project (Li, China's manufacturing locus in 2025: With a comparison of"Made-in-China2025"and"Industry 4.0", 2018).

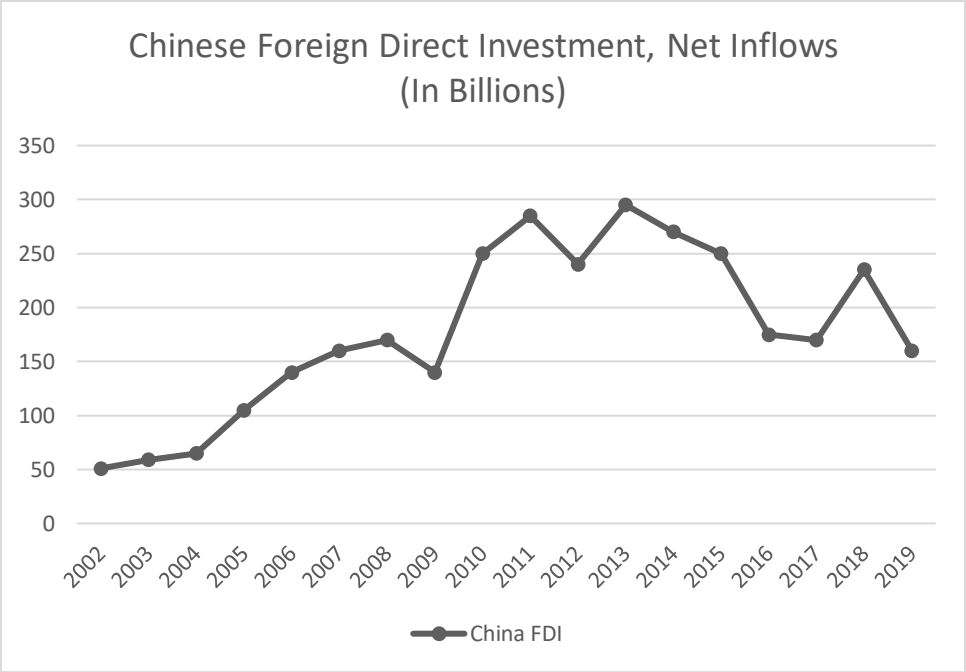
- Manufacturing capability is the first important driver to consider. A country that has a good production capacity starts in an advantageous position in the world scenario and China in this sense is the global leader. A high capability alone is not enough since it is necessary to integrate it with smart processes. Three items are included in manufacturing capability: GDP, Foreign direct investment net flow and high technology exports.

GDP is an appropriate and universally recognized measure to assess a Country economic performance. It follows logically that a high GDP indicates a healthy economy and therefore a strong manufacturing capability. In 2006 the Chinese GDP was the same value as Germany, in 2008 was $4.5 trillion, in 2019 is $14.2 trillion, almost 5 times the German one and is continuously increasing (Tab. 1).

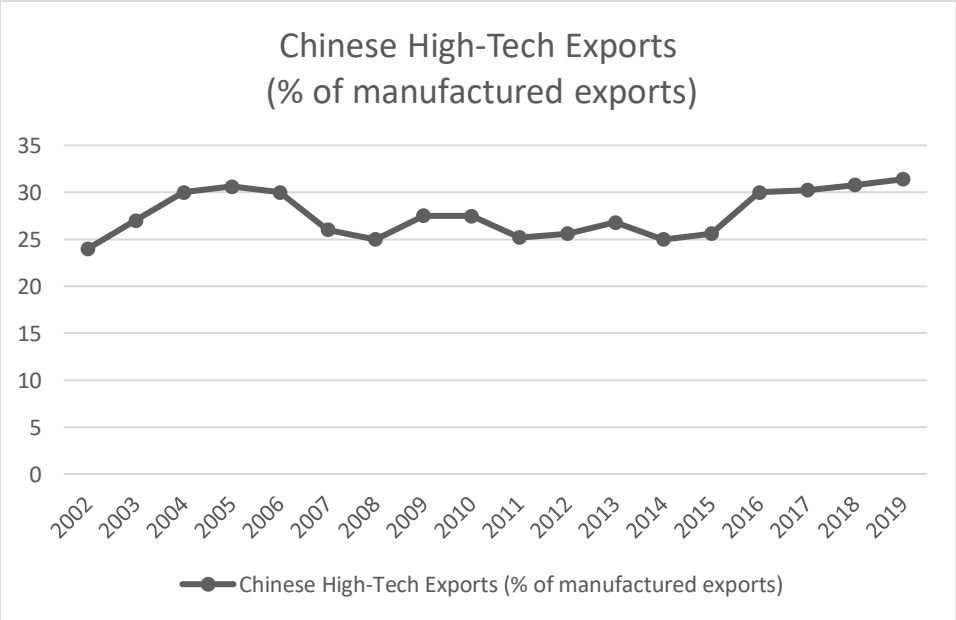



Tab. 1 – Source: (The World Bank Data)

On the other hand, the analysis of FDI performance shows that there was an exponential increase from 2002 to 2013, which has progressively decreased since 2015 to date (the only exception being 2018), which is the implementation period of MIC 2025, indicating a slight abound of foreign investors from the Chinese market (Tab. 2). The reason for this could be the reaction of the major world powers to the announcement of the ambitious Chinese plan, but the result is that China had to rely on its own investments, especially on its huge domestic consumption. This has inevitably led to a technological development that has contributed in turn to increase from 2015 to date the percentage of high technology exports from 30 to 31.5% (Tab. 3). Ultimately, we can without doubts conclude that the first driver, namely manufacturing capability, is a factor that could affect positively the Chinese plan (Li, 2018); (The World Bank Data).



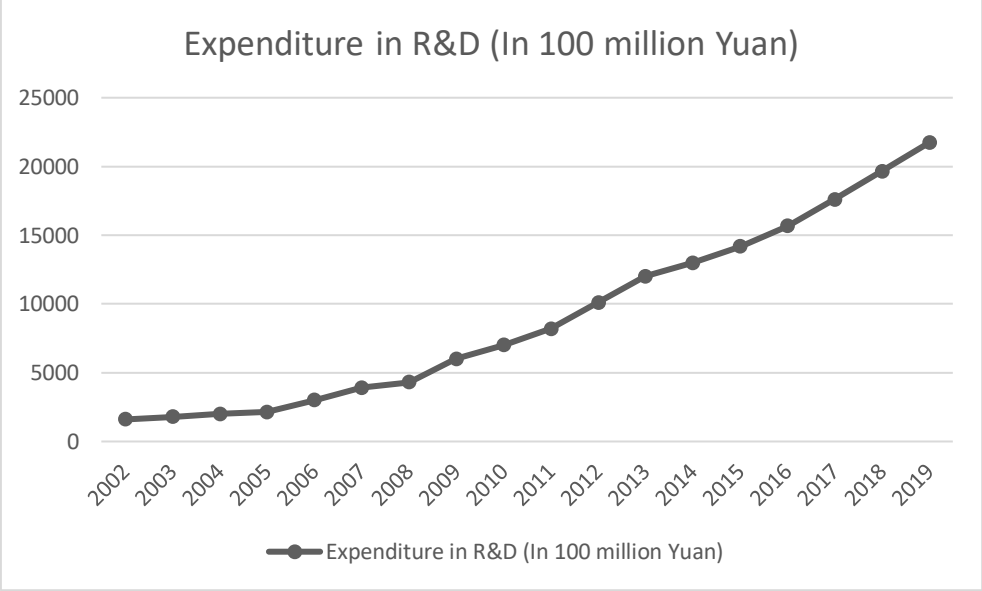

Tab. 2 – Source: (The World Bank Data)




Tab. 3 – Source: (The World Bank Data)

- The innovative development mentioned above is the obvious result of a very strong increase in the R&D expenditure. The investment was carried out in an extremely thoughtful way, as it is a 360-degree research, that covers from the basic research to the applied research and

experimental development. Only in 2019, China has spent about 21.7 million Yuan in research (Tab. 4). All this indicates a huge change in the Chinese managerial decision making process, since it is increasingly moving away from low-cost production with low technological content, in favor of a tech-production oriented approach that has the aim to create “made in China” brands recognized for their quality and innovation all over the world. Such a dramatic increase in R&D investment is perfectly in line with the MIC2025 since innovation is the real key to achieving global leadership (Internal R&D spending in China 2009-2019, 2020); (China National Bureau of Statistics). It should be mentioned that it is thanks to this strategy that China has succeeded since 1978 in excelling not only in industries with a high production rate such as footwear, but also in more advanced industries such as personal computers and electronic items, being also able to succeed in significantly improving certain realities such as that of the textile industry. The case in question could be represented by "Esquel Group", a textile company that offers innovative and sustainable solutions to create premium cotton shorts (Esquel Group). All those things indicate that R&D is a fundamental factor for the implementation of the plan, and China is moving in the right direction.

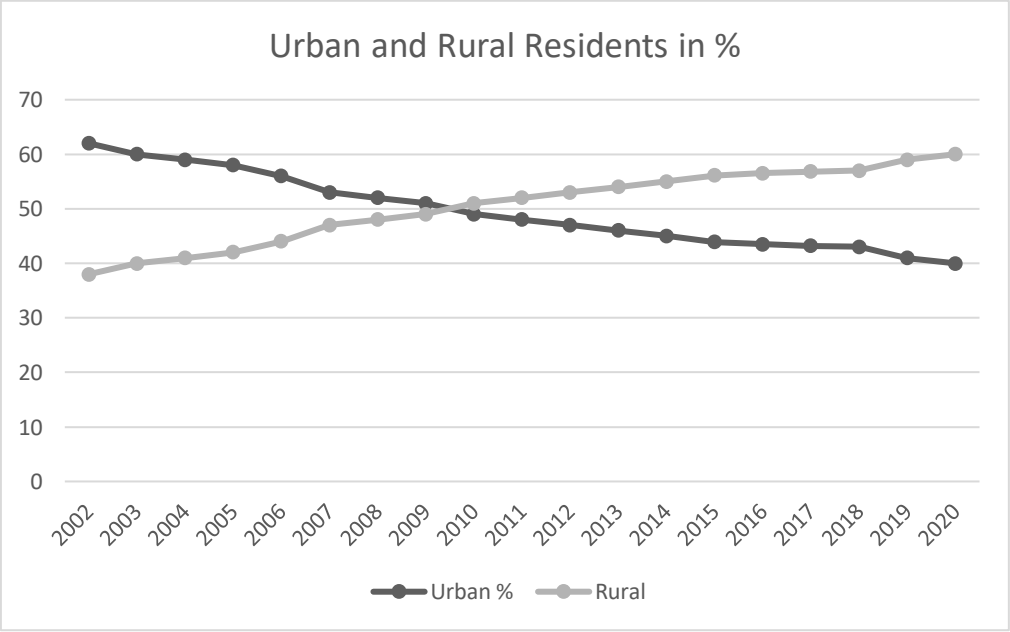



Tab. 4 – Source: (Internal R&D spending in China 2009-2019, 2020)

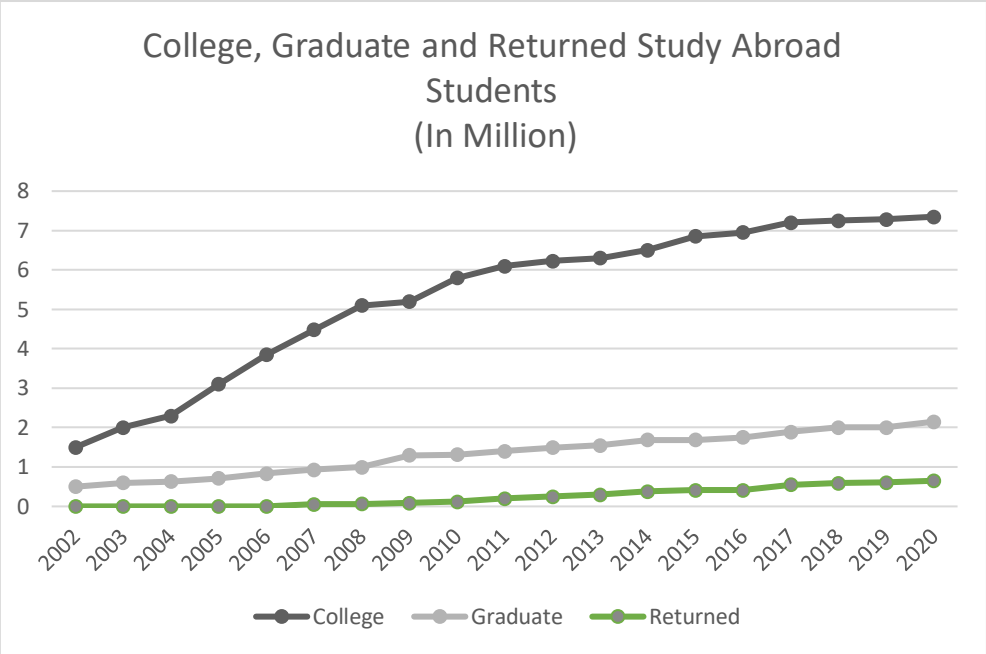
- The most interesting driver is the human capital. As previously mentioned, the search for talent, that is the highly specialized worker, is considered the crucial point for the achievement

of global manufacturing leadership. The analysis in this case must start from the percentage of urban and rural residents, which, since the beginning of 2000, has seen a drastic increase in urban percentage and at the same time a decrease in rural one. This data is very interesting considering that before 2002 a high rural percentage (Tab. 5) (China National Bureau of Statistics), which indicates a major source of low-cost labor, allowed the Chinese economy to support an incessant and inexpensive mass production. In recent years, however, with the advent of Industry 4.0 the picture has turned upside down. Cheap labor is quickly replaced by machines, while specialized profiles are constantly in demand, and it is therefore crucial for China to decrease the proportion of rural residents in favor of urban ones.

Another factor to consider is the number of students completing a more complex education path. The only way to create a generation of talent is in fact to implement the average level of education, and in this sense, the number of college students is constantly increasing in 2020 (Tab. 6). Another important statistical data for China is the increasing number of abroad students returning home, considered a fundamental resource since they allow to integrate business models and skills acquired worldwide. (Li, China's manufacturing locus in 2025: With a comparison of“Made-in-China2025”and“Industry 4.0”, 2018); (China National Bureau of Statistics).




Tab. 5 – Source: (China National Bureau of Statistics)




Tab. 6 – Source: (China National Bureau of Statistics)

### 1.3 – Politics: the main Driver behind MIC25

Behind the successes of Chinese development in recent years there are not the initiatives of companies, but the Chinese Communist Party. The implementation of the "MIC25" is in fact strongly led by the CCP, which must ensure the success of the plan to assure the Chinese economic well-being and consequently to continue to legitimize its position in the country. Since 2015, when the plan was announced, the party has faced numerous challenges and changed the direction of the strategy several times, however, the biggest challenges are mainly two.

Historically Chinese people had difficulties in opening up to the world, only in 1978 the government decided to adopt the "open door policy", altering the strategy from a self-sufficiency based to an "active world participation" one (Huan, 1986).

Hence the Country closed mindset, which leads to a lack of enterprise initiatives. Most Chinese businesses are risk averse, especially when it comes to investing in high tech

industries, since for decades the economy has been based on low cost, high intensity production far removed from the type of enterprise the party wants to create with the MIC (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016).

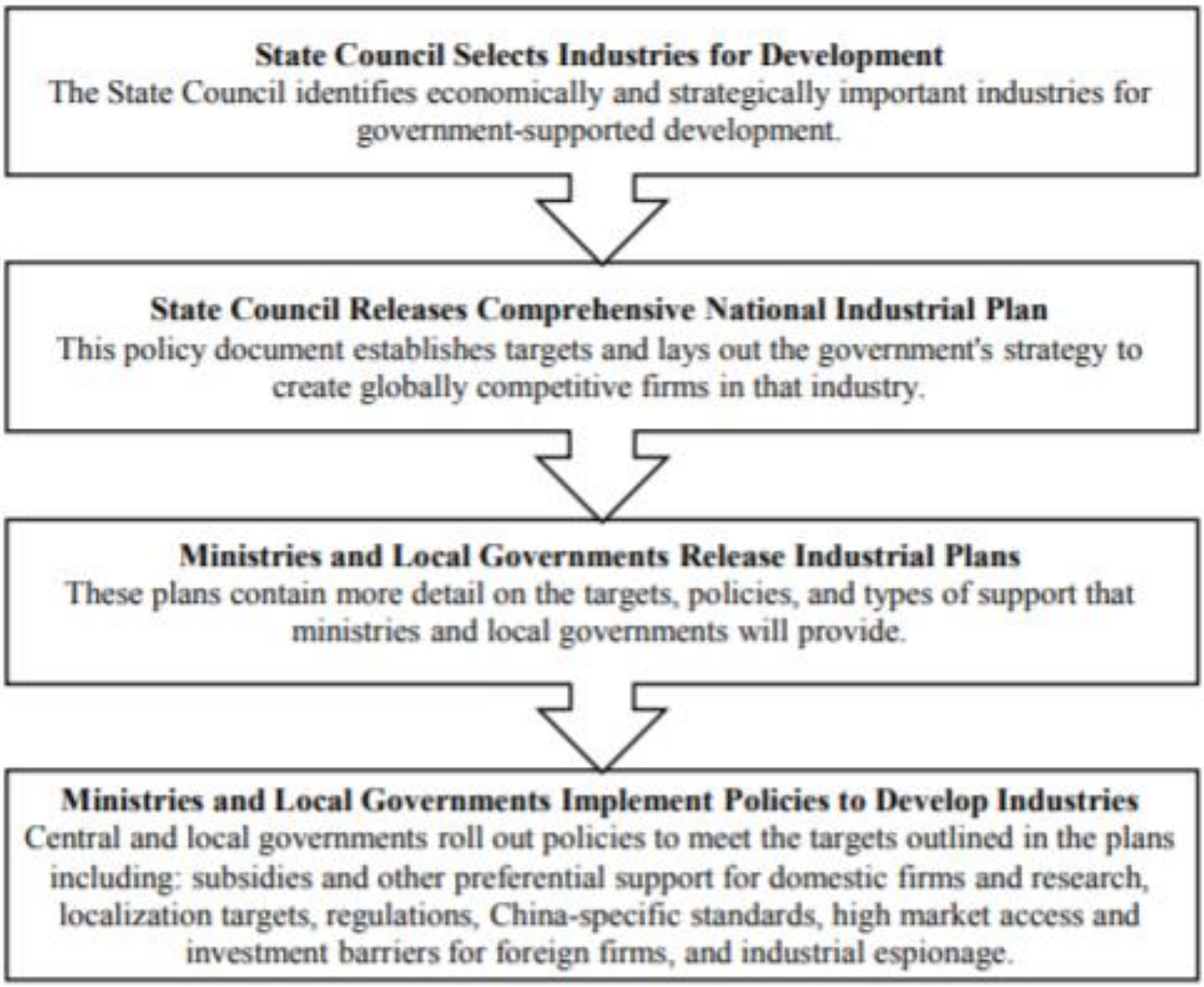
Managers prefer to opt for a low-cost solution not only from the production point of view, but also from the investment side, thus causing a first real obstacle for the CCP. In 2016, a German study showed that just over 20% of Chinese companies experimented smart working, while in Germany the corresponding reached almost 40% in the same year (Romberg, 2015).

It is here that the centrality of politics is manifested. The solution for this lack of enterprise initiatives was found by adopting a model that encourages innovation through the use of incentives and benefits for all companies that invest in the transformation and upgrading of the manufacturing process: policies and measures to support the real economy through financial support have been implemented since 2015 (Shuang, 2018).

In 2016 China established several funds, including the "Advanced Manufacturing Fund" of CNY 20 billion, the "National IC Fund" with capital of CNY 139 billion and the "Emerging Industry Fund" with a capital of CNY 40 billion. Germany in the implementation of Industry 4.0 reached a total investment of no more than EUR 200 million (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016). All together, these funds for the stimulation of the development of the manufacturing sector, amount to 21 billion dollars and demonstrate very clearly the ambitions of Beijing regarding the pursuit of ambition to lead globally in technology (China’s New $21 Billion High-Tech Manufacturing Fund Likely to Rankle U.S, 2019).

The centrality of the CCP also concerns the design of the organizational structure using a top down Strategy. Decisions are made based on a well-defined hierarchical structure, at the top of which there is the “Inter-ministerial Leading Small Group for Constructing a Manufacturing Superpower”, headed by Deputy Prime Minister “Ma Kai”. The responsibility of the leadership is to plan and coordinate the main strategy (decision-making power), which is then communicated to the “Ministry of Industry and information technology”, the “Chinese Academy of engineering”, to the “National Development and Reform Commission” and to the “Ministry of Science and Technology”, which are responsible for implementing the policies decided at the summit. The ministry level is therefore considered as the executive

body, which must then communicate and supervise the lowest level: expert level, formed by increasingly specific bodies such as the “Academy of telecommunication”, the “China center for information industry development” and the “electronic technology information research institute”. The expert level, finally, heads on the last level: policy-industry interaction alliances (Sebastian & Stepan, 2016).



This top down approach specifically translates into different implementation plan at different levels of government. At the national level, in fact, China chooses the industries to innovate and in which to concentrate efforts, providing incentives to all companies that implement innovation plans. The next level is provincial one. To make the development plan more effective, each of the Chinese provinces has a different level of specialization in the 10 areas designated by Beijing. Guangdong Province therefore focuses on Print and flexible displays, The Shaanxi on 3D printing, Hubei on information and digital design, Hunan on advanced railway transportation, Liaoning on robot industry and so on. If at the provincial level the focus is low, it is with the creation of innovation centers that a very high level of specificity is reached. In each of the provinces have been selected demonstration area and clusters, within which it's possible to descend to the highest level of specialization, improving the guidance and implementation mechanism of the "Made in China 2025" sub-Provinces and cities, and forming a development pattern of competition according to local conditions and differences (Shuang, 2018).

Since the inauguration of MIC25, China has gone from the first cluster in Ningbo to 30 different clusters, each with a different focus level, nationwide.

Another problem for the CCP is the danger of falling into the middle-income trap. It's a term that refers to countries that have experienced a fast and big growth and goes from a low income economy to a middle income one, but fails to overcome to catch up the developed countries, remaining stuck in the middle of the two incomes (Glawe & Wagner, 2016).

Many countries have faced this issue during their development path. Malaysia and Thailand provide a good example of this phenomenon, since both the two countries had benefited from extremely low labor costs, managing to excel in high intensity production, as soon as China and India took over the market with even lower labor costs (Agénor, 2015).

China has always benefited from extremely low labor costs and has established itself as a major supplier of some products, including low-skilled items like textiles and clothing and sophisticated products like office and telecommunications equipment. In recent years, however, with the introduction of Industry 4.0, labor costs have increased to the point of wondering if this feature is still a competitive advantage (Ceglowsky & Golub, 2012).

It is indeed true that China knows that the increase in wages due to deep innovation could be a real problem in the middle-long term period, especially considering that the Asian neighbors such as Cambodia and Vietnam already have way lower wages. The CCP seek to defend the country’s status as the "factory of the world" for low-value industries against developing countries and to do so the strategy is the reshoring to industrial countries, as Germany did recently with the re-opening of an high-tech automated Adidas factory. With automation and digitalization, it will be possible to replace low wage workers, and eliminate the gap with developing countries.

## 2 – MIC25 STRATEGY

The MIC25 has many points in common with the industry 4.0 plan implemented in Germany and it seems that the first was simply inspired by the latter. The reality is that while the core of the German plan was the achievement of the technological development, the Chinese plan goal, instead, is the restructuration of the entire industry, making it more advanced and competitive by using technological development as the main tool to center the objective. The MIC is therefore on a higher step than Industry 4.0 since it uses the German target as a simple tool for the success of the project.

The Chinese Government has developed the plan based on the weaknesses and domestic and international challenges of Chinese industry, changing and renewing the strategy in relation to the problems that arise over time, but what specifically consists of the plan? (China Manufacturing 2025: Putting Industrial Policy Ahead of Market Forces, 2017)

### 2.1 - Technology Substitution: The First challenge

On June 9, 2014, Leader Xi Jinping, during a speech at the 17th congress of the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE) highlighted the weaknesses of the Chinese economy to communicate the areas to improve. The speech highlights China's heel Achilles: the foreign tech dependency.

The centrality of science and technology innovation is out of the question, but despite the improvements and application of future technologies, it remains highly dependent on foreign high-tech components in critical fields (Hongyi & Hua, 2014). The most complex and technologically advanced components, as well as the most innovative machinery, are still imported from abroad, and their use basically concerns all industries except computers and communication fields (Zenglein & Holzmann, 2019). This strong dependence is critical for China, because despite huge efforts and investment in R&D, and despite the invention of new processes and highly innovative machinery, it is forced to rely on the scientific and Technological achievements of the others, to improve their scientific level. Only by mastering

the Chinese core technology, it is possible to reach the independence and reach the MIC goal (Hongyi & Hua, 2014).

This dependence is particularly critical for PRC as it concerns foundational technology, such as semiconductors, new materials and basic research, which are the basic skills to be able to introduce core technologies (as electric vehicle batteries, industrial robots and artificial intelligence), which are in turn indispensable to create future technologies (as autonomous driving, smart cities, facial recognition). China is particularly developed regarding the latter two, but suffers excessively this weakness, considering then that it would suffer a permanent interruption when denied the access to basic resources. The well-known examples of this dependency relate to the case of Huawei and ZTE. A series of policies by the US, in fact, limited in November 2018 the access of Chinese to the fundamental resources for the development of the products of the two famous brands. The result was disastrous for China, which found itself forced to pay billions of dollars annually to continue to find the US parts and patent rights. Access to core components and technology is a prerequisite for the advancement in emerging industries, and China with the implementation of MIC25 (in turn with an exponential increase in R&D investments) is reducing its dependence, fueling US concerns (McDonald, 2018).

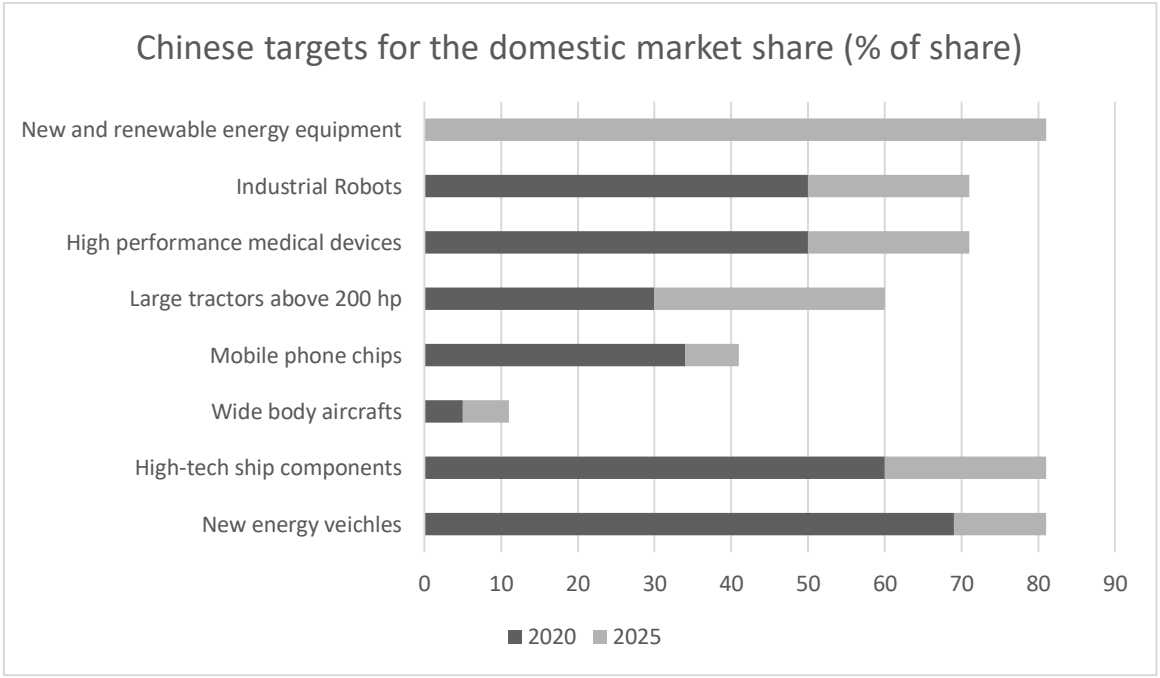
In this scenario, in order to solve the problem of foundational technology, industrial policy aims to replace foreign products in a lumpy way with domestic technology. R&D is crucial at this stage, as the objective is to equip industry with innovative technologies that will make it possible to no longer depend on foreign countries, weakening foreign competitors and improving its position in the world market. It is not a case that the official documents concerning MIC25 often contain terms such as "indigenous innovations" and "self-sufficiency" that can guarantee the achievement of 70% of the market share of "basic components and materials" (Zenglein & Holzmann, 2019).

According to this thesis, however, innovation is not necessarily the strategy to follow, but an "indigenous invention". Indigenous innovation is in fact a new method or component that is inserted in a production process. It is therefore a simple adaptation to an existing technology that improves the productivity of a business model, in fact not creating anything new, but simply improving something (Economist, 2015). Indigenous innovation means a process of

creation from scratch. The difference lies in the fact that it is not the creation of a component or a method, but the invention of something that has never been made before. The latter certainly requires greater efforts in terms of R&D, but it can potentially bring more benefits.

What are the market shares targets of this indigenous innovation?

In October 2015, the Chinese academy of engineering has provided a document named "China Manufacturing 2025 Key Area Technology Roadmap" including the most important targets of domestic and international industries to reach by 2020 and 2025. The analysis of these targets is fundamental because it allows to predict in which fields the government intends to make direct capital injections or preferential loans, and at the same time to understand in depth which are the areas where China is weakest or where it needs to allocate resources (Tab. 7).




Tab. 7 – Source: Expert Commission for the Construction of a Manufacturing Superpower.

From the data shown in the table it is possible to draw an important consideration. Targets include not only fields where China needs to improve, such as high-tech ship components, wide-body aircrafts and mobile phone chips, but also emerging industries where China is in

a position of advantage over foreign competitors, demonstrating a different approach depending on the type of sector.

## 2.2 – MIC approach to 10 industries

The main guideline of MIC25 is to adopt an innovation-driven and talent base approach, flanking an environment friendly policy by focusing not only on a smart manufacturing, but also on a green one, by the creation of green factories, green industrial parks and green supply chain management.

China has shown over the years to be able to achieve goals of this scope, clear examples could be found in the electronics and manufacturing industry with companies that now enjoy enormous fame as Huawei, Lenovo and Esquel Group. The first two brands are the result of a huge development in the electronic industry: originally the focus was on just the simple assembly of electronic products, today, however, the two Chinese giants have integrated and absorbed into the value chain more complex and innovative processes and parts, being recognized internationally. On the other side, there's Esquel Group, a textile company that has managed to integrate sophisticated smart factors into the production process, managing to fully achieve the goal of sustainable production.

MIC25's strategy is very detailed and outlines very precisely ten priority industries within which to achieve the greatest progress over next decades: next-generation IT, biomedicine & high-performance medical equipment, new materials, agricultural equipment, high end computerized machine & robots, aviation & space equipment, maritime engineering equipment & high tech ships, advanced railway transportation equipment, energy savings & new energy vehicles, energy equipment.

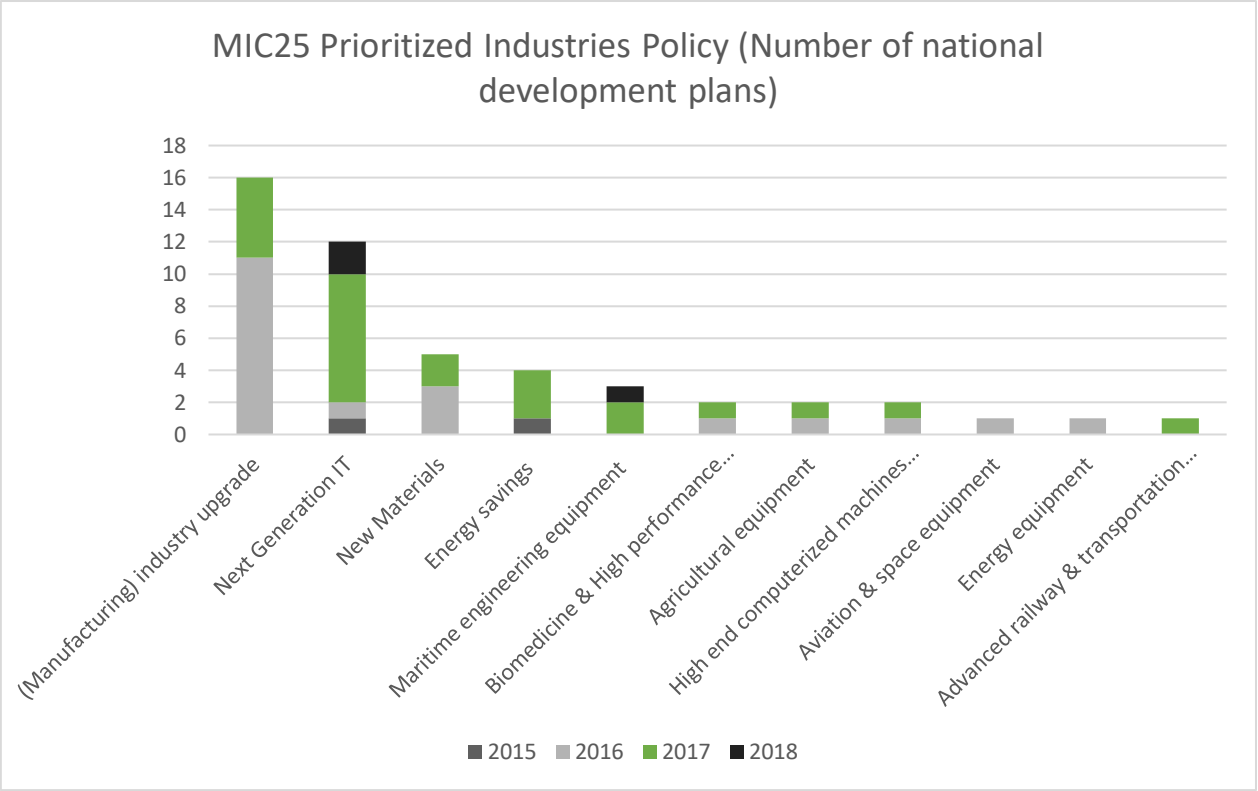
It is possible to divide the latter into 3 main groups in relation to the degree of skills and innovation that China has in each of them: the sectors in which the Country has a strong position, the ones with weak position and finally the emerging sectors.

The dynamic and adaptive nature of the MIC25 has allowed to adjust the strategy in relation to the performance and emerging challenges, thus allowing China to adopt a different approach for each of the major designated industries.

The fields in which China has already forged ahead are the next-generation IT with the 5G networks, the energy equipment with the ultra-high voltage electricity transmissions and advanced railway transportation equipment. The Country already competes internationally on these sectors, but it doesn't mean that they are paying low attention on them: policy efforts focus on a general upgrade of manufacturing capabilities, allowing to do not lose the competitive advantage acquired over time in those industries.

Decision making becomes more interesting when analyzing the other two groups. Not being able to put the same intensity on all 10 sectors, China decided to not pursue the development of high quality products within industries where it is objectively less developed, such as aerospace equipment, machine tools, or software engineering and advanced semiconductors. In this case the strategy is to accept to remain some generations behind the general technology level, being able to rely on a large domestic market. This factor should not be lightly considered since there is sufficient demand and above all a moderate internal competition. These two features make it possible to overcome the technological deficiencies of China, encouraging, even if in a small extent, internal development even in less developed sectors.

The plan prioritizes on emerging and digital industries. As shown in the graph (Tab. 8) (Zenglein & Holzmann, 2019) efforts are going mainly on high technology areas like AI, new energy and intelligent vehicles. These fields represent a great opportunity for China and in my opinion represent the core goal they want to achieve. These industries are characterized by a lot of uncertainty and thanks to the large domestic demand and a constant R&D, the Country could rapidly move from domestic to international market, assuming a leading position in all those segments. The importance that is attached to this strategy is demonstrated by the fact that the government pushes a lot for the development of future technologies in those sectors, by the using of massive investments and by the artificial creation of the demand (Zenglein & Holzmann, 2019).




Tab. 8 – Source: (Zenglein & Holzmann, 2019)

An example of development in an emerging field is the case of the electric vehicle battery market. China began its journey in this industry just 10 years ago in 2010 and only 7 years later held more than 50% of the global market. In this specific case, the huge boom was driven by huge domestic demand, due to the introduction of all-electric vehicles, including renting electric bikes companies as Mobike, that has now a huge market share (The Central Committee of the Communist Party of China, the State Council issued the Outline of the National Innovation-Driven Development Strategy, 2016).

### 2.3 – The strategy around Private and State-Owned Enterprise

In this environment the Government, that has a leading role, must take care to balance the different visions of entrepreneurs: on one hand there's the open approach, risk prone and market-oriented of the most advanced and innovative companies, on the other hand there's that of conservative nationalists entrepreneurs, which is more state-led oriented and adverse

risks since they're frightened by possible radical reforms. Both factions, however, contribute to the country's economy, "forcing" the government not to balance in favor of either maintaining a neutral approach. In order to achieve a proper implementation of the plan private sector strength must be harnessed in the most advanced and prosperous industries. intelligently allocating resources, lending and financing mechanisms. The second achievement is about focusing at the same time on the development and improvement of the State-Owned Enterprise (SOEs) through, when needed, the implementation of merges between SOEs and partnerships or merges with private companies. This strategy is the key of MIC25: The Government focuses on development and innovation, builds a competitive innovation system, but does not give up the most important feature: its strong presence and influence on all the economic actors (Zenglein & Holzmann, 2019).

One of the first case of giants 'merger was the one made by the two most important Country's shipping conglomerates: COSCO and China Shipping Company with combined revenue of more than $40 billion (China's Cabinet Approves Merger of Cosco Group, China Shipping, 2015). The reason behind that operation was the fact that, according to COSCO chief Ma Zehua and China Shipping's Xu Lirong, both the companies have struggled to be competitive, with overlapping investments, high costs, similar business operations and industrial chains.

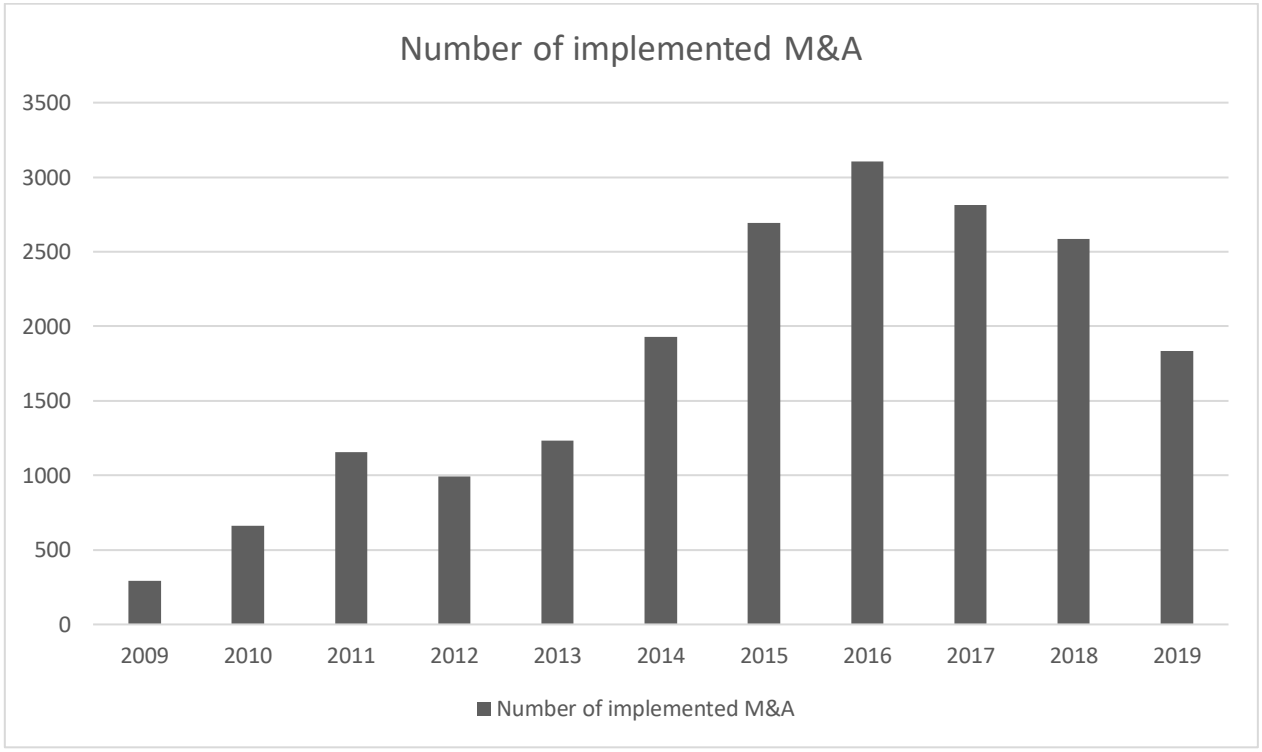
Large merges also concern industries like nuclear, rail, shipping, materials and grains. In 2014, two of the largest Railway vehicles manufacturers, CNR Corp and CSR Corp, merged into one conglomerate. An academic of the Chinese Academy of Engineering has found, inside the motivations of this operation, the objective from the two companies to prevent a fierce price competition because of the saturation of the high-speed railway vehicles market. They have come together to eliminate domestic market issues by avoiding each other's weakening and trying to become more competitive in the global market. In the last years the two firms have fought for important Government projects, holding high the competition and consequently the level of innovation (Nan, 2014).

The merges also concern the Nuclear Industry. In 2015 China Power Investment Corporation and State Nuclear Power Technology Corp have officially announced their merger, consolidating China's position in the industry. The new company, State Power Investment Corporation, is expected to own assets almost as 690 billion yuan ($115billion) and to post

revenue of over 190 billion yuan annually (China nuclear power firms merge to fuel global clout, 2015).

Merge operations, as much as they can reduce the internal competition and prevent the main companies from weakening each other, at the same time entails a lowering of the competition and therefore of the focus on innovation, the true goal of the MIC25.

The number of M&A increased exponentially from 2008 to 2016 (Tab. 9) (Number of completed M&A deals with participation of companies from mainland China between 2008 and 2019, 2019), then suffering a slight decrease probably due to the diminution of enterprises that actually need operations of this type.




Tab. 9 – Source: (Number of completed M&A deals with participation of companies from mainland China between 2008 and 2019, 2019)

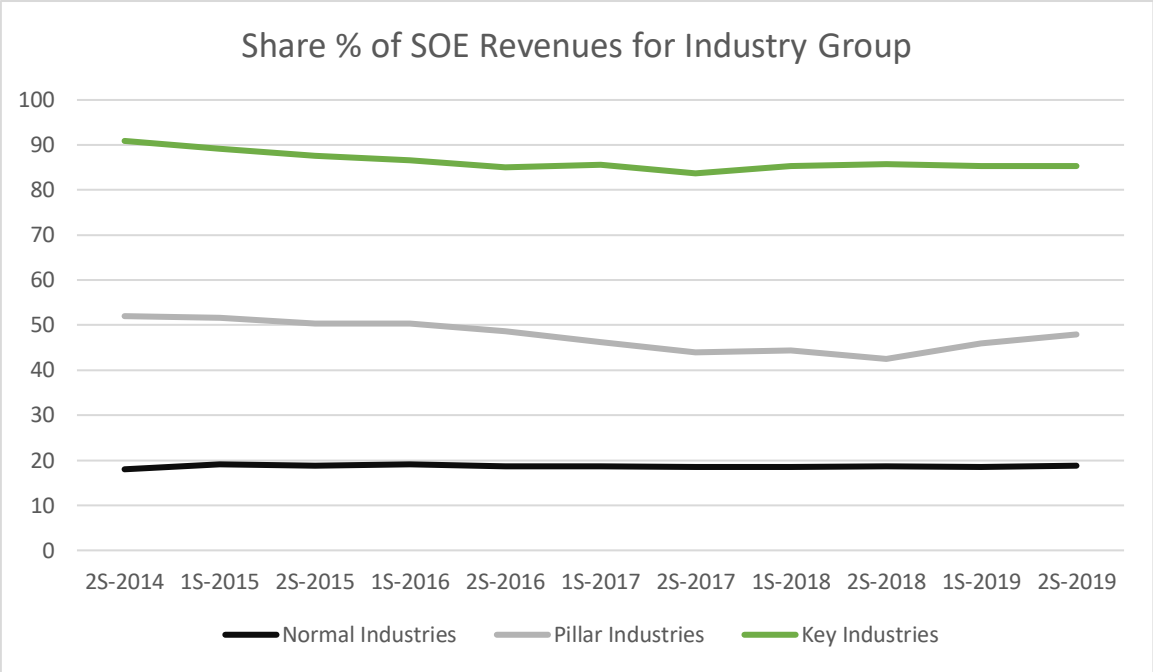
### 2.3.1 – Behind SOEs

The first object of analysis is the State-Owned Enterprise.

The importance of this type of company for Chinese government is easy to understand. The 360-degree management makes it a critical factor in the implementation of the MIC, but their persistent inefficiency has made SOEs a target for reforms. Since 2014 Beijing has tried to increase competitiveness through an acerbic program of mixed ownership with private firms, but it has been incomplete, therefore making no great changes. In 2017 a new merging and acquisition strategy was introduced (and continues today) along with a "corporatization" approach, which includes the creation of a board of directors that may manage the firm as a private company, improving performance in terms of efficiency, managerial structure and innovation (Asia Society Policy Institute, 2019).

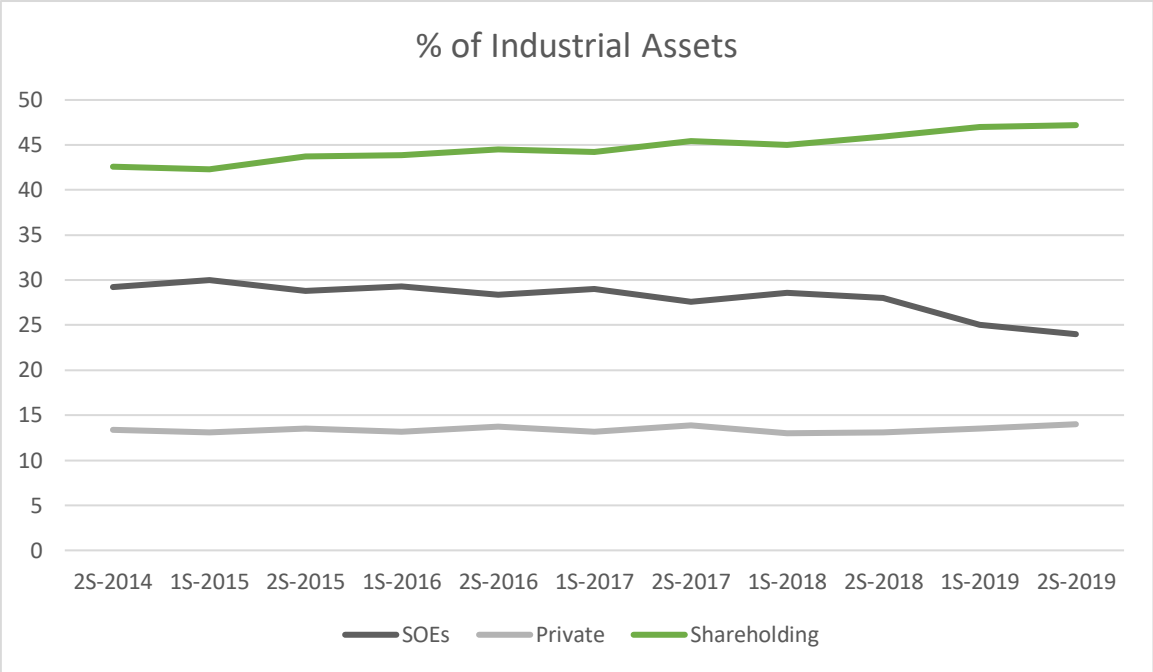
To understand the reforms rate of effectiveness it is possible to consider a primary indicator: The Share of SOEs revenues in the different groups of industries indicated by the government as the main 3. The subdivision has been made in order to balance and distribute in more optimal way the economic objectives all around the territory. The first category, "key industries", includes all the industries that are the lifeblood of the national economy and on which the CCP gives top priority: defense, electricity, oil and gas, telecom, coal, shipping, aviation, and rail. The second category, "Pillar Industries", includes the most high-tech industries, which are at the center of the MIC25 project: auto, chemicals, construction, electronics, equipment manufacturing, nonferrous metals, prospecting, steel, and technology. The last category "normal industries", is formed by the base industries such as agriculture, pharmaceutical, real estate, tourism, investment, professional services, general trade, and general manufacturing (Zhang, 2019).

The data and information found by Bloomberg and Rhodium Group allows to state the extent to which the reforms have taken effect, analyzing the share of SOEs revenue for each of the categories above (Tab. 10) (Asia Society Policy Institute; Rhodium Group, 2020).




Tab. 10 – Source: (Asia Society Policy Institute; Rhodium Group, 2020)

In line with MIC targets, the share percentage in Pillar Industry has increased by about 2% over the past two years, while the share in Key Industries has remained unchanged. Unexpectedly there is also a minimal increase in the share of "normal Industries", which implies a sufficient presence of government even in the sectors with lower focus. If we consider the trend since 2015, however, we note a substantial decrease in the first two categories. The reason is due to the growing development of private and shareholdings companies, which in recent years have increased their industrial assets much more than the SOEs (Tab. 11) (Asia Society Policy Institute; Rhodium Group, 2020).




Tab. 11 – Source: (Asia Society Policy Institute; Rhodium Group, 2020)

It can be concluded that although private enterprises are growing at great speed, SOEs still contributes sufficiently to the National economy. The direction of the reforms remains, however, to try to integrate the two types of enterprise, privileging a merging approach.

When this is not possible, the alternative is, as stated before, the merge between the largest SOEs. The goal in 2016 was to continue this strategy until the number of the biggest SOEs was no more than 100, and in 2017 the objective was reached by counting less than 95 enterprises (China to merge central SOE group to 100 - state media, 2016).

### 2.3.2 – Behind Private Enterprises

Behind this CCP strategy there is mainly awareness of the huge private sector strength, considered pivotal to Chinese economy. It contributes more than 60% of GDP (Yuan, 2018). That's not the only important data, private companies contribute 80% of the urban population

and are responsible for 70% of the technological innovation and 90% of total exports (Zitelmann, 2019).

The biggest brands like Huawei and Alibaba have a huge influence on the technological development of the country, that's the reason why they're considered the real drivers behind the development of AI, big data, alternative energy vehicle and so on. These information suggest that the government needs to rely on large companies in order to achieve national goals, and the truth is that the CCP gives a lot of freedom and autonomy to Chinese big companies, making sure that the latter align the objectives with those expressed in MIC25.

In recent years, especially because of the MIC, the private sector is increasingly under siege by the government (Tai, 2018). Companies that find themselves reaching a leadership position in the industries are immediately called to contribute to the achievement of national targets, very often creating merges with State owned enterprises. This approach, while ensuring that the government has marginal control over companies, is a mechanism that can prove to be dangerous and undeniable (Yuan, 2018). Establishing a Government cell/component within a private company may have a strong influence on choices, managerial decision making and objectives, turning the company into a half-SOE one. Operational decisions may no longer be guided by market trends, consumer demands, choices of domestic or global competition, but by the party's needs, which may not coincide with the company's well-being.

The first step taken in that direction has been made by Premier Li Keqiang, who decided to promote the PPP (public-private partnership) in some sectors that were considered "pillars" for the Chinese Economy such as environmental protection, medical treatment and transport by promoting the use of public and private funds (Public-private deals encouraged, 2015).

In 2017 the government found an interesting solution with the recruitment of a "National AI Team" by the Ministry of Industry and Information Technology. The choice of companies it's crucial since the endorsement means huge benefits as local government support, access to regional project and national data resources. If on one hand there are the rewards for the presence in the team, on the other hand there are guarantees to be respected. The Government expects in fact that the developments of artificial intelligence field are coordinated between all stakeholders and that, through the creation of an open innovation platform, all enterprises,

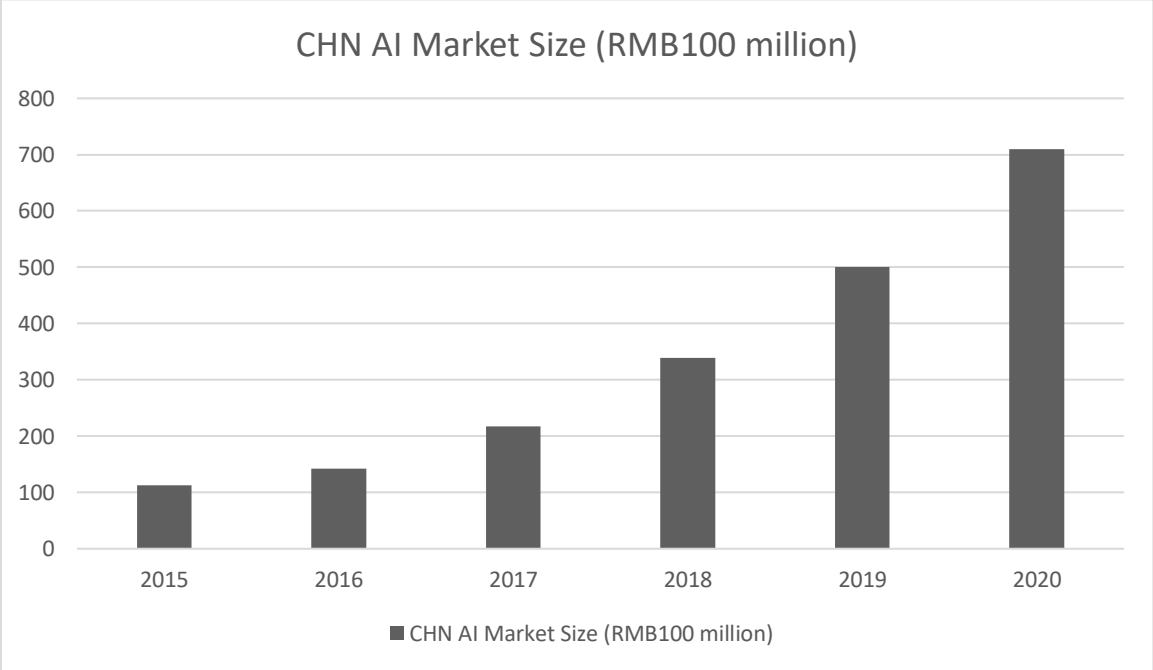
including medium - small, access to and take advantage of innovations in the sector (Larsen, 2019).

The project initially included the selection of only 4 technology giants' companies from the private sector for the creation of the platform. Originally the group consisted of Baidu for autonomous driving, Alibaba Group Holding for smart city initiatives, Tencent Holdings for computer vision in medical diagnosis and FlyTek for speech recognition (Dai, 2019). In 2019 the Group was expanded to 15 "Artificial Intelligence Open Innovation Platforms" and over time it could be assumed that new companies would join in. Among the new members there are well-known companies as "Sensetime" for smart vision, "Xiaomi" for Smart home and "Huawei" for its hardware and software competencies (Chin, 2019). The reason for the "narrowness" of the team is in the fact that it is composed of the giants that possess the best high-tech competencies in the AI Sector, therefore the companies to be considered must show first a good capacity for innovation, but above all they must specify which sub-category of the platform AI they intend to develop, making any knowledge available with other companies (Larsen, 2019).

The main tasks for the "big 15" are focusing on an intense R&D, data sharing, but above all sharing and support for smaller companies and SOEs. The Government, however, takes great care to encourage the big firms, ensuring an active support for each initiative. In the case of Tencent, for example, whose core is medical imaging, CCP have guaranteed access to public medical data, while for Baidu, which deals with autonomous drive, have been created entire realities in which testing the progress achieved.

The competitive advantage of this strategy is that if implemented correctly, it allows to create an ecosystem in which Government and Private Companies, in achieving common objectives, can benefit from each other, creating a real cooperation. Tencent has developed an AI platform that support doctors in the treatment of diseases such as cancer by screening medical images, while in 2018 has developed a system of AI that allows ,based on the patient's movements, to quickly diagnose Parkinson's disease (Chin, 2019). Alibaba is instead engaged with the country in several realities to ensure smart solutions in the transport and supply of water and electricity in the most rural regions of China, but it has also made an enormous contribution to the fight against coronavirus. Alibaba and Baidu have in fact made available their AI platforms to help the staff of the local community saving time on phone calls for

information about the residents' health and their recent trips. The Baidu platform can make 500 calls per second, and automatically collects and arranges feedback from all calls (Rossi, 2020). Tencent also gave a huge contribution to the fight against Covid19 through the media-platform WeChat, providing data and statistics during the pandemic. From 2015 to 2020, thanks to these operations and to the R&D results of the 15 companies, the Chinese AI market size grew very rapidly, recording an increase in the total compound annual growth rate of 44.6%, unlike the global CAGR which increased by only 26% (Tab. 12) (Deloitte, 2019).




Tab. 12 – Source: (Deloitte, 2019)

In conclusion, the MIC is strongly linked to the private sector. Success can only be achieved if the cooperation and merge strategy between SOEs and Privates continues to function. The government must not be too invasive and should give independence for the objective's achievement, while reaping all the technological advantages that derive from cooperation.

Beijing's approach, however, does not go in this direction, since its objective remains to maximize the efficiency of state-owned assets by improving the governance of SOEs, redefining the state's involvement in their management.

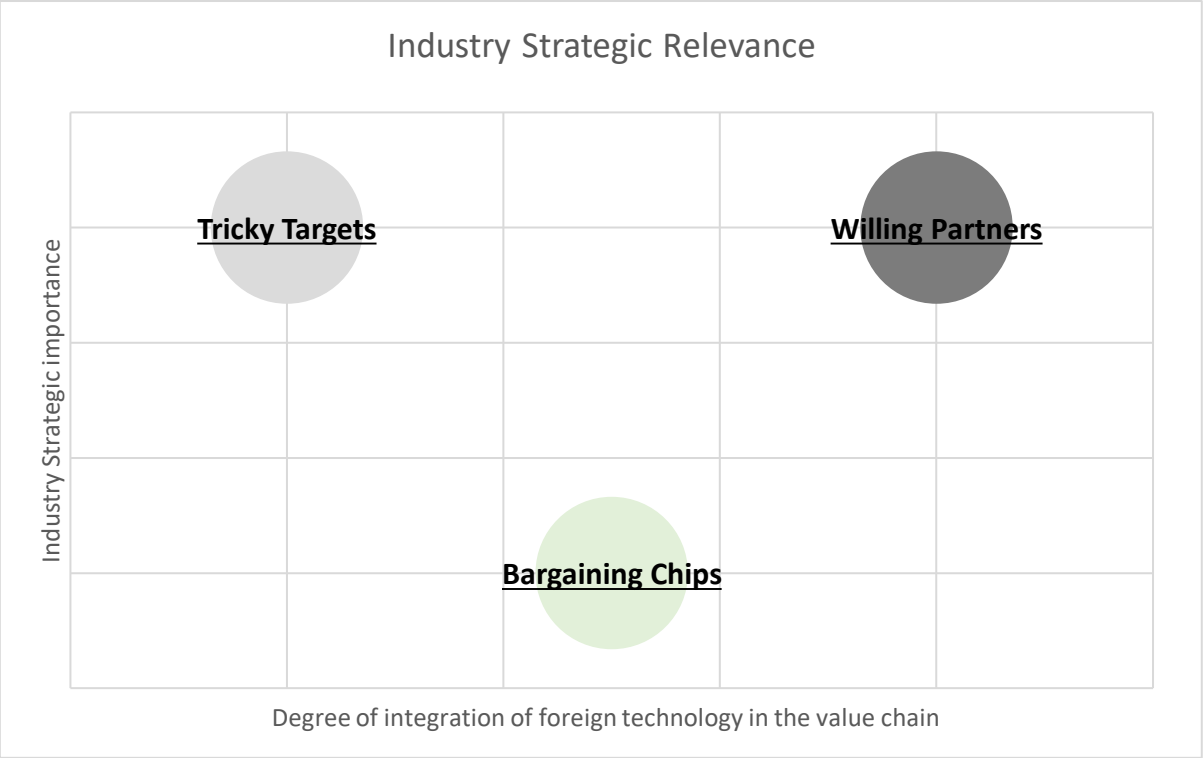
The policy of “zhuada fangxiao" (grasp the big, release the small) that resulted in a wave of mergers into groups and Privatization of small companies (Xinhua, 2019), helped mainly the SOEs, putting private companies in the background and giving them a role of total support, trying to create a new generation of state owned enterprises that could be competitive at first domestic and then international level.

# 3 – MIC25 APPROACH TO THE WORLD

The development of the MIC25 has not only domestic implications. The strategy aims to strengthen the country's domestic capabilities, but it cannot rely just on its own strengths to do it. This translates into an outward-looking approach, so that access to innovative capacity and know-how from around the world can be guaranteed, learning knowledge that will not have to be developed from within. In a nutshell, the strategy is to learn how to innovate from foreign powers, so that we can introduce the new technological value chains into the national economy and quickly bridge the gap with foreign advanced companies. In this regard, this chapter deals with the Chinese approach to foreign companies.

## 3.1 – Willing partners, Tricky Targets and Bargaining Chips

The complexity and the great scope of the MIC translates into a further effort also regarding the strategies to be followed abroad. China has a different approach depending on the relevance of the Industry and the strategic objectives that the CCP intends to achieve: the lower the Chinese tech level in an Industry, the higher must be the priority to penetrate it and acquire access to know-how. If the first feature is "the strategic importance of the industry for China", the other is instead the "degree of integration of foreign technology in the value chain": that is the level of presence in the Chinese production process. In this way it is possible to divide the targets into 3 main groups according to the different types of foreign companies: Willing partners, Tricky Targets and Bargaining Chips (Tab. 13); (Zenglein & Holzmann, 2019).




Tab.13 – Source: (Zenglein & Holzmann, 2019)

The first group to be analyzed is the B.C. It is formed by foreign companies that belong to sectors of low priority for the MIC and whose Technologies are normally integrated in the Chinese value chain: this is the case of consumer goods industries such as restaurants, but also supermarket chains and in general almost all retail sales. In this scenario China's approach is to open the market to foreign investors through the implementation of less restrictive policies, incentives, or, as happened recently, through the abolition of restrictions previously imposed in the electric vehicle sector. On April 2018, President Xi Jinping announced the further opening up of the Chinese automotive industry due to the abolition of the limit on foreign ownerships in vehicles and the removal of the restriction that no more than two joint ventures are allowed for each foreign investor (Liu, Peng, & Shen, 2018).

The reason why CCP has adopted an attitude of openness in the automotive industry, in stark contrast to the usual approach of closure, lies in the fact that in this Industry foreign technologies are on average integrated in the value chain, but China has now reached a level of leadership (and high tech competencies level) in this sector and can afford to open the market. In general, however, the reason why China adopts an open attitude with bargaining

chips industries is that the integration of endogenous technologies with the production process does not pose a threat to CCP, since it is a small-importance industry, so the purpose of opening a limited number of sectors is to offer them as a bargaining chip in negotiations with foreign governments. The Chinese government can thus announce to global partners the commitment to liberalize its own economy.

Willing partners are companies that easily accept to move the most complex and innovative parts of the production process to China, thus moving them permanently outside their country. This operation allows the Chinese government to develop and improve the domestic sector, incorporating foreign know-how in the value chain in a practically definitive way. In this case China's attitude is quite passive: industries of this type are emerging in sectors where the margin of profitability is very high and government policies are very convenient. All of this, combined with the great domestic demand of the Chinese market, represent a great opportunity for foreign investors, who can benefit in the short period. On the other hand, the Chinese government manages to attract technological innovation, being able to control the most tech part of the value chain in its own country: "the more dependent companies are on the Chinese market and the more eager they are to participate in flagship projects, the more leverage the government will have over them" (Zenglein & Holzmann, 2019). This strategy has been successful in the electronics sector: since 2002 the industry has been stormed by foreign entrepreneurs, causing a huge increase in innovation. While in the early days China was only involved in product assembly, now it is more sophisticated and has added more value domestically and internationally and became specialized in creating key processes (Morais, 2012).

The last group is the Tricky targets, companies that keep the main value chain processes inside their country, which are part of Industry focal points for the implementation of the MIC. While access to their know-how and innovation fabric is crucial to implement China's technological development, it is extremely difficult to penetrate them. In this case, the CCP approaches may be multiple, but they will not necessarily work. The first, the "Attraction", is the least desirable option, as it is very similar to the approach it uses with B.G. China could be willing to soften the restrictions and open the sector to foreign investment, making the business environment simpler and more penetrable through simplified market access or, for example, as in the case of the electric vehicles sector, removing the restrictions

for joint ventures. However, the integration of foreign technologies with the value chain could be particularly burdensome for the Chinese economy, which may not take government control over these highly innovative production processes because of a soft policy. Despite the reluctance to operate in this direction, in 2018 BASF, thanks to the use of political incentives on joint ventures, began the construction of its $10-billion integrated petrochemicals project in China's southern province of Guangdong (Xu & Cadell, 2019).

Chinese government in order to face "Tricky targets" can implement two other strategies. The first one is the "Acquisition", which is the one most used by CCP: in the areas where it is not possible to attract foreign investors in the country, a strategy of high-tech acquisition through FDI and legal licensing of intellectual property rights is necessary. The second is "Attack", which involves China's effort to acquire foreign talent (Zenglein & Holzmann, 2019).

## 3.2 – Implications for Industrial Countries

### 3.2.1 – FDI State-Driven: Technological Eradication

As amply demonstrated above, the CCP's industrial policy is based on the partial restriction of the market through "protection" mechanisms that put foreign companies, trying to access the Chinese market, in serious difficulty. In addition, the instruments used by China are very often unclear policies or opaque and nuanced economic measures that prevent the entry into the sectors established by China as "closed and protected". All this creates important implications for industrial countries, which, being fully involved in the Chinese strategy, are forced to face many Challenges.

The first implication concerns the technological eradication by FDI State-driven. As anticipated in chapter 1, foreign direct investments have grown significantly since 2010 favoring China, but first the host countries. European and American companies that have received substantial investments from the East have benefited significantly from the huge economic inflow generated, maintaining at least in the first period a good percentage of independence in management decisions. The benefits received by foreign companies in the

short term, however, are the result of a careful and widespread strategy of the Chinese State, a true driver behind Chinese FDI worldwide. The objective has now been clarified: guarantee revenues to targeted companies and then systematically acquire and assimilate their technological production processes. If, in the short term, Europe and America will benefit from the capital absorbed, in the long-term Chinese companies will erode part of their technological leadership, relying on advanced technological development and a policy of probably lower prices. China's "outdoor" policy is therefore crucial for the implementation of the MIC and the achievement of global leadership, as also attested by Ding Wenwu, head of the Electronic Information Technology Department of the MIIT saying that "international acquisitions are often also an opportunity to attract foreign talent and to acquire technology". Chinese ambitions are not a secret, however, it is easy to guess the strategy since in recent years direct and indirect investments by the State have increased exponentially (Tab. 14): even behind acquisitions by private Chinese companies there is often the active presence of the Government, which hides itself through confused policies and complicated financing operations (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016).

*Investment by Chinese enterprises in foreign companies specializing in automation and digitization of industrial production:*

| **Date** | **Chinese Investor** | **Foreign targeted Company** | **Country** | **Share** |
|---|---|---|---|---|
| December 2013 | AVIC* | KHD Humboldz Wedag | Germany | 79% |
| June 2014 | Preh | IMA Automation | Germany | 100% |
| January 2016 | ChemChina* | KraussMafei machine tools | Germany | 100% |
| March 2016 | Siasun* | Teutloff | Germany | 100% |
| May 2016 | Shangai Electric* | Manz | Germany | 19,67% |
| August 2016 | Shanggong Group | H.Stoll | Germany | 26% |
| August 2016 | Midea | Kuka | Germany | 94,5% |
| October 2016 | Shangai Electric* | Broetje Automation | Germany | 100% |

| | | | | |
|---|---|---|---|---|
| Failed | FGC Investment | Aixtron | Germany | / |
| December 2014 | Wolong Electric | SIR Soluzioni Industriali | Italy | 89% |
| May 2016 | Dongfang Precision | EDF Europe S.R.L. | Italy | 100% |
| June 2016 | Agic Capital | Gimatic | Italy | / |
| January 2015 | Huachangda Intelligent Equip. (HCD) | Shanghai DEMC/ Dearborn Mid-West Company (DMW) | US | 100% |
| April 2016 | Wanfeng | Paslin | US | 100% |

Tab. 14

As shown in the table (Tab. 14) the last FDI have essentially covered Germany and the United States: this is not surprising considering that these are the two most industrialized countries and further ahead in the sectors of high technological innovation. Germany is the country that has implemented the Industry 4.0 project and has assumed a major role in the main tech industries such as mechanical engineering, automotive, publishing, textile, telecommunications and healthcare (Deloitte, The German Technology Sector: from hardware to software & services, 2019). In the last 7 years China has made extremely targeted acquisitions in German companies specialized in automation and digitization of industrial production: the first case in 2013 is the acquisition by "AVIC International Beijing Company" of 79% of KHD, a German equipment supplier (CemNet, 2013). The reason for the impressive investment lies on the fact that 7 years ago, with this operation, China acquired the advanced and very specific skills of a global leader in cement plant technology, equipment, and services, but also a leader in energy-efficient and environmentally friendly products for the grinding and pyro-processing sections of cement plants (KHD Humboldt Wedag: Company profile, 2020).

The acquisition in 2016 by “PREH IMA Automation” of German “IMA Automation” aimed at acquiring the know-how of a full-service firm dedicated in developing, manufacturing and

assembling industrial robots, also expert in providing tailored industrial automation systems and solutions (Ningbo Joyson Electronic's unit to acquire US company EVANA Automation, 2016). Also in 2016 the acquisition of Krauss (Kan, 2016), Manz (Apple supplier Manz to sell 29.9% stake to Shanghai Electric, 2016), Stoll (H. Stoll inks partnership with Shang Gong Group, 2016) and Broetje-Automation GmbH (Stanway, 2016) has created a win-win situation for Germany, which has benefited from substantial investments to improve the value chain, and for China, which has opened the access to the know-how of several leading companies in the most advanced industries. Krauss has made improvements in production processes in the chemical sector through the use of robots equipped with IA, Manz has instead allowed China to learn technologies in which it was particularly weak as manufacturing of high-tech components for smartphones and tablets (Apple supplier Manz to sell 29.9% stake to Shanghai Electric, 2016), while Stoll, has given tech skills in the manufacturing sector.

Despite the German government's open attitude towards the Chinese FDI, some acquisition cases have raised controversy: it is the Midea - Kuka case. In 2016 the Chinese giant Midea, manufacturer of household appliances, increased 90% of the German company's holdings. The case has raised a lot of concerns in Europe since there were fears about the possible negative development for Kuka in the hands of a Chinese company that had experience only in the household appliances industry. The IG Metal trade union, together with some officials in Berlin, tried to keep at least a share of more than 26% in Germany, but could not find any entrepreneur (Berlin approves Kuka sale to Midea, 2016). Kuka was thus acquired by Midea, which replaced the previous German CEO in 2018 (Martin, 2018).

The second interesting scenario concerns FDI in the United States. In this case, as in Europe, China has made significant investments, but has focused on the entire semiconductor sector, considered in chapter 1 as the Achilles heel of the MIC Strategy. The table (Tab. 14) shows the two main operations in this direction: Huachangda Intelligent Equipment Group which manufactures factory automation equipment (Bloomberg, 2020) acquired competencies from Dearborn Mid-West Company and Shanghai DEMC, both manufacturers of semiconductors and machinery designed to provide advanced intelligent manufacturing equipment and systems integration services (Shanghai DEMC Automotive Equipment Manufacture Co., 2020); (Dearborn Mid-West Company Company Profile, 2020). The operation between Wanfeng and Paslin has barely the same objective, with the difference that Pasin is the world's

leading provider of welding robot application systems to the global automotive and heavy industries market (Feifei & Xiaofeng, 2016).

It is difficult to predict the extent to which technological eradication by FDI State-driven will affect global leadership. While it is possible to anticipate that there will undoubtedly be a change in global leadership and that China will be able to excel in some tech industries, it is not clear what the specific trend will be for each sector. Undoubtedly there will be an absorption of skills by the Chinese, and if they succeed in optimizing and implementing the new know-how in an effective way by duplicating foreign value chains and bringing them home, they will be able to achieve global leadership. This intuition is very plausible if we consider the Chinese and American experience in a rather recent scenario: at the beginning of 1990 Magnequench, a not too developed company producing permanent magnets, was acquired by "Non-Ferrous Metals Import and Export Corporation" and "San Huan New Material", two State-Owned Chinese Companies. Under the leadership of the two firms led by the Chinese government, Magnequench opened a perfectly equal structure in China and closed the original structure located in America (Tkacik, 2008).

The operation is particularly interesting when you consider that China emerged as the largest manufacturer of permanent magnets worldwide.

### 3.2.2 – Data and Cyber Regulation: An Invisible Barrier

The second implication concerns the complex mechanics that revolve around cyberspace. Smart manufacturing, industry 4.0 and the Internet of things are almost completely based on data in general, their acquisition, processing and above all their transmission in real time. To do business in the high-tech industry is therefore necessary to safeguard the security and integrity of data, which is not at all easy in the Chinese market. China offers a very unfavorable and simple environment for foreign enterprises, adopting an extremely restrictive control policy on cyberspace. Cybersecurity Law is the fundamental pillar of the regulation of technological security laws and provides elaborate regulations and definitions on legal liability. The reason why this set of regulations affects most businesses is that it includes not only internet security, but also information, communication, computer, automation, and

control system security. It means that the businesses affected by the Cybersecurity Law are not limited to those in the information technology (IT) industry (Zhao & Xia, 2018). China adopted in 2017 a series of very controversial measures in relation to cybersecurity, which generated concern given the current unfavorable environment for foreign companies. The provisions include requirements for all businesses to store personal, business and market data, which must then be provided to the Chinese government to ensure "technical support" to Beijing's national security needs. Foreign companies to stay within the Chinese market are then obliged to provide their data, such as big firms as Airbnb, Apple Inc. and LinkedIn who have given the database information to the Chinese government (China: Controversial cybersecurity law passed, requires business to comply with further internet censorship rules, 2017). The strict control of the CCP as well as subjecting companies to its own rules it's an obstacle for the transmission of data because of the use of a complex system of censorship and control of encryption systems, which allows the government to maintain firm control of the entire Cyberspace (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016).

These measures are extremely harmful to foreign entrepreneurs for various reasons. First, if they want to do business in China, they must do so with the knowledge that they are at a disadvantage: the Chinese government can request access to the database in its entirety at any time and the data obtained could be used by Chinese enterprises to study the secrets of competitors at any time. The only way that foreign companies must "protect" their data is to evade, all too often illegally, the rules imposed by the CCP. The second big problem concerns the almost total impossibility of instant communication via the Internet at a distance: the ineffectiveness of communication due to low connection speed makes it impossible, for example, to maintain vehicles or machinery at a distance.

As discussed in the previous chapters, the strategy is to leave only some tech industries open, implementing the above policies to complicate or in some cases prohibit the entry of foreign competitors. However, the process is gradual and the CCP is now willing to start closing markets that were previously open: in this case two policies come into play, the first one related to SaaS and SaaP, the second, still under development, concerns the social credit system. In the first case we must consider that the primary issue for Internet business in China is that all commercial Internet businesses require the website owner acquire a commercial ICP (Internet Content Provider) license. This means that in addition to traditional e-commerce

websites, cloud computing, software as a service (SaaS) and software as a platform (SaaP) sites all require a commercial ICP license (Dickinson, 2015). The problem for foreign companies is that receiving this type of license is very difficult and expensive in terms of time and money, so much that large firms such as CISCO and IBM have strongly accused this restriction. The more companies are digitized and connected to the Internet, the more the government will have more power over them, succeeding in the strategy of "protecting their Industries". The second Policy concerns as anticipated the credit social system associated with the ITC Rules. The certifications and regulations that impose the criteria for reliability certification are another huge barrier for non-Chinese investors, whose products are very easily not labeled as reliable or safe. All these certifications could have a great impact in the future on the SCS, which is tasked to rate companies depending on their economic and social trustworthiness. This system performs several functions at the same time, on the one hand it allows you to directly monitor companies, on the other hand it is a tool that can limit the development of business activities because they are far from specific criteria (Berti, 2019).

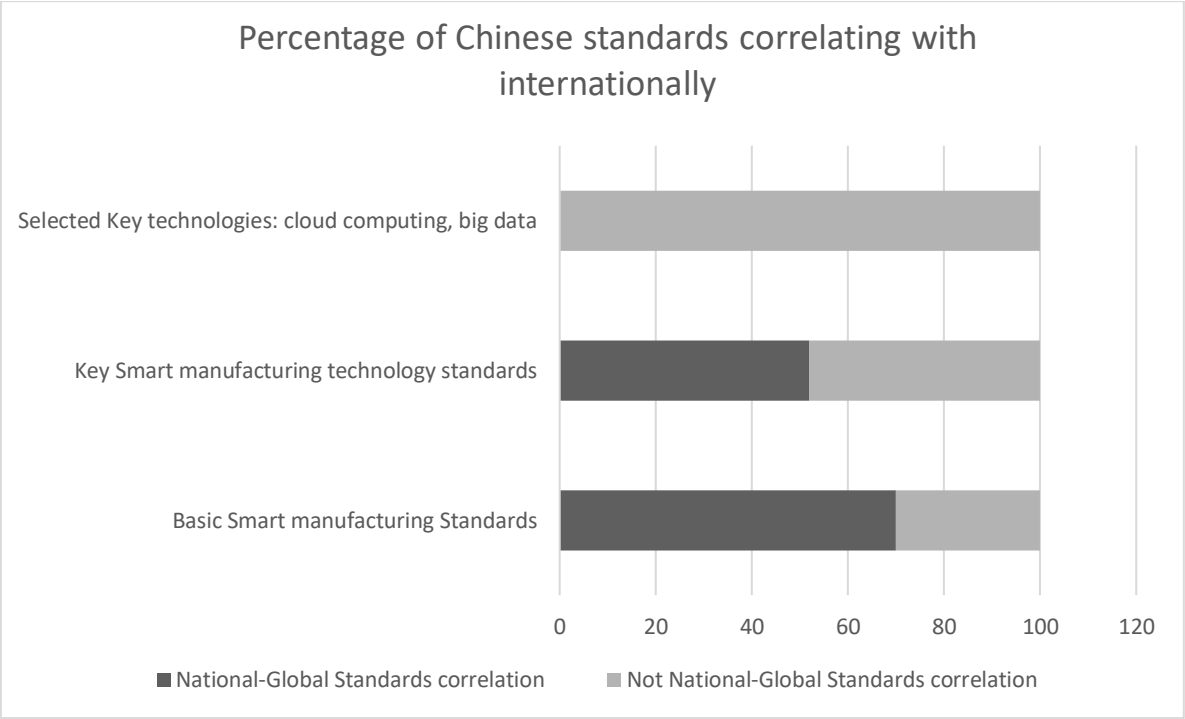
### 3.2.3 – Misalignment between National and Global Standards

In clear similarity with the plan to partially open the market only in some sectors, China harmonizes its national standards with global ones where it wants to facilitate the access of foreign entrepreneurs to the market. In this sense it seems that the CCP is adopting a policy of market liberalization and internationalization, pushing private companies to work with regulators to achieve a high rate of standardization, and in fact this is exactly what the Chinese strategy provides. Germany and China, for example, have managed to achieve a level of standardization regarding intelligent production methods. While in some areas this alignment can be verified, in others the Chinese government is at a disadvantage and is therefore forced to pay royalty fees for international patents in order to secure market access. The objective of the CCP is therefore to acquire expertise (and therefore influence) such that it can exercise greater power over the international committees. Since 2015 China has already managed to set its own standards in some areas, such as the introduction of two new wireless standards

designed specifically for process and factory automation, approved by the Chinese committee (Verhappen, 2016).

However, when the CCP wants to hinder market access, it implements a policy of misalignment between national and global standards: China deliberately creates national standards that are very different from global. The most striking cases concern the possibility for China Mobile, conferred by the Ministry of Industry and Information Technology (MIIT), to offer mobile services based on FDD-LTE technology (China Mobile handed FDD-LTE licence, 2018), and the case of the WAPI standard for wireless networks (Gao, 2008).

The implication resulting from this attitude concerns the creation of an additional barrier to investment by foreign companies. In fact, China could implement a much stronger national standardization policy in the smart manufacturing sector, almost permanently preventing market entry. This strategy is possible because the CCP can "circumvent" the approval of committees in standard setting, through the increased influence in the introduction of standards exercised by SOEs and state led associations. China has so far chosen this direction in selected key technologies such as cloud computing, industrial software and big data, totally diverging national standards from global standards. Although to a lesser extent, the same is true for basic smart manufacturing standards and key smart manufacturing technology standards. The direction CCP has taken is therefore clear: cut out of the Chinese market machinery manufacturers and software developers in strategically relevant sectors or force them to pay royalty fees in order to remain in the market with different standards (Tab. 15) (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016).



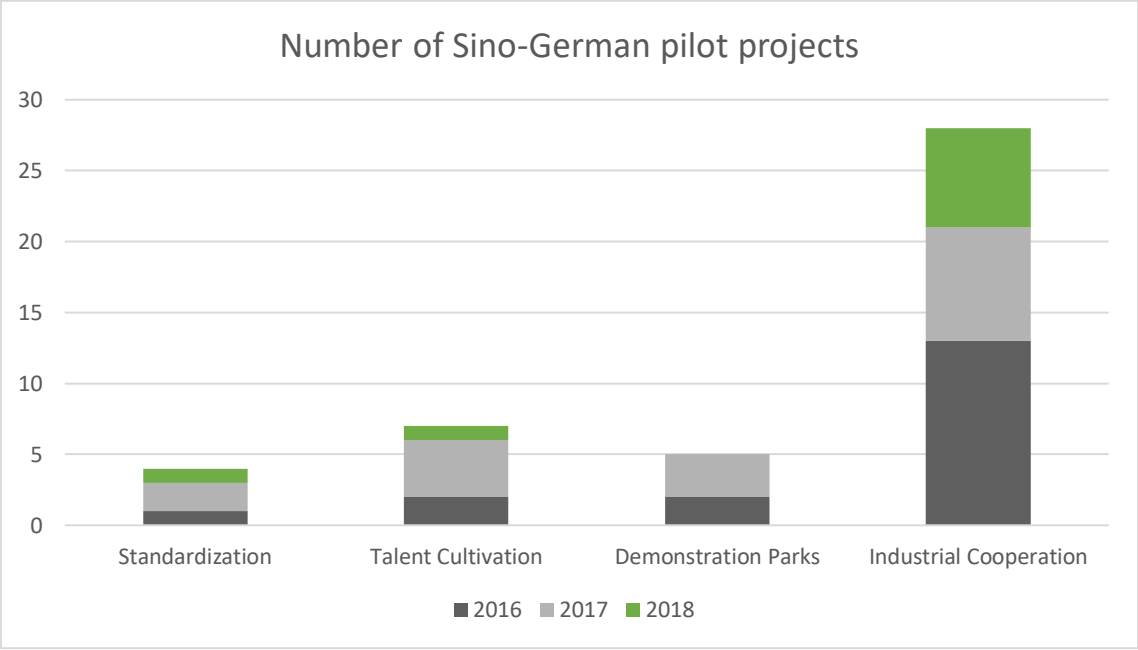

Tab. 15 – Source: (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016)

### 3.3 – The Case of Germany, Japan, South Korea and Taiwan

Analyzing the relationship between China and Germany and understanding what role the latter plays in the MIC25 is essential to analyze its possible success or failure. The significance that Germany and its Industry 4.0 has for China is of incredible importance, since the Germans are the main reference point for Chinese development. The countries were each other's largest partners from 2011 to 2019 with a 140% increase in actual investments by German companies in China in 2018. In that year, the leaders of the two Powers signed an agreement in 3 significant points: Xi Jinping stressed the willingness of the Chinese people to continue this partnership in the interest of the development of both countries, emphasizing the development of bilateral cooperation to provide an example of advantageous agreement. At the same time, the Chinese leader stressed his intention to promote the partnership in areas such as artificial intelligence, automatic driving, new materials, new energy, life sciences and smart city (Xi makes 3-point proposal on China-Germany ties in meeting with Merkel, 2019).

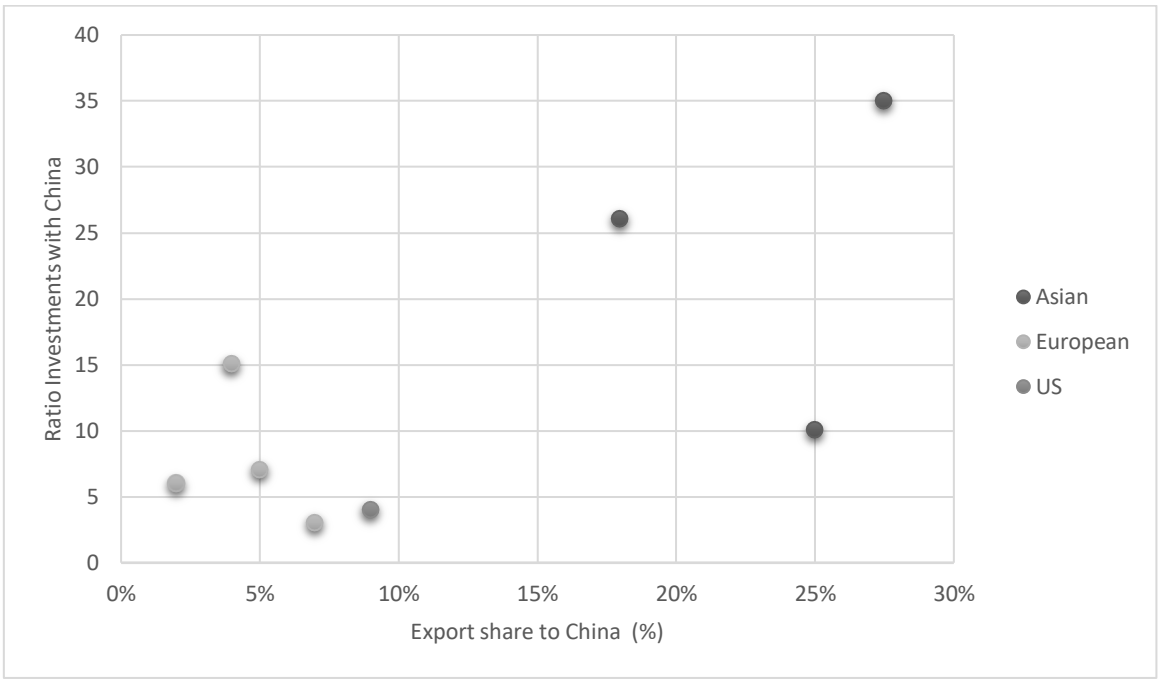
Germany is one of the most developed countries in the world and according to the analysis so far, its economic base is strongly threatened by the ambitious Chinese project. So, the questions are why is there great collaboration between the two? And why are German companies well disposed towards Chinese projects?

The German approach and cooperation in numerous projects aim to benefit from 4 main areas: Industrial cooperation, the possibility to implement talent cultivation, the construction of demonstration parks and the implementation of common standardization (Tab. 16). Since 2011, when two countries started to cooperate, the projects have concerned the creation of innovation platforms in the high technological innovation sectors, the implementation of the "clean water" project, which allowed Germany to access the Chinese market to help the government to solve the problems related to water in China, the creation of a life-science platform that allowed to create a huge common database accessible to both, and finally, projects related to universities (Research, 2015). The latter represent a critical aspect to consider, since German universities, such as TU Darmstadt and Karlsruhe Institute of Technology (KIT), have a particular focus on industry 4.0, and given their nature as "research center", they appear to China as a key model for the development of national laboratories and the acquisition of German talent.




Tab. 16 – Source: (Wübbeke, Meissner, Zenglein, Ives, & Conrad, 2016)

While Germany is a willing partner, the experience of major Chinese competitors in Asia such as Taiwan, South Korea and Japan reveals a diametrically opposed attitude. The situation for Asian countries is completely different from the European one, not only for geographical reasons, but also because they are closely linked to the Chinese economy. The percentage of exports to China by Asian countries is relevant: 19% by Japan, more than 25% by South Korea and about 28% by Taiwan (Waldeck, 2020); (Taiwan Exports, 2020); (Japan Trade, 2018). Not only that, over time these countries have accumulated a large number of investments, which, added to the high export percentage, make Japan, Korea and Taiwan particularly sensitive to the MIC25 and, in general, to the trend of the Chinese economy, also considering that these countries are particularly dependent on high-tech industry (Tab.17).




Tab.17 – Source: (Zenglein & Holzmann, 2019)

The "three Asian tigers" have taken drastic measures to defend themselves against China, which include limits in the field of cooperation, awareness of companies and rules on investment and acquisition of high-tech companies. These measures are taken to safeguard key processes and know-how, not allowing China to assimilate key processes in the value

chain, as in Europe and America. So, while Europe is friendly in the MIC25 implementation process, Asia is moving in the opposite direction.

The MIC25 for 5 years has caused multiple changes in the economic environment, creating a new market demand for high tech products, and increasing the previous one for advanced products. More and more foreign entrepreneurs have moved large parts of the production chain to China in order to benefit from the huge and developing market, ensuring their presence in the Chinese Industry. The structure of incentives and policies is very favorable for companies that want to enter the Chinese market and at the same time can benefit from China's industrial upgrading. All these features result in a high percentage of participation by foreign companies in less technologically innovative areas (European Business in China - Business Confidence Survey 2019 Shanghai Launch Event, 2019).

This implies that China's strategy works, considering that the less innovative an area is, the more foreign companies are willing to move their production chain, causing an increase in tech competence in Chinese industries, in order to seize the opportunity of short term gains. This attitude of openness is obviously extremely selective: as previously analyzed, some industries such as electric vehicles enjoy greater openness and convenient policies, but many other sectors remain extremely difficult, or barely impossible for foreign investors to penetrate. This direction taken by the CCP is very convenient for foreign countries in the short term, but the long-term effects are quite different, since once a peak of innovation is reached, China's competitiveness will increase dramatically, weakening markets in the rest of the world.

Worldwide, the macro-implications of the MIC25 are mainly 3. With reference to the 10 main industries designated by China as targets of the plan, the first implication concerns the change in leadership in each of the sectors considered. At this moment China still considers the intervention and leadership in the main high-tech sectors of the most advanced European and American companies necessary, as their expertise is still vital for the development of Chinese capabilities. As happened for AI and electric vehicle industries, however, in the long term the trend of European leadership could change in favor of Chinese leadership, leading to their dominance in the global market. Another implication is the change in the dynamics of innovation: the achievement of the Chinese gap with the rest of the world in the most advanced sectors has generated an increase in the level of competition which has translated

into a further increase in technological development. Taking advantage of this scenario is China, which is becoming the arrival point for the R&D activities of global companies, especially emerging ones that are generating their value chains directly in China. Striking cases of this phenomenon also involve big firms such as BMW or Volkswagen, which have transferred R&D related to electric vehicles industry to two different centers: Shenyang and Beijing (Research and development in China, 2019). The country has in fact become the world hub in the sector, but this has happened in the long term after the contribution of foreign companies such as Byton, a company founded by German investors in China.

It can be concluded that the advantage of Chinese companies is the ability to integrate technological development, a massive recourse to incentives and facilities, which allow them to advance faster and sustain R&D costs, closing the technology gap in the weakest sectors and increasing competitiveness in others.

# 4 – INDUSTRY OUTLOOK

Based on what has been said so far, it can be inferred that the outcome of Made in China will not necessarily be positive or negative but may be different depending on the Industry. Sectors such as NEVs and energy savings vehicles have already revealed a supremacy of China, outlining in that area the success (at least for now) of the MIC25, unlike the area of semiconductors where there is still a high weakness and high dependence on more advanced countries. In addition, the CCP has adopted a different strategy in each of the sectors generating a different path for China and for foreign countries within them: the railway industry market, for example, has limited access to competition after the Chinese have assimilated and implemented advanced technology, while the new materials market has remained open to allow the absorption of new skills. The aim of this chapter and thesis is to analyze in depth each of the 10 industries indicated by the MIC25 to understand the developments made by CCP so far and what are the present and future opportunities for the whole world (except for two areas, Aviation and Energy Equipment, of which there is not enough information to define a precise strategy plan). In fact, it should be noted that the presumed benefits for all the actors involved will not necessarily be the same during the implementation of the strategy: in the short, medium and long run the results could change drastically, initially bringing advantages for foreign countries and then for China. In addition, it should be considered the ability of companies to respond effectively to the dynamism of the market, a strong variable in the outcome of the MIC25.

## 4.1 – Next Generation IT and Cloud Computing

The Next Generation IT Industry is certainly at the forefront of the Made in China 2025, since it is the one that penetrates in a capillary way in each of the 10 fields considered: IT leadership allows to exercise greater control and influence on the domestic market. In the last 5 years China's performance in this field has been very good, the growth in investment and R&D has allowed the sector to grow by 6.5% per year until 2020 (IT Services Industry in China - Market Research Report, 2020), becoming the key Industry in the national economy. In terms

of spending, Chinese IT market is one of the first in the world for width, competing with Japan, Germany and US, reaching an investment of $105 billion for the Industry, with a forecast market growth rate of 10% for the next 5 years (China IT industry and the software sector in Beijing, Shanghai, Shenzhen, s.d.). The Next Generation IT Industry, which includes areas such as Hardware and Software and It Services, is the one in which the government exercises the most closure approach, with the objective of completely nationalizing the field, permanently eradicating products manufactured by FIEs and replacing them with local technology. The opportunities for foreign companies are even lower because this is an Industry in which operations by the CCP started already in 2015, with the entry into force of rules that anticipated the will to "accelerate the advancement of domestic production, indigenous and controllable substitution plans, and the building of secure and controllable information technology systems " (Martina, 2016); (The Politburo of the CPC Central Committee conducted the 36th collective study on the implementation of the strategy of network power., 2016), or, as in 2016 with the introduction of rules and restrictions on information security and network (Ning, 2018). With reference to tab.8 of chapter 2, which shows the relevance of the industry through the number of projects implemented, and the creation of such strict standards and restrictions, it can be inferred that China's goal is undoubtedly to leave no room for foreign companies, favoring domestic ones.

Opportunities for non-Chinese entrepreneurs are virtually absent in this scenario, but this does not mean that a wide range of opportunities are available for Chinese enterprises. The consequent reduction in the presence of foreign companies forces China to drive the process of innovation, which is only possible if China will be able to acquire and correctly implement the technological processes absorbed over the years: only in this way the Chinese government will be able to achieve the objectives of the MIC25 and achieve leadership in the sector (European Union Chamber of Commerce in China, 2017). On the other hand, there is another challenge facing the CCP. The U.S. Chamber of Commerce, after analyzing the nationalist approach by many countries to their domestic market, has highlighted the problem of deglobalization. While the aggressive protectionist approach favors the development of local businesses, it also leads to the isolation of its economy from the benefits of using global ICT, creating a precarious situation for local businesses that very often fail to sustain technological advancement. This will carry a real economic cost: it has been calculated that the potential

de-globalization of China's ICT industry more broadly could lead to a 1.9 to 3.5 per cent reduction in China's GDP. Based on 2015 figures, this amounts to more than EUR 180 billion per year, and by 2025 could amount to a cumulative reduction of EUR 3.00 trillion (U.S. Chamber of Commerce & Rhodium Group, 2016).

In this regard, it is possible to apply a series of measures that could benefit both Chinese and foreign companies, albeit in different measures. China should reduce in a small percentage the protectionist and Embrace a more Globalized ICT Sector approach: the dynamism of this Industry is largely due to its globalized aspect and to the frequent innovations and solutions that constantly reshape the market, and a strategy of this kind would promote national and international competition further favoring technological development. On the other hand, China can afford such a rate of challenge, being able to count on its level of innovation and its leadership position in the Industry thanks to Really big Companies such as China Mobile, Tencent, Alibaba, Baidu and Xiaomi just in the Software Industry (Ross, 2020).

As anticipated in chapter 3, most of the access limitations of foreign companies have been introduced in cloud computing, specifically for the Iaas and Paas segments, through the introduction of standards, licenses and certifications. The reason why the sector is targeted by the Chinese government is that cloud computing is on-demand access, via the internet, to computing resources (applications, servers, data storage, development tools, networking capabilities) hosted into a remote data center managed by a cloud services provider, which makes it possible to reduce most IT costs and significantly increase the speed of digital operations (Vennam, 2020). Cloud computing is therefore the heart of smart manufacturing, as the competitiveness, efficiency and innovation of the entire smart manufacturing process increasingly depends on the quality with which this feature is managed. The concern of CCP is therefore to ensure full security and protection of data by its cloud service providers, combined with a control of the entire cyberspace. From 2016 to date, a series of regulations and reforms have been implemented in this direction, which through the introduction of licenses and restrictions that force foreign companies to provide their data to the government, have almost completely limited access to the market (McKinsey&Company, 2015). The policy followed in Cloud computing respects the one pursued in the Industry to which it belongs, i.e. the ICT sector, and in fact the resulting problems are essentially similar: hindering the development of foreign enterprises makes them recruited in outsourcing willing,

leading to a weakening of the most advanced operations in the sector. China should therefore apply a softer policy at least in the cloud computing sector, considering that the implications in this area could be far greater than in any other industry.

### 4.2 – Telecommunication Equipment

The telecommunication equipment industry, unlike the previous one, is not characterized by the constant intervention of standards by the state, but by a simple presence of the same: Chinese telecommunication equipment manufacturers enjoy incentives and benefits from the government, managing to become competitive in international markets. The CCP is basically the owner, operator and also operator of the telecommunications sector in China, counting among its ranks the 3 main Chinese companies: China Mobile, China Telecom and China Unicom (McCarthy, 2012). The strategy in this case is to use policy instruments that can support local companies, such as the recent use of catalogues of domestic high-technology products that has enabled the included companies to receive benefits such as preferential tax rates and low-interest loans from the Bank of China or China Development Bank. The real competitive advantage, however, comes from the absence of OECD export financing rules, which allows the Chinese government to support the local industry assiduously, unlike Europe or the United States, which cannot provide a similar contribution. This regulation has been developed in order to ensure transparency and proper conduct of government financing, which very often have a strong influence on international markets, facilitating the position of companies coming only from specific countries. This is the case of China, which, not having joined the OECD, has supported numerous companies over the years: one of the best-known cases concerns the strategic partnership founded between Huawei and Turkcell Group in 2016. This operation between the two firms was carried out with the strategic objective of focusing on the development of 4.5G and 5G technologies in the telecommunications sector and was accompanied by an agreement between the Turkish company and China development bank of about 1.3 billion Euros to structure the company's existing loans and to help finance procurement from China for infrastructure investments (Pamuk, 2015). A very similar situation occurred with a CDB loan of about USD 200 million to OGER Telecom, a

telecommunications and technology services provider based in South Africa, Asia and the Middle East, whose maturity, grace period and annual interest rate did not comply with the rules and limits imposed by the OECD rules (Regulatory Disclosure - Long Term Loan Agreements, 2015).

In international markets where there is a high level of competition, support from the government that does not respect the OECD proves to be the real competitive advantage for companies, in the case of China this attitude eliminates, on balance, any attempt at competition from companies that are not Chinese. In this scenario the opportunities for China are clearly superior in the domestic market, but the lack of habit to develop through constant government support reduces the level of competitiveness of the Chinese companies themselves, which will most likely not be able to exploit this advantage at the international level (where the competition and the level of technological innovation is much higher). Therefore, in order to ensure an advantage at the international level, China should align with the best practices provided by the OECD: in the short medium run, the Chinese government has managed to bridge the technological gap in the communications sector by acquiring advantages through the policy just described, in the long run instead, it should try to align with the regulations in force.

### 4.3 – New Materials: Semiconductors

The analysis carried out showed that the New Material Industry is the most critical for the Chinese economy. Within foundational technologies, the market of semiconductors, the real Achilles heel of the MIC25, appears particularly weak. The reason why, despite the huge gap to be filled, the industry is included among the main 10 to be developed, lies in the fact that it is a field that serves as a basis for the development of as many sectors such as software, trains, planes, robots, aerospace, electrical networks and smartphones. Hence the importance of semiconductors, the most R&D-intensive industry in the world, with investments in research that are made every generation, even on products that already exist. In addition to this, the People's Republic of China is the first semiconductors customer in the world because more than half of its exports depend on the presence of this basic technology (U.S.

Department of Commerce, 2016). China stressed the importance of this sector in June 2014 with the publication of the National Guidelines for the implementation of MIC (Guidelines for the Development and Promotion of National Integrated Circuits Industry, 2014), although, as mentioned in chapter 2, the idea is to accept to remain some generations behind the general technology level, being able to rely on a large domestic market. The dependence on foreign countries in this area is demonstrated by the fact that in 2016 China represented the destination of about $100 billion of global conductor shipments, equal to about 30% of world production (U.S. Department of Commerce, 2016). The solution to this weakness is moving on two different tracks: taking into account the fact that China intends to remain two generations behind in technological expertise, on the one hand the government tries not to increase this gap and, if possible, reduce it as much as possible through intensive R&D, on the other hand it assists local Firms to form mergers and/or make acquisitions internationally (Ernst, 2016).

The first way is therefore the development and internal consolidation, possible only by updating the technological capabilities in this area through a financial support policy supported entirely by CCP. The numbers from 2015 to 2020 show the growth of the industry that has increased from $84 billion to $157 billion remaining robust even in the first quarter of the last year despite the Covid-19 breakdown (China Semiconductor Industry – Expansion Plans Analysis and Trends (Government Policies and Guidelines, Import and Export Impact on Trade Partners, Key Concepts, Case Study, Key Strategies Adopted, Future Plans, and Recommendation to Players), 2016), to which is added that very small companies in this industry have disappeared in favor of the creation of more large companies. The company that most reflects this strategy is Tsinghua UniGroup, a majority owned subsidiary of Tsinghua University's government-owned Tsinghua Holdings, which in 2016 invested $50 billion to become the world's third-biggest chipmaker (Carsten & Lee, 2015).

The second way for development concerns the creation of investment funds by the government to promote dynamics such as acquisitions, mergers and modernization of semiconductors plants. Table 8 shows that this is the CCP's preferred strategy in this industry, so much so that in March 2016 the government injected more than $20 billion to support and improve the facilities of Chinese semiconductor companies (Shenshen, 2016) after creating a multitude of similar funds such as the China Integrated Circuit Industry Investment Fund or the Beijing IC Industry Equity Fund. The CCP is strongly oriented in this direction, so much

so that recently in July 2020 it generated a further boom in the semiconductor industry with the injection of almost $4 billion for 72 companies (China’s Semiconductor Boom: 72 Chip Companies Receive CN ¥26.7 Billion in 2020, 2020). While some of the investments go towards the improvement of existing structures, the largest part is oriented towards the acquisition of foreign companies that, as analyzed above, aim at the acquisition of technologies in Europe and the United States.

Basing of what has been said so far, it is possible to analyze the opportunities and threats that may emerge in the long term for China and the rest of the world. The government relies on an intense R&D and internal consolidation strategy, which may not be effective in achieving the objectives of the MIC25: as stated by McKinsey, the semiconductor industry, mainly based on technology and innovation, makes it particularly difficult to displacing the established leaders in the sector, which is why a simple R&D policy, moreover a country lagging behind in the sector, is not enough to break down these barriers to entry and therefore to achieve success. The opportunity cost of funding in a sector where China it is extremely weak its damaging for areas where those same investments could produce a higher output. Moreover, considering that China's strategy is to remain two generations behind technological development, then this type of operation is not particularly efficient. In fact, the Chinese industry would risk having a large number of weak companies, equipped with non-advanced technology that base their strategy on intense R&D (led by the government and not by the companies themselves), particularly ineffective, in my opinion, if not applied to a solid base of expertise that in this case China does not have. On the other hand, government-led and government-supported acquisition and merger operations with highly advanced foreign companies could be the key to the MIC25's success in this area. The investment direction of the CCP should only be this one as it would allow the gap to be closed quickly and catalyze government funds towards a single goal. Opportunities for Europe exist here especially in the short term but will decrease significantly in the long run as soon as China is able to assimilate the know-how and innovative technological process. Much of the success of the MIC in this sector depends on the total success of the Chinese plan since semiconductors and more generally new materials are the basis of smart manufacturing.

### 4.4 - Robotics

The Robotic Industry represents one of the sectors in which the greatest number of controversies related to the chosen policies is revealed. Of the 10 core areas targeted by the MIC25, the sector in question is the one in which the Government has implemented the largest number of subsidies and funding and represents the continuous attempt by the Chinese authorities to improve the Industry. The strategy began as early as December 2013 with the publication of an official document called Guidance Promoting the Development of the Robot Industry, which planned the objectives that would be clarified a year later with the Made in China 2025 (Cheng, Jia, Li, & Li, 2019). To demonstrate the persistence of the Chinese approach to the Robot field there is a long series of reforms carried out during these 5 years, in particular those proposed and then implemented by MIIT, MOF and NDRC (Ray, et al., 2016) and the continuous subsidies provided to companies that contribute to the sector. This policy has undoubtedly fed the Industry, stimulating it so much that China became the world's largest industrial robot market for four consecutive years, with a sales volume of about 100000 units in 2015-2016 (Yingzi, 2016). 5 years ago, production was expected to increase from 100 to 150000 industrial robot units in 2020, but China has only reached these numbers in 2018, reaching almost 180000 units in the current year (Industrial robot production volume in China 2015-2018, 2019). The data therefore show a development of the Chinese market, which, however, cannot be said to be absolutely satisfied with the investments made.

The strategy implemented by the Chinese authorities includes two main guidelines, the first concerns the use of subsidies, the second focuses instead on the creation of industrial parks: both have contributed to the growth of the sector, but present many problems and limitations. The program of grants from the State began in 2016 with the identification of about 28 provinces and cities as clusters and development centers within the robotic industry. The province that most benefited from such subsidies was Guangdong, which was the target of the establishment of a government fund of about CNY 17 Billion with the aim of replacing the workforce with intelligent machinery and robots. Within the province, however, it was the local governments that pushed this huge operation of subsidies, creating a fund of about 30 million euros in the city of Dongguan alone, about 70 million euros in the city of Shenzhen and many others, also implementing in parallel a series of standards/facilitations for these

same cities that concerned awards for the introduction (creation or purchase), by local companies, of intelligent robots and machinery as in the case of the cities of Wuhu, Foshan and Dongguan (European Union Chamber of Commerce in China, 2017); (Huifeng, 2016).

China's decision to assign to each province one of the 10 areas designated by the MIC25 and consequently create clusters within the most developed cities in each province is undoubtedly a winning one. In the case of Robotic Industry, the Chinese government has provided for the creation of clusters and the allocation of incentives in the Guangdong region, entrusting it with the development of a part of Made in China 2025. However, government support for this sector is extremely poorly designed and uncoordinated. In fact, funding is allocated based on criteria that are very easy to reach or even circumvent, making access to funds extremely simple for many companies. In 2017, the number of firms capable of producing advanced components or finished robots themselves stood at around 8%, the remainder being assembly companies, which in most cases purchased most components from foreign companies. (European Union Chamber of Commerce in China, 2017). Still others carried out rebranding operations of products assembled elsewhere, accessing, in fact, to financing, without operating at all in the Robot Industry. In this scenario it is clear that the allocation of economic resources is totally inefficient and the reason lies mainly in the fact that local authorities, which have to assess the compliance with the requirements, very often do not have the appropriate skills to perform this type of analysis (Qingyan, 2016). To complicate the situation, these errors in the allocation contribute to the survival of companies benefiting from subsidies that without them would leave the market: in China there is therefore a large number of companies that "operate" in the industry sector without any requirements, that do not contribute to the growth of the sector by accessing government subsidies and that, given their lack of expertise, do not even fuel market competition, creating de facto economic stagnation and innovation (Xutian, 2016).

The second guideline is the creation of industrial parks. The aim of clusters of this type is to create development centers, which act as national hubs, in which to concentrate research and development of skills in the sector. In this case, China has established 40 parks for the Robotic Industry alone, giving it a highly inadequate structure: as mentioned above, the companies that can access these clusters are very poor, and often very little differentiated, thus making it

unnecessary and unjustified such a huge investment for such a large number of parks (Lin, 2018); (Qingyan, 2016).

Robotic Industry is extremely important for the success of the MIC25 since its development would positively affect the other 9 areas, so China needs to adjust its focus as soon as possible: the subsidy strategy is extremely inefficient and, following the example of IT Industry, needs to be replaced by an R&D policy combined with government support in the acquisition of foreign companies with high expertise in the sector. In this way it will be possible to justify the huge investment made in the creation of Parks, which could become real international hubs in the medium long run.

### 4.5 – NEVs

The strategy chosen for this Industry has seen two very different approaches since 2010. First, it should be noted that the NEVs sector was targeted by the Chinese authorities well before the MIC25: already in 2009 China was interested in plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs). The ways in which the government has improved and strengthened the industry are those now known, i.e. first a long series of investments that in the last 30 years have reached about 6 billion dollars (Cheung & Mahnken, 2016), combined with an intense R&D strategy and a strong pressure on foreign companies to force them to transfer both basic and advanced skills in exchange for access to the Chinese market. However, the strategy has undergone a series of changes due to the fact that since about 2018 China has partially reached the MIC25 goal for this sector, softening, in fact, the restrictions imposed mainly on foreign companies, making the Chinese market open again, albeit in a limited way.

From 2009 to 2016 the pressure for technology transfers was carried out through rules and restrictions on Joint Ventures: the first obstacle was the shareholding that could not exceed 50% for foreign entrepreneurs, the second was the imposition of rebranding for the production that came from Joint Ventures. The real advantage was obtained by the obligation for the Chinese Joint Venture to control at least one of the three key technologies previously designated: whole vehicle control systems; interfaces and boundaries between NEV core

components; engine and powertrain control systems (U.S. Chamber of Commerce & Rhodium Group, 2016). On January 6, 2017, China's Ministry of Industry and Information Technology replaced the previous rules, strengthening and clarifying the rules of access to the Chinese market, clarifying the requirements to be met in order to enter the NEV market. While it was previously possible for foreign companies to "hide" some of their core competencies, in 2017 these limits were reinforced, forcing foreign entrepreneurs to demonstrate full competence and mastery of all key processes and thus more simply, forcing foreign entrepreneurs to disclose and transfer their entire know-how to China. (New administrative regulation on market access of new energy vehicle manufacturing enterprises and products now released, 2017). In this way China was able to acquire the foreign expertise it lacked by building the foundation for leadership in the Industry.

The policy of subsidies has followed the same direction of the Robotic Industry becoming the main instrument in the growth of the sector but turned in a different way. The first real benefits for domestic companies were introduced in September 2015 with funding for all firms that procured at least 30% of their total vehicles or that could contribute to the development of the Industry, leading the sector to grow sales by 343% in the following years (European Union Chamber of Commerce in China, 2017). The problems arose when this type of operations began to "drag" small companies that otherwise would not have survived in the market, also creating a major problem of overproduction (Yan, 2015). It has been observed in fact an enormous growth in the productive process pushed from the governmental financing and subsidies, extremely useful to satisfy the initial demand of the State that has intervened in order to make huge purchases in the sector. Over time, however, the effects proved negative, since, as stated by Chinese People's Political Consultative Congress member and NEV expert Ouyang Minggao, annual sales of electric minibuses in 2016 amounted to about 25,000 units, a figure that Chinese manufacturers were able to achieve in just under a month (Limin, Zhiming, & Wei, 2016). In 2017, however, the Chinese authorities were able to understand the problem of overproduction, starting a downsizing policy to avoid overperforming in an already saturated market. On the other hand, despite the not completely effective allocation of subsidies, combined with an R&D strategy has allowed China to acquire the leadership in the sector, first succeeding in absorbing skills from foreign companies and then implementing them correctly by expanding the domestic industry. As for the Robotic Industry , CCP's

misallocation of resources also involved investments in companies that did not really operate in the NEVs sector and did not contribute to the development of the industry (Adjustment to Subsidies for New Energy Veichles in China, 2017).

The subsidies have also provided a huge boost to the speed of development of the industry, not giving consumers time to generate real demand for NEVs. While international companies have favored a gradual development of the industry by moving from highly efficient combustion models to hybrids that would allow consumers to approach the reality of electric vehicles and softly approach the new market. In this way, it was possible to create the conditions to generate real demand, which was not the case in China, where electric vehicles were improvised too quickly (Spring, 2016).

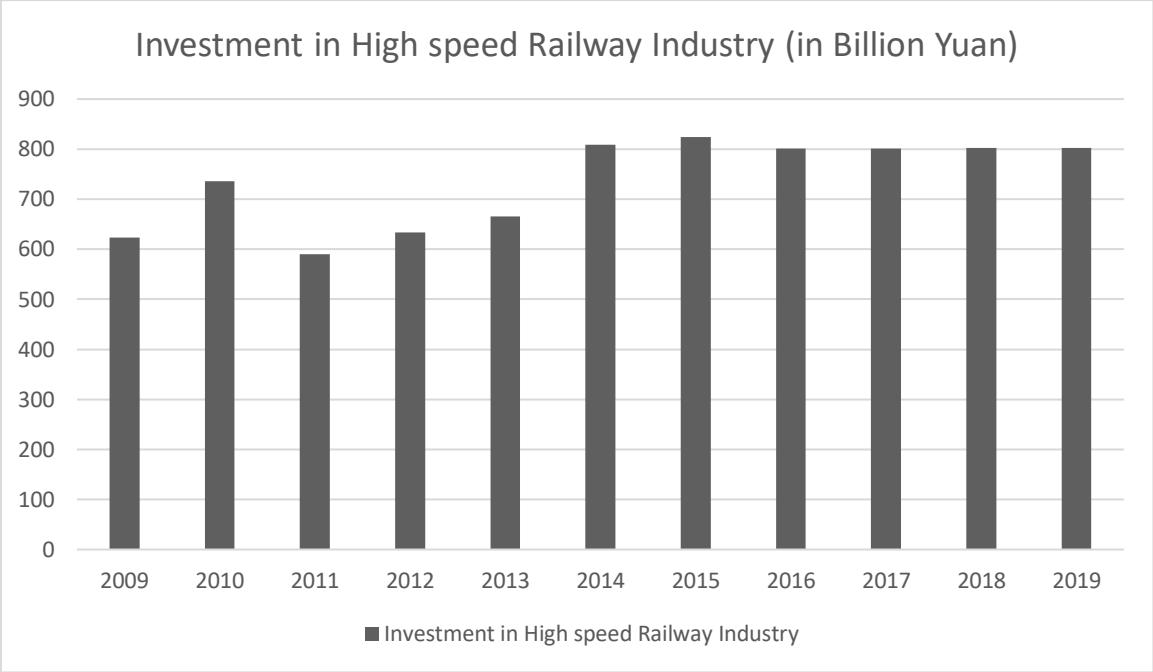
The path of China can therefore be divided into two phases: the first has seen a great effort of the state in terms of subsidies, regulations, R&D, acquisitions abroad and implementation of protectionist policies that have helped to develop the sector enormously until reaching leadership. In 2018, the Chinese authorities realized that the threat of overperforming along with a lack of real consumer demand was real, and that furthermore, closure and subsidies were no longer the strategy to follow. In fact, in 2020 China cut its subsidy funds by 10% with the goal of decreasing them further in the coming years (Sun & Goh, 2020) and made steps back in the industry, easing mandates and providing flexibility for automakers to get back on their economic feet (Strong, 2020). The case that allows to understand the Chinese strategy is that of Samsung and LG Chem, two manufacturers of EV batteries that in 2016 have not reached the requirements to access government subsidies remaining, in fact, outside the Chinese market. The operation was clearly aimed at limiting the presence of foreign companies in the sector, but recently, after having achieved advanced expertise in the NEVs sector, China has decided to limit the closure approach by reinserting the two companies in the list of companies that can access government funds (Jin-young, 2016). In conclusion, the CCP approach is correct in this sector: the weaknesses concern the approach too much oriented to the exclusion of foreign companies, which is however decreasing over time.

### 4.6 – Advanced Rail Equipment

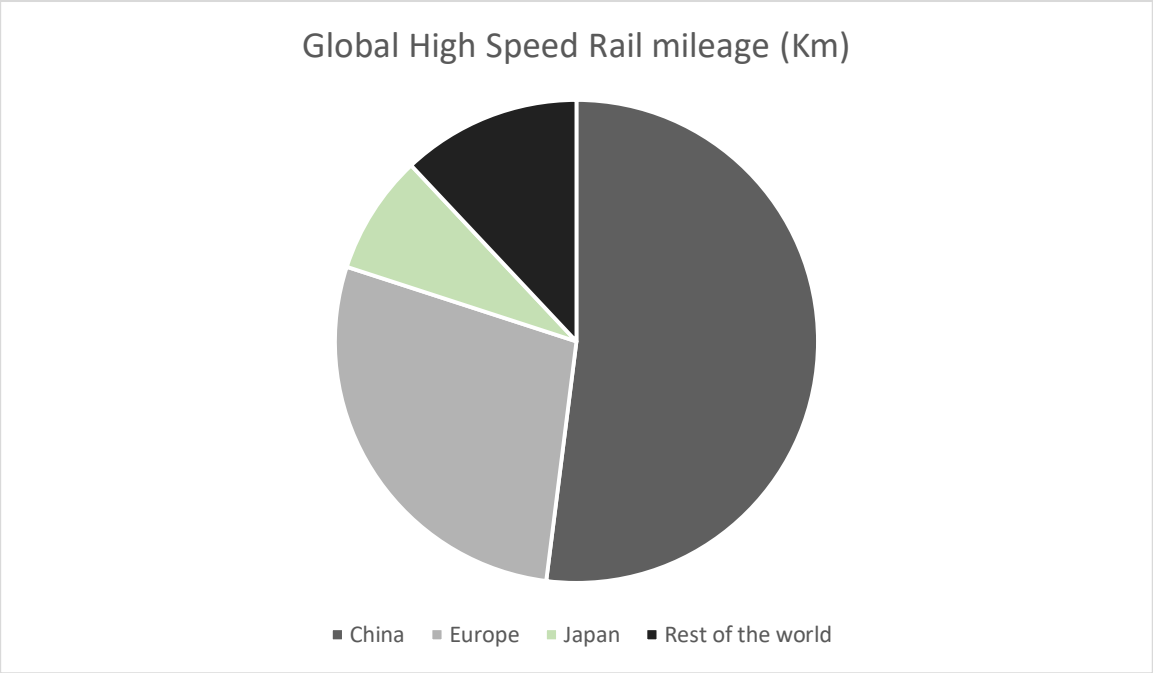
High-speed rail is the area where China's strategy has worked best. China has managed to acquire and exploit foreign technology by relying on the size of its domestic market. It has added to this an appropriate R&D strategy that has improved the know-how and tech skills of other countries and implemented an internal acquisition and merger policy. The strength of the sector lies in the fact that it is an area of strong governmental control since the Minister of Railways has a strong authority on production processes, management and allocation of resources and technological direction. It is a sector that occupies an important position in the Chinese "go outside" and "One belt", and under the leadership of former Minister Liu Zhijun it has developed exponentially thanks to a strategy of transfer of skills and technologies of the most advanced foreign firms such as Alstom, Bombardier, Siemens and Kawasaki. Alongside the foreign joint ventures, the Chinese authorities have planned the creation of a dense ecosystem that favors the development of the sector through structures such as specialized universities and research and development units that work synergistically not only to implement technological expertise, but also to ensure effective coverage of the sector's location. The boost received by the industry in recent years has mainly depended on improvements made by Siemens and Kawasaki, which have implemented the speed of operation of key processes. Despite China's openness to these companies, the rail market remains fairly closed: as soon as China acquired the necessary skills, supported by intensive R&D, it continued to develop the sector on its own, reducing the chances of non-Chinese companies entering the market. However, one should not make the mistake of comparing the closing attitude of this industry with those analyzed previously: the railway sector presents numerous opportunities to enter the market, especially through the creation of joint ventures in China.

An interesting merger operation was carried out in 2014 involving China South Locomotive and Rolling Stock Corporation (CSR) and China CNR Corporation (CNR) to form CRRC Corporation Ltd (Dodillet, 2015). In essence, the operation has created the largest state-owned multinational corporation with a global market share of just under 50% that benefits, unlike other big corporations, from constant state benefits that allow it to compete globally. CCP's commitment through increasing investments in the sector since 2009 has led to the creation

of the largest high-speed rail network in the world, which alone occupies more than 50% (Tab. 18); (Tab. 19); (Chan & Wang, 2016).




Tab. 18 – Source: (Chan & Wang, 2016)




Tab. 19 – Source: (Chan & Wang, 2016)

The challenge for the future is to start eliminating some restrictions on the market, especially considering the enormous strength of the internal multinationals. Greater openness in the sector could lead to greater competition and consequently, greater technological development, essential for China, which could improve the sector in which it turns out to be the largest customer.

### 4.7 – Biopharmaceuticals and Medical Devices

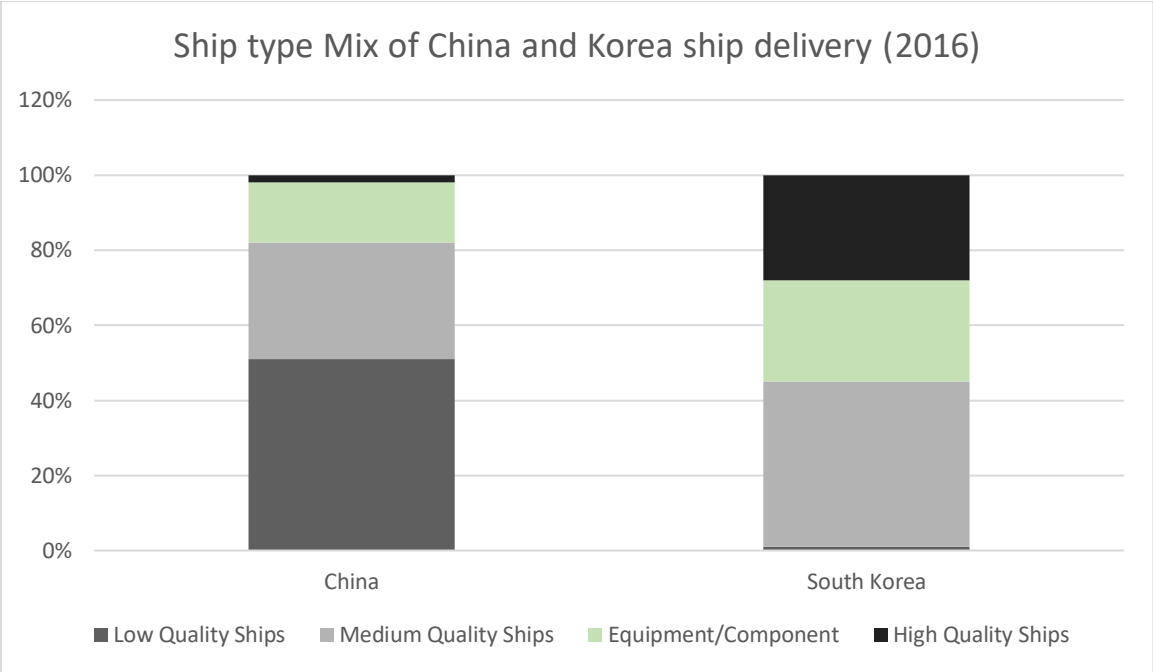
MedTech Industry is the most delicate area of the MIC25. Medical devices encompass a wide range of instruments, equipment, apparatus, in-vitro diagnostic reagents, calibrators, software, and consumables intended for the purpose of detecting, measuring, restoring, correcting, or modifying the structure or function of the body for a medical purpose. The Chinese market has grown very rapidly from 2010 to date, reaching a value of about US$ 1.2 trillion, with a 10% increase between 2019 and 2020. Despite this, China is still lagging in the sector. (Wong, 2020).

The strategy of the Chinese authorities is the same as many other areas of the MIC25, i.e. an intensive program of acquisitions and mergers and a policy of market closure. The M&A program is carried out in a very precise way: the government finances acquisitions with European companies in order to acquire their skills, carefully avoiding local deals. China's lack of technological expertise in this sector has not allowed the country to develop large companies with innovative know-how, so CCP, unlike for example the Railway Sector, cannot afford to encourage domestic deals among small and low-tech Chinese companies. Different discourse is valid for outbound deals, operations that aim not only to learn foreign know-how, but also to improve the Chinese presence in the global market (Luo & Xie, 2016). The closing attitude towards the domestic market, on the other hand, reveals an enormous series of critical issues. China's National Medical Product Administration (NMPA) is the main regulatory and administrative body that creates, implements, and governs the standards of all medical devices, cosmetics, and drugs in China. NPMA is responsible for approving a product before it enters the market and is also responsible for post-marketing activities. Development and approval are therefore in the hands of the Chinese government, which seeks to prioritize

the use of local drugs and machinery through the creation of medical equipment catalogs that often only include products made in China. The criticality of this strategy lies in the fact that MedTech industry, unlike the other areas of the MIC25, requires expertise in disciplines such as medicine, natural sciences and engineering, skills that are therefore not easily assimilated with a single outbound acquisition strategy. China should review its policy of openness towards the domestic market by refraining from using sector-specific catalogs, allowing foreign companies to invest in the Chinese market and direct state support towards massive R&D.

### 4.8 – Maritime Engineering Equipment & High-Tech Ships

Thanks to its excellent manufacturing capacity, China has managed to become the world's number one shipbuilder in shipbuilding. The Gap that it must bridge with more developed countries is not about production capacity, but about the quality and technology implemented in the sector, a quality in which it is still slightly behind. In the last few years it has managed to surpass Japan and Korea (tab. 20) in the production of ships, boasting 4 of the world's top 10 companies in the production of maritime equipment, but being able to rely only on ships and products of low value and low technology. In concomitance with the implementation of the MIC, in 2016 MIIT published the Shipbuilding Industry Deepening Structural Adjustment, Accelerating Transformation and Upgrading Action Plan, whose objectives are to reduce the production of low cost ships to focus on high technology products and especially to implement an R&D policy with which to bridge the tech gap with other countries.




Tab. 20 – Source: (China Ship Equipment and Component Market, 2019)

In 2018 the CCP has undertaken a series of actions to increase investment in R&D while ensuring at the same time an opening of the market abroad. The result was that China started to produce high-end ships such as Ro-Pax, Ro-Ro, chemical tankers and advanced mega containers. In 2018 Fincantieri S.p.A., an Italian company, began a collaboration for the construction of the first Chinese luxury cruise ship. Another successful strategy was that, already seen in the Railway Industry, to carry out inbound fusion operations of the largest shipyards. In fact, in 2016 COSCO Shipping Heavy Industry Co Ltd was created following the merger of the 13 most important shipbuilding companies in China, which allowed to improve production capacities and technological skills in the Industry.

China's large shipbuilding companies are moving up the value chain into ship equipment/component and carrying out vertical integration to enhance their competitiveness and profitability. The ship equipment industry is an important part of the shipbuilding industry. The importance of ship equipment can be easily deduced from the percentage that it occupies in the production cost of a ship: about 50%, which is why the Chinese authorities

are moving in this direction. The Chinese industry has undergone an enormous transformation in recent years. The modernization of the entire sector has allowed the country to open new and numerous opportunities and the not overly closed market policy has allowed to acquire skills in the construction of more advanced products (China Ship Equipment and Component Market, 2019).

# 5 – LESSONS TO LEARN

Made in China is not a simple program or a political strategy: it is a 30-year long-term project that will have a huge impact on Industries worldwide and will determine leadership in the potentially most important sectors over the next 20 years. The outcome will not necessarily be positive or negative as China could only achieve leadership in a part of the ten sectors, but in any case it will irreversibly change the increase in the advancement of technological research and develop skills and know-how that will at least allow it to be competitive at a global level in all ten MIC Industries. On the other hand, the rest of the world has to face the Chinese advancement, guaranteeing itself a role in the leadership of certain sectors and trying to counter the Chinese mechanisms and policies that are particularly harmful and disadvantageous for non-Chinese companies. In this last chapter, based on what has been analyzed so far, conclusions will be drawn regarding recommendations and lessons to learn from all the actors involved in the implementation of Made in China 2025.

## 5.1 – Recommendations for China

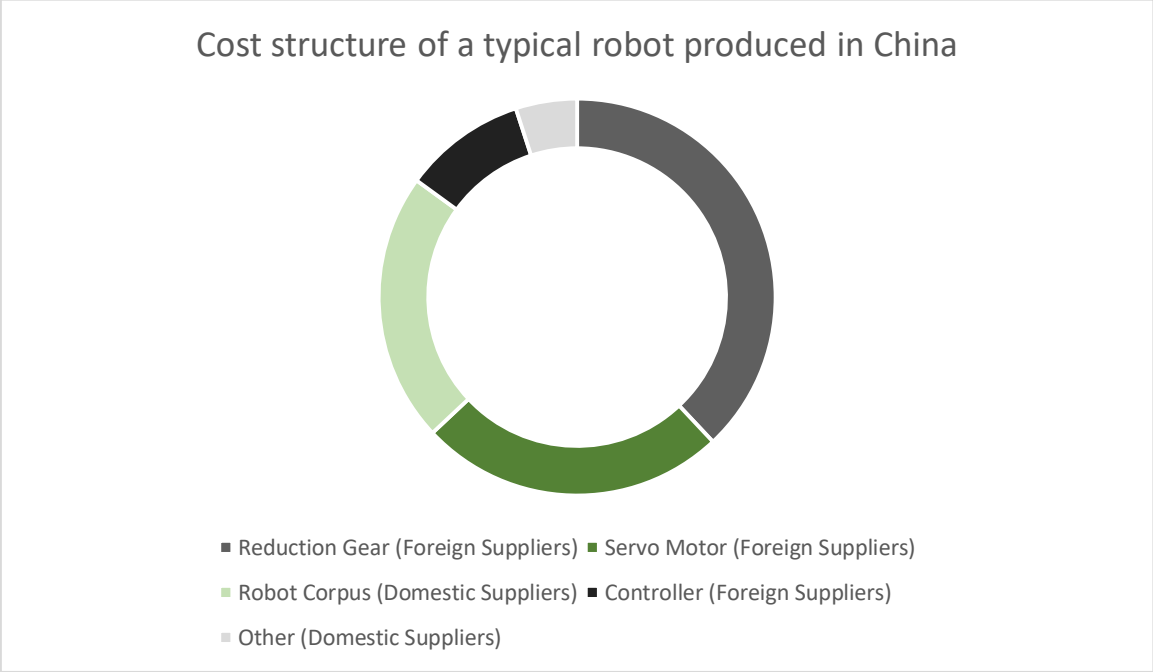
The first recommendations concern the protagonists of the project: China. In the previous chapter we have already analyzed the critical issues for each of the sectors and provided alternatives to achieve more success in the implementation of the MIC, however, it is useful to mix them with suggestions regarding the use of critical drivers and factors analyzed in the first chapter. The success of the MIC25 depends primarily on two factors: the first is the highly adaptive nature of the plan, which allows China to respond quickly to dynamic markets by simply removing or introducing policies. A long-term plan such as the MIC will inevitably go through a high number of phases of change, new foreign competitors entering the global market and constant changes in consumer demand, therefore, the ability to adapt quickly to change will be a crucial tool for the success of the MIC. The second crucial factor is the constant presence of the government behind the strategy, the true driver behind the plan. However, these characteristics must be considered a double-edged sword for the implementation of the MIC25, since on the one hand the Chinese authorities represent a huge

boost and competitive advantage for Chinese companies, on the other hand they risk to negatively influence the companies' performance based on policy objectives rather than market demand. The alignment of the government with the needs of national companies and an adequate and efficient allocation of state resources is therefore fundamental in achieving the goals set from 2025 to 2049. In the same way, it is essential to review in some of the ten Industries the policy of closing the domestic market: if in the last few years it has been extremely useful to ensure the protection of the domestic market, favoring the development of Chinese companies, now it is proving to be a wake-up call for non-Chinese companies that see themselves cut off from the Chinese domestic market, but above all, it has drastically decreased the domestic competition by disadvantaging the technological development, the central goal of the MIC25. The policy of acquisition through FDI aimed at Europe and the United States is instead proving to be the real tool useful to the cause, allowing China to quickly reduce the technological gap with foreign countries by bypassing an internal development, particularly difficult both for lack of talent and lack of skills, within the Chinese territory: for China it is currently better to buy than to build.

The Industry of reference that allows to deeply understand the weak points and therefore the areas in which to improve is the Robotic Industry. This is the sector where political support is maximally strong and where enthusiasm for intelligent production is at its highest: growth as previously stated has been exponential since 2014, allowing China to be the largest global robot market. The problem lies in the fact that the construction capacities of Chinese robots are extremely limited, in fact, as the graph shows, of all the components of an intelligent machinery, China contributes only 27%, the remaining part comes from foreign suppliers that for 66% affect the production of robots (Tab. 21) (Statista, 2016). The direction that China must take is therefore simple to predict: eliminate dependence on foreign suppliers in order to achieve a competitive position in the sector by 2025.

The industry that must be the reference for the general trend of Chinese economic policy must instead be that of smartphones. The sector in question remains the one in which China has achieved the most important results thanks to the development of highly innovative private companies such as Huawei and Xiaomi and not thanks to the intervention of the Chinese government. The global market share of Chinese mobile phones has reached 21.5%

only thanks to Huawei, and in 2018 also the emerging Xiaomi has managed to penetrate and acquire a slice market share of almost 14% global, surpassing in 4 years the Apple and Samsung giants. In this scenario it remains to be understood if the Chinese government with its constant presence is not slowing down or even blocking the Chinese innovation process, since private companies have managed, independently, to achieve excellent results (Technological Innovation, Supply Chain Trade, and workers in a Globalized world, 2019).




Tab. 21 – Source: (Statista, 2016)

## 5.2 – US and Europe Recommendations

On the other hand, the rest of the world is forced to face Chinese expansion in terms of FDI and acquisitions of foreign companies. Especially Europe and the U.S. should continue to welcome these operations, benefiting from the enormous advantages they can acquire in the short term, however, since these state-led acquisitions aim to "steal" technology and consequently to reshape leadership in the sector, it is necessary that countries establish

policies to protect themselves. Another major problem is that China denies access to its markets by not providing the same conditions as Europe and the United States, undermining the principles of fair competition. The total control by the government in foreign investment and the "discriminatory" policy therefore need an effective response in a short time, therefore, the solution that must be found is to create a "package" of policy instruments to combat this phenomenon. In this regard, the possible operations that Europe, the US and the rest of the world can implement are listed below. The first should be to make the Chinese acquisition process more transparent through a greater clarification of M&S requirements and objectives. The first step could be to require a more detailed explanation of the background of external investors, in order to study their objectives and possibilities in the long term, introducing a notification threshold that must consider the company's shareholding. This could be extremely useful since it would allow, in the event of a high percentage of acquisition, to study the reasons for the transaction and how much the CCP is driving it. Another answer to the Chinese policies should be to renew the criteria for the determination of threats to national security: at present these are related only and exclusively to sectors and products no longer strategic, therefore they should be updated and extended not only to the defense industry in the strict sense, but also to cyberspace and competition practices for the review of state investors. Another measure that could prove particularly useful in this scenario, which has already been examined by the European Commission, is to align the regulations regarding competition policy: the existing European rules provide a basis for investment transactions between the member states of the European Union, safeguarding the interests of the parties involved. The solution could be precisely to adapt the same laws for operations carried out by Chinese companies in order to have greater control over the intentions of state companies, as happened previously for the control carried out by the European Commission on an operation directed by China Nuclear Power Corp, a state driven company. The last possible operation to face the Chinese FDI phenomenon could be to establish reciprocity measures that allow to evaluate the necessity of a state intervention on the basis of reciprocal attitude and market access: investments should be allowed only if the same thing is guaranteed to inverse parties. The latter operation would not only be disadvantageous in the short term but would also be complex to implement since it would go against the principles of the OECD. Undoubtedly, the solution is not to be found within the cyberspace laws, since while the solutions just discussed can be implemented within the European/US territory and are therefore in the hands

of non-Chinese countries, trying to soften the Chinese cyberspace restrictions could prove to be far more complicated and in any case not certain.

By analyzing the MIC25 phenomenon in more depth, it is possible to distinguish further players involved, the first are non-Chinese suppliers of smart manufacturing technology and to follow the whole category of enterprises using smart manufacturing. The problem that the MIC25 suppliers must face concerns the balance they have to find between benefiting from the Chinese demand and being able to protect key competences and essential advanced technologies. The first solution could be to prevent a unidirectional technology transfer: if on the one hand it is necessary to relocate their production processes, moving key competences to China, on the other hand foreign companies have to try to guarantee a technology transfer from China by creating research partnerships, universities and technology hubs, within their own countries. In this way it would be possible to ensure long-term access to future Chinese technological expertise. The second strategy that could prove to be more effective, should instead be the limitation of expansion in China, which would guarantee access to the Chinese market but limiting the sharing of technologies.

In conclusion, the opportunities for Europe and the US are many in the short term, but the focus on Chinese development must be of primary importance. In order to avoid losing the leadership in most high-tech industries, it will be necessary to move quickly, avoid a massive sharing of skills and finally, continue to implement a relentless R&D policy in order to maintain the current technology gap with China.

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**MADE IN CHINA 2025**

## Introduction

*"It does not matter whether the cat is black or white, as long as it catches mice".*

This is how the main leader Deng Xiaoping speaks to Chinese people in 1978. On the background there is one of the poorest and most backward countries of the world, emerging from a decade of extreme poverty: the income per capita reaches the equivalent of $150 per year, and has grown by only 2.3% per year over the past 30 years. With a series of structural reforms Xiaoping wants to give a direction to the Chinese people, who are struggling to find a way to face the new industrial world. The result was that if in the 1970 food production and suppliers were insufficient to support a population of over 965 million of inhabitants, at the beginning of 2012, the People's Republic of China becomes the number one leader in the manufacturing operations and the second strongest economic power in the world. China has succeeded in making one of the most significant manufacturing miracles since the industrial revolution began in Great Britain in the eighteenth century, to the point that in the country was produced 90% of computers around the world, 70% of mobile phones, 80% of energy-saving lamps and air conditioners.

Towards the end of the 70s the goal was to emerge from a resounding poverty and improve the general condition of the country, but now, as a result of deep changes and at the peak of the fourth industrial revolution, challenges and opportunities have dramatically increased. Global industry is undergoing an epochal change due to an unprecedented technological revolution. The use of big data, the internet of things, cloud computing, intelligent machines and modern communication are interweaving more and more with industrial production and in this new dimension governments and industries are aware that this innovation reality is rewriting the dynamics of the global market.

The challenge for China is to transform the industry from a labor-intensive production to an intensive manufacturing that integrates all the features above, managing to become competitive worldwide.

In this scenario the Party and leader Xi Jinping himself intends to achieve an audacious goal: become a global leader in manufacturing high quality and high-tech products and substitute Chinese technology for foreign versions on domestic and global markets, all this, by the first half of the 21st century, through the "MIC25" plan.

The extraordinariness of the nature of the program resides in the name itself.
The perception that comes to mind hearing about “Made in China” is in fact a mass product, often relatively cheap, that is not associated with high quality: there is an effective consistent need for Chinese manufacturer to improve the product quality over almost all product lines.
In this regard through "MIC25" there’s the opportunity to innovate the entire manufacturing industry, acquiring the ability to create highly innovative products, build internationally well-known high quality brand, thus re-evaluating the image of Made in China, by conferring quality and luster, reinforcing the perception of Chinese products. The strategy defines, as stated in the official document of European Chamber “China Manufacturing 2025”, putting industry policy ahead of market forces”, ten high-tech core industries targets that strongly contribute to economic growth in advanced economies: next-generation IT, Biomedicine & high-performance medical equipment, new materials, telecommunication equipment, high end computerized machine & robots, aviation & space equipment, maritime engineering equipment & high tech ships, advanced railway transportation equipment, energy savings & new energy vehicles, energy equipment.

The aim of the thesis is to analyze specifically the plan of the Chinese government, understand its margins of feasibility, strategies, factors that can and cannot contribute to the success of the Leader Xi Jinping, taking into account the results obtained five years after the announcement of the plan. The analysis also revolves around the measures taken by the Chinese government, which with the use of a top down strategy, is the real driver behind the development of the project. There will also be a focus on the effects that the plan has had worldwide, as other countries have welcomed this ambitious project and what are the countermeasures that have taken the major powers worldwide.

## CHAPTER 1

The analysis of MIC25 must start by taking into consideration the factors behind the project. The first step is to understand the scope and nature of smart manufacturing, the core factor for the development of the plan. Next, the analysis will identify the main drivers behind the implementation and possibly the success of the plan and finally the biggest difference that the Chinese industrial revolution has with the rest of the world: the central role of politics. The realization of the "China Dream" and therefore the achievement of resulting goals revolve around "smart manufacturing". But could its correct application really be so impactful?

The S.M., as well as the internet of things and industry 4.0 is not something that can be learned and involved into the production process. It is in fact about a series of technological features such as automation and digitization, which combined, affect the organization and industrial production. The scale and the great impact they may have is justified by the fact that it is in all respects an industrial revolution: in the past the great technological innovations have always led to a complete reversal of the market structure, causing radical changes in the global economy. Mckinsey has predicted that by 2025, IoT applications could have 11$ trillion total impact. Specifically, smart manufacturing means a production characterized by the interconnection between machines, people, and data. The data returned by the machines are used and analyzed to optimize energy consumption and production processes. This type of production, much more complex, was born with the need to adapt to the extremely dynamic nature of the market, allowing industries to respond quickly to market demands, adopting an approach no longer predictive, but reactive. Chinese plan assumes much more shades considering that the goal is not only to create a "made in China", but, following Germany and US experience in the past, is the creation of a "designed and innovated in China". Building a solid manufacturing capability through the technological development becomes therefore necessary for Xi Jinping and in this sense, according to this thesis, the fundamental drivers that could mark the success are the manufacturing capability, the R&D investments and the human capital. The reason for this choice lies on the fact that these are the quantities to consider for a successful implementation of the plan. Manufacturing capability is the first important driver to consider. A country that has a good production capacity starts in an advantageous position in the world scenario and China in this sense is the global leader. A

high capability alone is not enough since it is necessary to integrate it with smart processes. Three items are included in manufacturing capability: GDP, Foreign direct investment net flow and high technology exports. Another important variable is a very strong increase in the R&D expenditure. The investment was carried out in an extremely thoughtful way, as it is a 360-degree research, that covers from the basic research to the applied research and experimental development. Only in 2019, China has spent about 21.7 million Yuan in research. The most interesting driver is the human capital. As previously mentioned, the search for talent, that is the highly specialized worker, is considered the crucial point for the achievement of global manufacturing leadership.

Behind the successes of Chinese development in recent years there are not the initiatives of companies, but the Chinese Communist Party. The implementation of the "MIC25" is in fact strongly led by the CCP, which must ensure the success of the plan to assure the Chinese economic well-being and consequently to continue to legitimize its position in the country. Since 2015, when the plan was announced, the party has faced numerous challenges and changed the direction of the strategy several times, however, the biggest challenges are mainly two. Historically Chinese people had difficulties in opening to the world, only in 1978 the government decided to adopt the "open door policy", altering the strategy from a self-sufficiency based to an "active world participation" one. Hence the Country closed mindset, which leads to a lack of enterprise initiatives. Most Chinese businesses are risk averse, especially when it comes to investing in high tech industries, since for decades the economy has been based on low cost, high intensity production far removed from the type of enterprise the party wants to create with the MIC. Managers prefer to opt for a low-cost solution not only from the production point of view, but also from the investment side, thus causing a first real obstacle for the CCP. In 2016, a German study showed that just over 20% of Chinese companies experimented smart working, while in Germany the corresponding reached almost 40% in the same year. It is here that the centrality of politics is manifested. The solution for this lack of enterprise initiatives was found by adopting a model that encourages innovation through the use of incentives and benefits for all companies that invest in the transformation and upgrading of the manufacturing process: policies and measures to support the real economy through financial support have been implemented since 2015.

## CHAPTER 2

The MIC25 has many points in common with the industry 4.0 plan implemented in Germany and it seems that the first was simply inspired by the latter. The reality is that while the core of the German plan was the achievement of the technological development, the Chinese plan goal, instead, is the restructuration of the entire industry, making it more advanced and competitive by using technological development as the main tool to center the objective. The MIC is therefore on a higher step than Industry 4.0 since it uses the German target as a simple tool for the success of the project. China's heel Achilles is the foreign dependency: the centrality of science and technology innovation is out of the question, but despite the improvements and application of future technologies, it remains highly dependent on foreign high-tech components in critical fields. The most complex and technologically advanced components, as well as the most innovative machinery, are still imported from abroad, and their use basically concerns all industries except computers and communication fields. This dependence is particularly critical for PRC as it concerns foundational technology, such as semiconductors, new materials and basic research, which are the basic skills to be able to introduce core technologies (as electric vehicle batteries, industrial robots and artificial intelligence), which are in turn indispensable to create future technologies (as autonomous driving, smart cities, facial recognition). China is particularly developed regarding the latter two, but suffers excessively this weakness, considering then that it would suffer a permanent interruption when denied the access to basic resources. In this scenario, to solve the problem of foundational technology, industrial policy aims to replace foreign products in a lumpy way with domestic technology. R&D is crucial at this stage, as the objective is to equip industry with innovative technologies that will make it possible to no longer depend on foreign countries, weakening foreign competitors and improving its position in the world market. It is not a case that the official documents concerning MIC25 often contain terms such as "indigenous innovations" and "self-sufficiency" that can guarantee the achievement of 70% of the market share of "basic components and materials". MIC25's strategy is very detailed and outlines very precisely ten priority industries within which to achieve the greatest progress over next decades: next-generation IT, biomedicine & high-performance medical equipment, new materials, agricultural equipment, high end computerized machine & robots,

aviation & space equipment, maritime engineering equipment & high tech ships, advanced railway transportation equipment, energy savings & new energy vehicles, energy equipment. It is possible to divide the latter into 3 main groups in relation to the degree of skills and innovation that China has in each of them: the sectors in which the Country has a strong position, the ones with weak position and finally the emerging sectors. The dynamic and adaptive nature of the MIC25 has allowed to adjust the strategy in relation to the performance and emerging challenges, thus allowing China to adopt a different approach for each of the major designated industries. The fields in which China has already forged ahead are the next-generation IT with the 5G networks, the energy equipment with the ultra-high voltage electricity transmissions and advanced railway transportation equipment. Not being able to put the same intensity on all 10 sectors, China decided to not pursue the development of high quality products within industries where it is objectively less developed, such as aerospace equipment, machine tools, or software engineering and advanced semiconductors. In this case the strategy is to accept to remain some generations behind the general technology level, being able to rely on a large domestic market. The plan prioritizes on emerging and digital industries. These fields represent a great opportunity for China and in my opinion represent the core goal they want to achieve. These industries are characterized by a lot of uncertainty and thanks to the large domestic demand and a constant R&D, the Country could rapidly move from domestic to international market, assuming a leading position in all those segments. In this environment the Government, that has a leading role, must take care to balance the different visions of entrepreneurs: on one hand there's the open approach, risk prone and market-oriented of the most advanced and innovative companies, on the other hand there's that of conservative nationalists entrepreneurs, which is more state-led oriented and adverse risks since they're frightened by possible radical reforms. Both factions, however, contribute to the country's economy, "forcing" the government not to balance in favor of either maintaining a neutral approach. In order to achieve a proper implementation of the plan private sector strength must be harnessed in the most advanced and prosperous industries. intelligently allocating resources, lending, and financing mechanisms. The second achievement is about focusing at the same time on the development and improvement of the State-Owned Enterprise (SOEs) through, when needed, the implementation of merges between SOEs and partnerships or merges with private companies. This strategy is the key of MIC25: The Government focuses on development and innovation, builds a competitive

innovation system, but does not give up the most important feature: its strong presence and influence on all the economic actors.

## CHAPTER 3

The development of the MIC25 has not only domestic implications. The strategy aims to strengthen the country's domestic capabilities, but it cannot rely just on its own strengths to do it. This translates into an outward-looking approach, so that access to innovative capacity and know-how from around the world can be guaranteed, learning knowledge that will not have to be developed from within. In a nutshell, the strategy is to learn how to innovate from foreign powers, so that we can introduce the new technological value chains into the national economy and quickly bridge the gap with foreign advanced companies. It is possible to divide the targets into 3 main groups according to the different types of foreign companies: Willing partners, Tricky Targets and Bargaining Chips. The first group to be analyzed is the B.C. It is formed by foreign companies that belong to sectors of low priority for the MIC and whose Technologies are normally integrated in the Chinese value chain: this is the case of consumer goods industries such as restaurants, but also supermarket chains and in general almost all retail sales. In this scenario China's approach is to open the market to foreign investors through the implementation of less restrictive policies, incentives, or, as happened recently, through the abolition of restrictions previously imposed in the electric vehicle sector. Willing partners are companies that easily accept to move the most complex and innovative parts of the production process to China, thus moving them permanently outside their country. This operation allows the Chinese government to develop and improve the domestic sector, incorporating foreign know-how in the value chain in a practically definitive way. In this case China's attitude is quite passive: industries of this type are emerging in sectors where the margin of profitability is very high and government policies are very convenient. The last group is the Tricky targets, companies that keep the main value chain processes inside their country, which are part of Industry focal points for the implementation of the MIC. While access to their know-how and innovation fabric is crucial to implement China's technological development, it is extremely difficult to penetrate them. In this case, the CCP approaches may

be multiple: “Attraction” means China could be willing to soften the restrictions and open the sector to foreign investment, making the business environment simpler and more penetrable through simplified market access or, for example, as in the case of the electric vehicles sector, removing the restrictions for joint ventures. Chinese government to face "Tricky targets" can implement two other strategies. The first one is the "Acquisition", which is the one most used by CCP: in the areas where it is not possible to attract foreign investors in the country, a strategy of high-tech acquisition through FDI and legal licensing of intellectual property rights is necessary. The second is "Attack", which involves China's effort to acquire foreign talent. As amply demonstrated above, the CCP's industrial policy is based on the partial restriction of the market through "protection" mechanisms that put foreign companies, trying to access the Chinese market, in serious difficulty. In addition, the instruments used by China are very often unclear policies or opaque and nuanced economic measures that prevent the entry into the sectors established by China as "closed and protected". All this creates important implications for industrial countries, which, being fully involved in the Chinese strategy, are forced to face many Challenges. The first implication concerns the technological eradication by FDI State-driven. As anticipated in chapter 1, foreign direct investments have grown significantly since 2010 favoring China, but first the host countries. European and American companies that have received substantial investments from the East have benefited significantly from the huge economic inflow generated, maintaining at least in the first period a good percentage of independence in management decisions. The benefits received by foreign companies in the short term, however, are the result of a careful and widespread strategy of the Chinese State, a true driver behind Chinese FDI worldwide. The objective has now been clarified: guarantee revenues to targeted companies and then systematically acquire and assimilate their technological production processes. If, in the short term, Europe and America will benefit from the capital absorbed, in the long-term Chinese companies will erode part of their technological leadership, relying on advanced technological development and a policy of probably lower prices. The second implication concerns the complex mechanics that revolve around cyberspace. Smart manufacturing, industry 4.0 and the Internet of things are almost completely based on data in general, their acquisition, processing and above all their transmission in real time. To do business in the high-tech industry is therefore necessary to safeguard the security and integrity of data, which is not at all easy in the Chinese market. China offers a very unfavorable and simple environment for foreign enterprises,

adopting an extremely restrictive control policy on cyberspace. Cybersecurity Law is the fundamental pillar of the regulation of technological security laws and provides elaborate regulations and definitions on legal liability. The reason why this set of regulations affects most businesses is that it includes not only internet security, but also information, communication, computer, automation, and control system security. It means that the businesses affected by the Cybersecurity Law are not limited to those in the information technology (IT) industry. China adopted in 2017 a series of very controversial measures in relation to cybersecurity, which generated concern given the current unfavorable environment for foreign companies. The provisions include requirements for all businesses to store personal, business and market data, which must then be provided to the Chinese government to ensure "technical support" to Beijing's national security needs. Foreign companies to stay within the Chinese market are then obliged to provide their data, such as big firms as Airbnb, Apple Inc. and LinkedIn who have given the database information to the Chinese government. In clear similarity with the plan to partially open the market only in some sectors, China harmonizes its national standards with global ones where it wants to facilitate the access of foreign entrepreneurs to the market. In this sense it seems that the CCP is adopting a policy of market liberalization and internationalization, pushing private companies to work with regulators to achieve a high rate of standardization, and in fact this is exactly what the Chinese strategy provides. Germany and China, for example, have managed to achieve a level of standardization regarding intelligent production methods. Analyzing the relationship between China and Germany and understanding what role the latter plays in the MIC25 is essential to analyze its possible success or failure. The significance that Germany and its Industry 4.0 has for China is of incredible importance, since the Germans are the main reference point for Chinese development. The countries were each other's largest partners from 2011 to 2019 with a 140% increase in actual investments by German companies in China in 2018. While Germany is a willing partner, the experience of major Chinese competitors in Asia such as Taiwan, South Korea and Japan reveals a diametrically opposed attitude. The "three Asian tigers" have taken drastic measures to defend themselves against China, which include limits in the field of cooperation, awareness of companies and rules on investment and acquisition of high-tech companies. These measures are taken to safeguard key processes and know-how, not allowing China to assimilate key processes in the value chain, as in Europe and America.

So, while Europe is friendly in the MIC25 implementation process, Asia is moving in the opposite direction.

## CHAPTER 4

The CCP has adopted a different strategy in each of the sectors generating a different path for China and for foreign countries. The Next Generation IT Industry is certainly at the forefront of the Made in China 2025, since it is the one that penetrates in a capillary way in each of the 10 fields considered: IT leadership allows to exercise greater control and influence on the domestic market. In the last 5 years China's performance in this field has been very good, the growth in investment and R&D has allowed the sector to grow by 6.5% per year until 2020, becoming the key Industry in the national economy. It is the Area in which the government exercises the most closure approach, with the objective of completely nationalizing the field, permanently eradicating products manufactured by FIEs and replacing them with local technology. The opportunities for foreign companies are even lower because this is an Industry in which operations by the CCP started already in 2015, with the entry into force of rules that anticipated the will to "accelerate the advancement of domestic production, indigenous and controllable substitution plans, and the building of secure and controllable information technology systems, or, as in 2016 with the introduction of rules and restrictions on information security and network. Opportunities for non-Chinese entrepreneurs are virtually absent in this scenario, but this does not mean that a wide range of opportunities are available for Chinese enterprises. The consequent reduction in the presence of foreign companies forces China to drive the process of innovation, which is only possible if China will be able to acquire and correctly implement the technological processes absorbed over the years: only in this way the Chinese government will be able to achieve the objectives of the MIC25 and achieve leadership in the sector. The telecommunication equipment industry, unlike the previous one, is not characterized by the constant intervention of standards by the state, but by a simple presence of the same: Chinese telecommunication equipment manufacturers enjoy incentives and benefits from the government, managing to become competitive in international markets. The CCP is basically the owner, operator and also

operator of the telecommunications sector in China, counting among its ranks the 3 main Chinese companies: China Mobile, China Telecom and China Unicom (McCarthy, 2012). The strategy in this case is to use policy instruments that can support local companies, such as the recent use of catalogues of domestic high-technology products that has enabled the included companies to receive benefits such as preferential tax rates and low-interest loans from the Bank of China or China Development Bank. The real competitive advantage, however, comes from the absence of OECD export financing rules, which allows the Chinese government to support the local industry assiduously, unlike Europe or the United States, which cannot provide a similar contribution. This regulation has been developed to ensure transparency and proper conduct of government financing, which very often have a strong influence on international markets, facilitating the position of companies coming only from specific countries. This is the case of China, which, not having joined the OECD, has supported numerous companies over the years. The analysis carried out showed that the New Material Industry is the most critical for the Chinese economy. Within foundational technologies, the market of semiconductors, the real Achilles heel of the MIC25, appears particularly weak. The reason why, despite the huge gap to be filled, the industry is included among the main 10 to be developed, lies in the fact that it is a field that serves as a basis for the development of as many sectors such as software, trains, planes, robots, aerospace, electrical networks and smartphones. Hence the importance of semiconductors, the most R&D-intensive industry in the world, with investments in research that are made every generation, even on products that already exist. In addition to this, the People's Republic of China is the first semiconductors customer in the world because more than half of its exports depend on the presence of this basic technology. The dependence on foreign countries in this area is demonstrated by the fact that in 2016 China represented the destination of about $100 billion of global conductor shipments, equal to about 30% of world production. The solution to this weakness is moving on two different tracks: taking into account the fact that China intends to remain two generations behind in technological expertise, on the one hand the government tries not to increase this gap and, if possible, reduce it as much as possible through intensive R&D, on the other hand it assists local Firms to form mergers and/or make acquisitions internationally. The Robotic Industry represents one of the sectors in which the greatest number of controversies related to the chosen policies is revealed. Of the 10 core areas targeted by the MIC25, the sector in question is the one in which the Government has

implemented the largest number of subsidies and funding and represents the continuous attempt by the Chinese authorities to improve the Industry. To demonstrate the persistence of the Chinese approach to the Robot field there is a long series of reforms carried out during these 5 years, in particular those proposed and then implemented by MIIT, MOF and NDRC (Ray, et al., 2016) and the continuous subsidies provided to companies that contribute to the sector. This policy has undoubtedly fed the Industry, stimulating it so much that China became the world's largest industrial robot market for four consecutive years, with a sales volume of about 100000 units in 2015-2016. The strategy implemented by the Chinese authorities includes two main guidelines, the first concerns the use of subsidies, the second focuses instead on the creation of industrial parks: both have contributed to the growth of the sector, but present many problems and limitations. consequently, create clusters within the most developed cities in each province is undoubtedly a winning one. In the case of Robotic Industry, the Chinese government has provided for the creation of clusters and the allocation of incentives in the Guangdong region, entrusting it with the development of a part of Made in China 2025. However, government support for this sector is extremely poorly designed and uncoordinated. In fact, funding is allocated based on criteria that are very easy to reach or even circumvent, making access to funds extremely simple for many companies. In 2017, the number of firms capable of producing advanced components or finished robots themselves stood at around 8%, the remainder being assembly companies, which in most cases purchased most components from foreign companies. The strategy chosen for NEVs Industry has seen two very different approaches since 2010. First, it should be noted that the NEVs sector was targeted by the Chinese authorities well before the MIC25: already in 2009 China was interested in plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs). The ways in which the government has improved and strengthened the industry are those now known, i.e. first a long series of investments that in the last 30 years have reached about 6 billion dollars, combined with an intense R&D strategy and a strong pressure on foreign companies to force them to transfer both basic and advanced skills in exchange for access to the Chinese market. However, the strategy has undergone a series of changes due to the fact that since about 2018 China has partially reached the MIC25 goal for this sector, softening, in fact, the restrictions imposed mainly on foreign companies, making the Chinese market open again, albeit in a limited way.

High-speed rail is the area where China's strategy has worked best. China has managed to acquire and exploit foreign technology by relying on the size of its domestic market. It has added to this an appropriate R&D strategy that has improved the know-how and tech skills of other countries and implemented an internal acquisition and merger policy. The strength of the sector lies in the fact that it is an area of strong governmental control since the Minister of Railways has a strong authority on production processes, management and allocation of resources and technological direction. It is a sector that occupies an important position in the Chinese "go outside" and "One belt", and under the leadership of former Minister Liu Zhijun it has developed exponentially thanks to a strategy of transfer of skills and technologies of the most advanced foreign firms such as Alstom, Bombardier, Siemens and Kawasaki.

## CHAPTER 5

Made in China is not a simple program or a political strategy: it is a 30-year long-term project that will have a huge impact on Industries worldwide and will determine leadership in the potentially most important sectors over the next 20 years. The outcome will not necessarily be positive or negative as China could only achieve leadership in a part of the ten sectors, but in any case it will irreversibly change the increase in the advancement of technological research and develop skills and know-how that will at least allow it to be competitive at a global level in all ten MIC Industries. On the other hand, the rest of the world has to face the Chinese advancement, guaranteeing itself a role in the leadership of certain sectors and trying to counter the Chinese mechanisms and policies that are particularly harmful and disadvantageous for non-Chinese companies. The first recommendations concern the protagonists of the project: China. In the previous chapter we have already analyzed the critical issues for each of the sectors and provided alternatives to achieve more success in the implementation of the MIC, however, it is useful to mix them with suggestions regarding the use of critical drivers and factors analyzed in the first chapter. The success of the MIC25 depends primarily on two factors: the first is the highly adaptive nature of the plan, which allows China to respond quickly to dynamic markets by simply removing or introducing policies. A long-term plan such as the MIC will inevitably go through a high number of phases

of change, new foreign competitors entering the global market and constant changes in consumer demand, therefore, the ability to adapt quickly to change will be a crucial tool for the success of the MIC. The second crucial factor is the constant presence of the government behind the strategy, the true driver behind the plan. However, these characteristics must be considered a double-edged sword for the implementation of the MIC25, since on the one hand the Chinese authorities represent a huge boost and competitive advantage for Chinese companies, on the other hand they risk to negatively influence the companies' performance based on policy objectives rather than market demand. The alignment of the government with the needs of national companies and an adequate and efficient allocation of state resources is therefore fundamental in achieving the goals set from 2025 to 2049. In the same way, it is essential to review in some of the ten Industries the policy of closing the domestic market: if in the last few years it has been extremely useful to ensure the protection of the domestic market, favoring the development of Chinese companies, now it is proving to be a wake-up call for non-Chinese companies that see themselves cut off from the Chinese domestic market, but above all, it has drastically decreased the domestic competition by disadvantaging the technological development, the central goal of the MIC25. The policy of acquisition through FDI aimed at Europe and the United States is instead proving to be the real tool useful to the cause, allowing China to quickly reduce the technological gap with foreign countries by bypassing an internal development, particularly difficult both for lack of talent and lack of skills, within the Chinese territory: for China it is currently better to buy than to build. On the other hand, the rest of the world is forced to face Chinese expansion in terms of FDI and acquisitions of foreign companies. Especially Europe and the U.S. should continue to welcome these operations, benefiting from the enormous advantages they can acquire in the short term, however, since these state-led acquisitions aim to "steal" technology and consequently to reshape leadership in the sector, it is necessary that countries establish policies to protect themselves. Another major problem is that China denies access to its markets by not providing the same conditions as Europe and the United States, undermining the principles of fair competition. The total control by the government in foreign investment and the "discriminatory" policy therefore need an effective response in a short time, therefore, the solution that must be found is to create a "package" of policy instruments to combat this phenomenon.