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BUILDING THE TECHNOLOGICAL COMPETENCES FOR A EUROPEAN RENAISSANCE

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ABSTRACT

On our computers and smartphones, it is never written "Made in Europe". The same applies to the social networks, the browsers and the online stores we use. It is an easy prediction that we will rely on foreign IA suppliers for an unpredictable future. If, so far, this has not been perceived as a problem, it is because Europe has successfully managed to acquire cutting-edge technologies through its strong integration in the world economy, while the Atlantic political and military alliance has acted as an overall guarantee.

The second Trump Presidency has however made it clear that to rely on external sources for general purpose technologies produces major weaknesses. As discussed in the technological sovereignty literature, the lack of control over strategic knowledge-intensive activities creates political and economic fragility. Should therefore the European Union and wider Europe try to generate its own competences which will allow it to cooperate but also to compete on a par with the United States, China and emerging nations? And how to do it? The paper argues that a strategy for a European Renaissance will necessarily require a major commitment of the public sector, but also the making of new public companies able to bridge the gap with competitors in other continents.

There are not many cases in which European nations have managed to join their forces creating joint ventures to face external competition. Cern has been a success story in non-competitive scientific knowledge. The only business successful case is Airbus, which challenged the dominance of the United States and of Soviet Union in the aircraft industry. It took more than half a century to build the competences, and this also implied severe economic and political conflicts. Eventually Europe has succeeded. One of the reasons behind Airbus achievement is associated to the way the company anchored itself in specific regions, creating networks of innovations and contributing the local development.

The paper argues that it is now a European priority to replicate this experience with a long-term commitment to generate a selected number of transnational Big Tech companies heavily associated to government activities. Rather than continue to complain about the technology gap which separates Europe from other regions of the world, it should be explored

how to use the wealth of existing capabilities to create products, processes and services in the dominant industries of our age.

KEYWORDS: innovation policy, state-owned enterprises, local development, emerging technologies, catching-up.

Introduction – The European Technology Gap

It is well-known that the European Union is lagging in critical infrastructures, especially in the ubiquitous digital technologies. EU invests a lower amount of R&D compared to the United States and it is far away from showing the outstanding growth rates of China. Despite the remarkable economic, scientific and technological competences existing in the Old Continent, there is a widespread sense of inadequacy and vulnerability. This feeling has certainly increased since the beginning of the second Trump presidency. We have heard several times from Washington that the Atlantic Alliance is not any longer a United States priority. Words were followed by actions, including increased trade tariffs, reduced military commitment, lack of consultation on foreign policy issues and even military threats, such as the declared intention to annex Greenland with force.

Are Europeans learning the lesson? It does not seem so. European leaders move with uncertainty and fear, at the national and continental levels. This shows that they have not yet decided which strategy should be adopted to preserve European autonomy and well-being. But, above all, each European nation has followed its own agenda and the fact that the EU is unable to speak with one voice is a major weakness. Even in trade negotiations, the area in which EU member countries have one voice, fragmentation of positions has made it impossible to present a strong response to the request of the US administration.

Political autonomy is not an abstract concept but it needs to be rooted in economic and reality. Very often, economic and political power go hand in hand, as many historians have noted (in a rather extended and fascinating literature, I refer to Kennedy, 1987; and Kindleberger, 1996). As student of innovation, I am particularly concerned with the importance of technology as the key component which allows economic development on the one hand, but also political and military power on the other hand (Mokyr, 1990).

In this talk, I deal with how it will be possible to build European competences in the next driving technologies, considering Old Continent is facing a radically new landscape, unimaginable even a year ago. While this increases the urgency of the tasks to be undertaken, it is difficult to envisage the agents willing to undertake them.

Where is the origin of the European problem?

The EU has a large wealth of scientific competences and in many areas it is on a par or above any other part of the world. The European scientific community is vibrant, well integrated and includes an abundance of collaborations with the other shore of the Atlantic. But it seriously lags industrial technologies, especially the dominant and emerging ones (Archibugi et al., 2025). Compare the public and the business R&D of the EU and the United States and China: it clearly emerges that the gap is not so much in the public sphere but in the business component.

This is a major problem for European public policies. While governments can directly decide how much to invest in public R&D, increasing funding for universities or other public research centres, they can only indirectly support the R&D in the business sector. The public and the business component of R&D are certainly connected: firms invest in research and innovation when they can benefit from the overall public infrastructures, including universities providing adequate human resources. If the business sector has not a sufficient innovation culture, additional public funding is unlikely to be effective. To transform new knowledge into new products, processes and services requires the agency of companies.

The leading sectors: A comparison between Automobiles and ICT

The European problem lies not only in the lack of aggregate resources, but also in their sectoral allocation. Today, Europe is lagging in the driving ICT: its innovations in the field are, in proportion, lower than those of the United States and China (Archibugi et al., 2025) and it lacks top corporations in the industry (Mendonca et al., 2024).

Major innovations, even when nurtured, developed and fostered by the public sector, flourish when there is a firm willing to exploit them. When there are new opportunities, many firms try to exploit them securing a market share of the newborn industry. Often in this process a few firms manage to ride the wave of the successful innovation and dominate the market. In the case of the ICT, the market concentration has been incredibly fast. Take as a benchmark the automobile industry: an industry born more than a century ago. The industry started with a myriad of artisanal companies producing the earliest vehicles and most of them were destined to be acquired by other companies or to die, while only a very few survived and grew. The surviving companies succeeded by producing better automobiles through product innovations and cutting costs through process innovations. Over a century, the industry evolved into a restricted oligopolistic market. The automobile industry has been one of the largest R&D spenders and only the companies which invested massively managed to survive.

The pioneers of the automobile industry belonged to several nations: Karl Benz, the Daimler brothers, Giovanni Agnelli, Emile and Armand Peugeot, the Renault brothers, André Citroen, Henry Ford, William C. Durant, Louis Chevrolet, Walter Chrysler and many others. Their companies succeeded in getting a large share of their domestic market before affirming as multinationals. The process of concentration went hand in hand with internationalization and continued for 130 years.

Are there significant differences between the evolution of automobiles and ICT? Both industries are dominated by a very few large corporations which are at the top of a capillary network of suppliers, distributors and technical assistance to final users. But:

- The concentration in ICT was achieved in a much shorter period. It took less than 20 years to reach the concentration that the automobile industry reached in more than a century.

- When there was a lack of national capacity, most governments promoted industrial policies to build and protect their own national companies. Despite several controversies, it was accepted that it was a legitimate objective of each nation to have its own automobiles. Concerning the ICT industry, the restricted oligopoly is made of companies coming all from the same nation, the United States. Only one nation has deliberately and successfully challenged the predominance of American Big Tech, that is, China (Rikap and Lundvall, 2021).

- The capacity of the ICT companies to acquire, monitor, provide content, interact and block users is incomparably higher than of the automobile companies. If a customer buys a foreign car, it is unlikely that it can be stopped in the case of a political or economic controversy involving its nation and the nation producing the foreign car. This is not the case with ICT: browsers, email providers, social networks, bank accounts can and are controlled by companies which should oblige to the laws, regulations and requests of their national government rather than on those of the hosting nations. ICT have become so pervasive that also trains, airplanes and other infrastructures require their availability. The literature on technological sovereignty has indicated that vulnerability goes far beyond the military industry (Crespi et al., 2021; Edler et al., 2023).

From benevolent competition to subjugation

From the European perspective, the supremacy of US companies in the ICT domain has for too long been overlooked. After all, it was believed that the whole Atlantic relationship was solid enough to prevent major abuses. Even if these companies were born, developed and grew in the US, they had to operate in the EU according to its rules and the size and strength of the market was strong enough to ask these companies to oblige our rules. There were some tensions ranging from the taxes these companies had to pay in the EU, the regulations – such as the GDPR – that they had to comply, the protection of IPRs, but they were not creating specific alerts. The controversies could be addressed in multilateral institutions such as the World Trade Organizations and the G7. The situation has dramatically changed with the second Trump Presidency. Mario Draghi, certainly a moderate and cautious administration, has affirmed that "For years the EU believed that the size of its market, 450 million consumers, would automatically yield power in international negotiations. That illusion has evaporated" (speech at the Rimini meeting of Comunione e Liberazione, 22 August 2025). The changes can be identified in the following tenets:

- The rules of trade, which Western countries agreed upon under the auspices of US President Bill Clinton in 1995, are not any longer valid. The World Trade Organization, created to develop trade and reduce tariffs, has not any meaningful role in this area. If it has a role today, it is in the protection of IPRs, that is, defending the business interests of the American Big Tech against imitators.

- Major corporations are not any longer aspiring to be "global", as many business scholars predicted and suggested. They have become tools to respond to the interests of their governments. The model according to which corporations could follow an independent strategy to navigate in a borderless world, so popular from the beginning of the 1990s, is dead. It is now clear that large firms need to be sponsored and protected by their home government. The visions of global corporations (Ohmae, 1990) and of a flat world (Friedman, 2005) do not any longer apply. Chinese corporations were from the beginning created and developed as tools of the government and, even when enlarging their scope by investing abroad, they have continued to be so. The second Trump administration has led corporations, especially those in the ICT area, to a path very similar to the Chinese one. There is an emerging pact where the US government protects the scope of the American business and the American business act in accordance with the government interests.

From self-indulgence to action

The surprising fact is that the EU, the UK and other European countries have been totally unable to react in any meaningful way to this dramatic change. In all controversial areas, the EU and the UK have simply obliged to the US requests. Just recap some well-known facts.

- Both the EU and the UK have accepted export duties of 15 per cent in the United States without taking any significant retaliatory action. Under the previous architecture of the WTO, European nations should have brought the case to the Dispute Settlement Body (DSB), but since the United States has blocked it in 2019, this is not an option. Not only that: Europeans are still afraid of acting in political, economic and even cultural ways fearing that the deal just brokered with the USA could be broken.
- The planned EU tax on digital advertising revenues, mostly relevant for the US Big Tech, has been postponed.
- The EU and the UK have passively accepted that Ukraine should commit its raw materials to the United States in exchange for the past military aid received. The Biden administration provided the support to the Ukrainian military as grants (as European governments did), if there should be an ex-post payback, why the sole USA should cash it?

At the end, neither the EU nor the UK look like credible political players able to defend their own interests. If the situation will continue, both the EU and the UK will further continue their dependency from the United States, which is not acting any longer as a partner but as a predator.

European Competences

While it has become commonplace to mention the EU for its lag in technological competence in the ICT domain, it is often overlooked that the continent has widespread competences which allow the EU to be on a par with the USA and above China in their diffusion and use (Bria et al., 2025). There is a widespread potential, even when the platforms, servers, data centres and satellites used are not owned and controlled by and within the EU. In other words, the gap is upstream, not downstream.

If this gap should be bridged it is therefore crucial to take some actions. This requires launching a cluster of publicly controlled corporations within the EU and wider Europe, strongly integrated with universities and research centres, and with a long-term mandate. This new cluster of European public corporations should have a new public-business approach. A great deal of the activities developed by ICT cannot, in fact, be classified as pure private goods. In the Internet society, most of the activities (networks, accessible infrastructures, standards) are public and they can be compared to the roads, train lines, water channels of the past rather than as private goods such as automobiles or domestic appliances.

For long, public infrastructures such as telephone networks, television, motorways and rail were under public control, and with good reasons: it was perceived that they should be available for everybody and be, also for security concerns, under public authorities. No state was willing to leave crucial infrastructures such as train stations, airports, televisions and communications in private hands, especially if they were directly or indirectly associated to security. The development of ICT has taken a different route from what has happened in the past, also because of the wave or privatizations carried out in the 1980s and 1990s has affected telephone, televisions, railways and other infrastructures. Today we are used to the fact that browsers, social networks, email providers, servers and even satellites are in the hands of a restricted club of top corporations. These private hands have, so far, been benevolent, often as a well-developed strategy to increase their users. But once they have built their monopoly power, and once they have started to be subservient to their national government, these companies will make the most to appropriate their efforts.

European Centres of Excellence

Many different techniques can be used to identify the emerging areas (Ciarli et al. 2021; Hausmann, et al, 2024; Archibugi et al., 2025). But regardless of the method and the indicator used, it clearly emerges that ICT is becoming more relevance, also because of the new expansion of AI, and that Europe is losing ground. The same evidence indicates the areas where the EU, the UK, and other European countries, hopefully joining their forces, should try to enter: Europe lacks competences embedded in corporations in e-commerce, search engines, artificial intelligence, financial transactions, social networks, media. In these areas Europe is dependent too much on the United States. It is certainly telling that the top US companies by market capitalisation are now all in these fields. Market cap does not necessarily correspond to corporate profits, sales, value added or employment but they do reflect business expectations. Expectations can be wrong, nevertheless they indicate a trend.

Chinese strategy has patiently tried to nurture, develop, protect and defend their own corporations in each of these fields (Zhang, 2024). Against the American Amazon, they have provided an Alibaba, to Apple they have opposed Huawei, to Google Baidu, to Nvidia Tenecet, to Facebook and Instagram (now Meta), TikTok, to Visa and Mastercard UnionPay. Even more than in military terms, the United States – China economic and political rivalry, is visible in their national corporations, used as government economic divisions, confirming the international political economy model of Stopford and Strange (1991). Where is Europe?

A fast technological change is often allowing companies to grow equally fast. Nvidia, for example, is 22 years old only, but it has become the largest company in terms of market capitalisation. Often it takes much longer for followers to reach a prominent position, but if a crucial economic area such as Europe does not wish to stay behind and perish, it should start to think to enter these new areas not only as a downstream user, but also as a upstream producer and innovator.

The first question is: will Europe manage to do it? Has it ever managed to do it before? Unfortunately, there are not many activities which can be cited as good practice, but some can be partially successful: Cern and the Framework Programmes in terms of scientific competences, and the sole Airbus as business experience.

Cern. In the early 1950s, the United States and the Soviet Union had a much greater expertise in nuclear physics than Europe. At the origin of the Cold War, European countries wisely decided to join forces to develop their own capacity, focusing on the civilian rather than the military side. It was still unclear if the nuclear technologies could also have civilian applications, and the Europeans decided to build competences. Cern started in 1952, a few years before the foundation of the of the European Common Market in 1957, and with a rather heterogeneous group of countries (besides the six countries which founded the ECM in 1957, also Greece, Norway, Sweden, Switzerland, the United Kingdom and Yugoslavia participated in the venture). Since Cern was intended to be a scientific venture based on international cooperation and non-commercialization of results, it was open to collaboration with a wealth of other non-European countries and implicitly applied the open science model.

Cern had a major impact on commercial innovations. Even those who have not read Dan Brown's *Angels and Demons* know that the single most important innovation of the XXI century, Internet, was developed there. Many other scientific activities were typically basic science and have not been directly exploited commercially by Cern (Nilsen and Anelli, 2016; Bastianin et al., 2025). After more than 70 years of activity, we can perhaps conclude that it would have been better if Cern had a more direct linkage with firms, and if many of the knowledge generated would have also been more directly implemented and exploited by

European corporations. Nevertheless, Cern is certainly a role model of European knowledge, also for its structure of open collaboration.

Framework Programmes. The EU major tool for to foster knowledge-development and innovation has been the several generations of Framework Programmes (FP). These have been rather successful in creating links across European countries, building a common research area and allowing peripheral regions to benefit from the knowledge developed elsewhere. FP were equally open to the academic community and to companies and the dissemination of the results was an explicit target of the programme.

Despite this major effort to build a European Community of knowledge (a modern version of the Republic of Letters of the Enlightenment), this was not seen in opposition to our colleagues on the other shore of the Atlantic or in other continents. Scientific co-authorships – taken here as a rough measure of international cooperation – indicates that European countries scholars are very willing to collaborate with the United States colleagues (Wagner and Cai, 2022). This allows to generate new knowledge beneficial for everybody. But it shows again that the European Research Area is still in the making.

The real problem with the FP is that the overall budget is very limited. The top EU R&D spender, Volkswagen, has alone an R&D budget which is larger than the FP. Amazon alone (with its 88 billion US dollars R&D budget in 2024), has an average yearly R&D budget which is six times larger than the whole FP programme (the latter is less than 16 billion US dollars in 2024).

The FP programmes have also made a priority to disseminate widely the outcomes. This is hardly surprising: since the activities are financed by all EU member states, it is natural that, even if the research is carried out in a few locations, all EU should benefit from it. In most cases, there was the hope that research and innovation teams from peripheral areas could collaborate with those in the core areas. The so-called "cohesion" wasis in fact, a target by itself.

If FPs have been such a useful instrument, is it possible to augment its resources, with a special aim of increasing its geographical scope and strengthening industrial partnerships? And how can they also contribute to the creation of a new generation of European high-tech start-ups?

Airbus. Both Cern and the FPs privileged the public rather than the business component of research and innovation. But there is an important case which from the very beginning was designed as industrial activity, namely Airbus. Started in 1969 as a German – French venture, Airbus decided to enter a market, commercial aircrafts, which at the time was dominated by two countries only: the United States and the Soviet Union.

The initiative was also stimulated by a cry for help: a policy-advisor, Servan-Schreiber (1968), argued that Europe was risking becoming irrelevant in the new global market because of what he labelled the American challenge. If the economic trends of the 1960 would have continued, he argued that the succeeding third superpower – after the United States and the Soviet Union – would have not been Europe, but rather the American multinationals in Europe! Servan-Schreiber also pointed out that the aircraft and space were becoming the next driving industries, and Europe was far away from the successes achieved by the superpowers. Perhaps Servan-Schreiber was overemphasising the importance of aircraft nascent general purpose technology, but certainly he was right in noting that, rather than opening up to US multinationals in Europe, the Old Continent should take some steps to strengthen their own large corporations.

The aircraft companies in the United States and the Soviet Union relied very much on military procurement, and this shaped their products. Boeing, Lockheed, McDonnell Douglas in the United States and Tupolev and Antonov in the Soviet Union, produced military airplanes which were subsequently converted to civilian purposes. While this strategy had its own economic advantages, especially since the research and design costs were afforded by governments, it also had its own disadvantages, namely the fact that the airplanes were ultimately designed for military rather than civilian purposes.

As the very name of the new company indicated, Airbus undertook a different route: generate, develop and commercialize *civilian* airplanes. It was not an easy task: it took several decades to develop successful products, and it required major financial support for R&D activities. There has been a long and still ongoing struggle between Boing and Airbus, each complaining against the rival to supposedly breaking the rules of competition: the former complaint about the R&D subsidies received by the European company and the latter mentioning the military contracts provided by the Pentagon. Both companies required political support: airlines, the ultimate purchasers of commercial airplanes, had to deal with major political pressures before committing to buy an Airbus or a Boeing.

US producers reduced to one company when McDonnell Douglas merged with Boeing in 1996. From the original German – French alliance, Airbus managed to expand to other countries, including the UK, Spain and the Netherlands. Airbus has become the largest company in the industry in 2019. Without this European venture, probably we would be today in a world monopoly, and this would not be beneficial, not even for American consumers. It was an achievement that required half a century of competence building and technological expertise in a variety of different fields. But, above all, such a success could not have been obtained without the integration between business and government.

Will European governments be brave enough to replicate this successful experience also for driving ICT sector and promote a handful of European corporations to compete with the US Big Tech? China has done it. Why shouldn't Europeans make a try?

Financing European Big Tech

Such a massive programme of competence building through a restricted number of large companies, integrated in the European scientific network, cannot be done without adequate resources. Quite clearly, it will be feasible not only if it is accepted as top priority of European institutions (ranging from the European Commission, the European Central Bank, the European Investment Bank and others), but also if it is a mission supported by national governments. It has not to start with unanimous consent: the three prior cases cited (Cern, FPs and Airbus) show that these ventures could be born successfully also by a smaller group of countries.

A major financial commitment will be needed. Many policy-advisors and policy-makers suggested the creation of Eurobonds released in the Eurozone. The proposal has bounced back in a variety of occasions, including as a response to the 2008 financial crisis, the 2009 Greek economic crisis and the Covid pandemic in 2020. The EU managed to undertake a crucial financial intervention with the Next Generation EU. But the basic difference is that the resources available were given, and administered, by national rather than EU authorities. This had certainly a beneficial effect to mitigate the economic impact of the Covid pandemic, but had a lower effect in promoting a genuine European economic recovery.

Next Generation EU should come to an end in December 2026. There is an ongoing debate about what will follow. One option would be to commit an equal number of resources (about 150 billion Euros a year) to finance the creation of industrial capacity and competences in the ICT. Such an objective has so far never been achieved, mostly because of the political divisions within EU governments. Will the second Trump Presidency trigger a braver approach by European leaders?

The local dimension

Even when large organizations provide knowledge and competences to a large area, they are often located in a specific space. Cern is in Geneva, Airbus is in a variety of locations but probably we will identify the company mostly with Hamburg and Tolosa. If Europe will commit to such a major activity, hopefully this can be used also as a much-needed instrument for regional development. This in turn will require that a central brainpower will not only distribute economic activities across the European space but also assess its implementation in terms of creation of infrastructures, education and other facilities.

European patriotism

Europe is a unique territory even in a fast-changing world. It has a long history, and it has been the cradle of culture, science and technology. Nationalism led to two of the most terrible wars of humankind. Some lessons have been learnt, and European integration has been based on political consensus rather than domination. But Europe has too often put crucial resources in the hands of other players, mostly the United States.

With the second Trump Presidency, the Atlantic alliance has taken a totally different shape. We may be surprised that this has not happened before, and we may hope that we could soon go back to the fruitful cooperation of the past. But to sustain its standard of living, culture and autonomy, Europe cannot ignore the material conditions, which today are represented by ICTs general-purpose technologies. If Europe does not manage to catch up, and quickly, in these areas, it risks becoming a colony.

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