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# Europe as a "Tech laggard" in the face of waves of technological change: Will European leaders carry on or break away?

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# Europe as a "Tech laggard" in the face of waves of technological change: Will European leaders carry on or break away?

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**Abstract**

Europe has been characterized as a "Tech Laggard" even though European leaders dedicated their attention and effort to new waves of technological change. The consensus or operating practice of European leaders is that it is up to firms to make investments; their role, i.e. the role of European leaders, is to provide the *Rahmenbedingungen* or the institutional environments. Firms compete in business ecosystems or communities of organizations, institutions, and individuals that impact firm success. This ESCP Impact Paper suggests that it is not that the institutional environment does not matter; it matters. It proposes that only focusing on enhancing the institutional environment does not solve the problem. Consequently, it suggest a break away from the operating practice that characterizes the conduct of European leaders.

Keywords: Technological Change, Business Ecosystem, Technology Management

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# Europe as a "Tech laggard" in the face of waves of technological change: Will European leaders carry on or break away?

## Breaking away from current operating practices?

It cannot be stated that European leaders do not see the future in technological change unfolding. A quick search for new waves of technological change such as solar panels, electric vehicles, and artificial intelligence clearly indicates the attention and effort of the European Parliament and the European Commission.

How come then that Europe has been characterized as a "Tech laggard" even though European leaders dedicated their attention and effort to new waves of technological change? Could it be that the approach taken by European leaders might be ideologically convincing, but practically inadequate? Is it that European leaders are required to break away from the established way of going about their business?

## Technological discontinuity and market disruption

Management scholars investigate why firms fail in the face of alien technologies invading their business and which firms might come out on top to obtain market leadership. The core framework guiding the thinking of management scholars is the study of technological trajectories (Utterback, 1994). An existing technological trajectory might be superseded by a new technological trajectory, which is based on new scientific principles and a new kind of engineering expertise. For example, the emergence of digital imaging in the photography industry entailed a shift from the chemistry-based technology trajectory underpinning silver-halide film to an electronics-based digital technology trajectory underpinning digital cameras. In the early phase of its evolution, the new technology underperforms the existing technology. In the early days, digital cameras did not match the image quality of film. Investments are required to improve performance of the new technological trajectory.

Unless firms undertake the required investments, the new technology will not improve to become good enough to supplant the existing technology.

Firm success as a result of the investments in the new technology is shaped by demand trajectories (Christensen and Bower, 1996), innovation ecosystems (Adner and Kapoor, 2016), platform ecosystems or the presence of network effects (Katz and Shapiro, 1986), and business ecosystems (Iansiti and Levien, 2004; Teece, 2007; Zacharakis et al., 2003).

## The perceived role of European leaders in the face of waves of technological change

The consensus or operating practice of European leaders is that it is up to the firms to make investments whereas their own role is to provide the *Rahmenbedingungen* or the institutional environments (Williamson, 2000). The institutional environment refers to the design of executive, legislative, judicial, and bureaucratic functions of government. Firms compete in business ecosystems or communities of organizations, institutions, and individuals (Teece, 2007) that impact firm success.

The operating practice is that European leaders are set to provide an institutional environment and contribute to the business ecosystem; it is up to the companies to make the strategic choices and to invest. It is the European way of adhering to and internalizing the prescriptions of the so-called "Washington Consensus" policies. It basically implies that European leaders focus on fighting inflation, keeping public finances under control, opening trade, ensuring free financial flows and limit to the extent it is achievable any industrial, competition and trade policy that does not follow this logic.

The question is not whether it is ideologically convincing. The question is whether it is practically adequate in the current context.

## Waves of technological change in Europe: the case of solar panels

A quick search online on "European Commission Solar Panels" and "European Parliament Solar Panels" reveals that the European Commission has an EU Solar Energy Strategy. It states that "solar is the fastest growing energy source in the EU." and it notes that "solar energy has a potential to become part of the mainstream energy system by providing power and heat to households and industry."[1]

The EU Solar Energy Strategy states that "initiatives will introduce a legally binding EU solar rooftop obligation to ensure accelerated installation of solar panels on buildings, help create a skilled workforce necessary to produce, install and maintain solar panels, and support the EU industry in expanding the domestic production of photovoltaic panels."[2]

An executive of a German solar panel installer noted that "Europe lacked a "long-term industrial strategy" for renewable power manufacturers of the kind implemented by countries such as China and India." While Europe produces fewer than three percent of the solar panels needed to meet its own 2030 solar power targets,[3] Chinese exports far exceed installation capacities in EU and other countries.[4] It is not that the European companies were not able to make a foray into the production of solar panels. Fifteen years ago, Europe was the world's largest solar power manufacturer.

By 2022, China's production of solar panels exceeds that of all other countries combined.[5] In April 2024, the EU, under its recently adopted foreign subsidies law, initiated investigations into Chinese solar panel manufacturers regarding market-distorting subsidies.[6] In fact, Chinese dominance is an outcome of deliberate activity.

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[1] EU commission: Topics: Renewable Energy: solar energy; https://energy.ec.europa.eu/topics/renewable-energy/solar-energy_en ; accessed May 2, 2024
European Parliament 2024. Legislative Train Schedule: *EU Solar Energy Strategy in a "A European Green deal"*, April 20; source: https://www.europarl.europa.eu/legislative-train/package-repowereu-plan/file-eu-solar-strategy

[2] European Commission 2022. *EU Solar Energy Strategy*, May 18; source: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A221%3AFIN&qid=1653034500503
European Parliament 2024, op. cit.

[3] Andy Bounds and Alice Hancock 2024. Brussels considers support for solar panel makers as Chinese imports flood market. *Financial Times*, January 27; source: https://www.ft.com/content/39af71b4-36dc-4bb9-a181-3710fdfb7ac2

[4] Alice Hancock and Edward White 2024. EU launches 2 probes into China solar manufacturers. *Financial Times*, April 3; source https://www.ft.com/content/5e677032-82c6-4761-9053-a441ef1a71c4

[5] Yuan Yang, Alice Hancock and Laura Pitel 2023. Solar power: Europe attempts to get out of China's shadow. *Financial Times*, March 23; source: https://www.ft.com/content/009d8434-9c12-48fd-8c93-d06d0b86779e

[6] Alice Hancock and Edward White 2024. EU launches 2 probes into China solar manufacturers. *Financial Times*, April 3; source https://www.ft.com/content/5e677032-82c6-4761-9053-a441ef1a71c4

Already a decade ago, EU officials noted that Chinese producers sell their solar panels at a discount of 88% compared to their own production costs.[7] In the fall of 2023, observers signalled that the price of Chinese solar panels had decreased by 25 percent in the previous few months[8] and that around €7bn worth of Chinese solar panels were sitting in European warehouses in the fall of 2023.[9] Government policies in China, and in particular city-level solar supply subsidies (both of production and innovation), shaped demand and, in turn, supply and prices of solar panels with repercussions around the globe. [10] Industry observers recently noted that Chinese manufacturers received over the years subsidies to the tune of €170bn.[11]

The current Chinese dominance did not happen by chance; it happened by design. In 2004, there was near-zero production capacity in China and there were a few hundred patents compared to over ten thousand by 2020.[12] Chinese share of production in polysilicon, silicon wafers, photovoltaic cells, photovoltaic modules for solar panels had expanded from zero a share of around or more than 80% in those four domains by 2022. In that year, over 95% of solar panel imports in the EU came from China.[13] In 2021, solar panel exportation contributed more than $30bn to the Chinese trade surplus. [14]

Of course, it is the role of European leaders to provide an institutional environment and contribute to the business ecosystem for solar panels (e.g., grid connection capacity, permitting issues, approval process for renewable energy subsidies), but is it enough?

A typical argument put forward by an academic representing the institutional environment thinking is that Chinese production capacity is already in place and therefore it is more "convenient" to buy[15] rather than, as EU Solar Energy Strategy states, to "support the EU industry in expanding the domestic production of photovoltaic panels." It might even be an argument worth considering if the market were mature; yet, it is not.

European and global demand is on the rise. The International Energy Agency (IEA) estimated that $120bn worth of investments are required as global production capacity for polysilicon, wafers, cells and modules would need to more than double within less than a decade to meet the goals set in its roadmap to Net Zero Emissions by 2050.[16] The

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[7] Beda Romano 2013. Mini-dazi Ue sui pannelli cinesi. *IlSole24Ore*, June 5; source : https://st.ilsole24ore.com/art/notizie/2013-06-05/minidazi-pannelli-cinesi-064049.shtml?uuid=Abbw9D2H

[8] Dario Prestigiacomo 2023. Invasione dei pannelli solare cinesi a prezzi bassi. *EuropaToday.it*, September, 12 https://europa.today.it/economia/invasione-pannelli-solari-cina-prezzi-bassi.html

[9] Edward White 2023. How China cornered the market for clean tech. *Financial Times*, August 9; source: https://www.ft.com/content/6d2ed4d3-c6d3-4dbd-8566-3b0df9e9c5c6

[10] Ignacio Banares-Sanchez, Robin Burgess, David Laszlo, Pol Simpson, John Van Reenen, and Yifan Wang 2024. *Chinese Innovation, Green Industrial Policy, and the Rise of Solar Energy*. LSE working paper, March 18

[11] Pietro Bardocci 2024. Pannelli fotovoltaici, tutti i numeri del dominio cinese. *Il Corrriere della Sera*, March 3; source: https://www.corriere.it/economia/energie/24_marzo_03/pannelli-fotovoltaici-tutti-i-numeri-del-dominio-cinese-la-transizione-green-passa-solo-da-pechino-a749c2ef-1b7a-460a-a93e-23bc949caxlk.shtml

[12] Ignacio Banares-Sanchez et al. 2024, op. citc

[13] Eurostat 2023. International trade in products related to green energy. *Eurostat Statistics Explained*, ISSN 2443-8219, November, 8; source : https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_products_related_to_green_energy&oldid=579764#Wind_turbines:_China_largest_import_partner.2C_United_Kingdom_largest_export_partnerhttps://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_products_related_to_green_energy&oldid=579764#Wind_turbines:_China_largest_import_partner.2C_United_Kingdom_largest_export_partner

[14] International Energy Agency 2022. *Special Report on Solar PV Global Supply Chains*; source: https://iea.blob.core.windows.net/assets/d2ee601d-6b1a-4cd2-a0e8-db02dc64332c/SpecialReportonSolarPVGlobalSupplyChains.pdfhttps://iea.blob.core.windows.net/assets/d2ee601d-6b1a-4cd2-a0e8-db02dc64332c/SpecialReportonSolarPVGlobalSupplyChains.pdf

[15] Marco Ottaviano 2024. Transizione verde UE: importare conviene. *ISPI*, March 24; source: https://www.ispionline.it/it/pubblicazione/transizione-verde-ue-importare-conviene-165915

[16] International Energy Agency 2022, op. cit.

competition and innovation dynamics are far from being established and the market is far from being mature.

Two decades ago, those dynamics were, of course, even further away from being mature and established. If the Chinese leaders had put forward a thinking of "more convenient to buy" when in 2004 they started to build their domestic production of photovoltaic panels, Europe's Green transition and its future solar panel installations would not depend today on Chinese products. Europe would not be transferring this amount of wealth to China.

Decarbonisation *could* be achieved by relying on Chinese solar photovoltaic production. EU decarbonisation will rely on deployment and most jobs will be created in deployment; solar photovoltaic is one of the most employment-intensive sectors of all renewable and fossil fuel energy technologies. European leaders can, if they want, declare that the race is lost and they do not see value in European companies riding this wave of technological change. Chinese leaders did not do so two decades ago and did not implement Washington Consensus policies; Chinese firms have since created substantial trade surpluses and wealth transfer to China.

Chinese leaders, it seems, have a certain understanding of their role when it comes to supporting the Chinese industry in expanding the domestic production of photovoltaic panels and, in turn, employment and trade surplus. The approach taken by European leaders fortifying the institutional environments might be ideologically convincing, but is it practically adequate?

## Waves of technological change in Europe: the case of batteries for electric vehicles

A quick search online on "European Commission Electric Vehicles" and "European Parliament Electric Vehicles" reveals that "Electrification of transport (electro mobility) is a priority in the Community Research Programme"[17] and that "Europe is the global frontrunner in the adoption of electric vehicles".[18]

In October 2022, The European Commission welcomed "the agreement reached last night by the European Parliament and Council ensuring all new cars and vans registered in Europe will be zero-emission by 2035."[19]

Not even a year later, the European Commission "formally launched an anti-subsidy investigation into the imports of battery electric vehicles (BEV) from China."[20] In 2023, the top two electric vehicle battery manufacturers, both Chinese, reach a market share of over 50 percent[21] and more than 60 percent of the European market.[22] By spring 2024, as with

[17] European Commission: Mobility and Transport: Transport Themes: Clean Transport: Clean and energy efficient vehicles: Green propulsion in transport: Electric vehicles; source: https://transport.ec.europa.eu/transport-themes/clean-transport/clean-and-energy-efficient-vehicles/green-propulsion-transport/electric-vehicles_en?prefLang=cs ; accessed May 2, 2024

[18] European Environment Agency: Topics: *Electric Vehicles: Key facts*; source: https://www.eea.europa.eu/en/topics/in-depth/electric-vehicles ; accessed May 2, 2024

[19] European Commission, 2022. Zero emission vehicles: first 'Fit for 55' deal will end the sale of new CO2 emitting cars in Europe by 2035. *Press release*, October 22; source: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6462 ; accessed May 2, 2024

[20] European Commission, 2023. Commission launches investigation on subsidised electric cars from China, *Press release*, October 4; source: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4752 ; accessed May 2, 2024

[21] Harry Dempsey and Gloria Li 2023. Chinese battery makers strengthen grip on global supply. *Financial Times*, January 4; source: https://www.ft.com/content/0d2553ad-e512-4979-af1b-39d08397de82

solar panels, Chinese electric vehicles are piling up at European ports, turning them into "car parks".[23]

The current Chinese dominance did not happen by chance; it happened by design. Across many of the key materials used in producing electric vehicles batteries, the cars' most expensive part, China has a more than impressive market share by 2024. For many components, it has an 80 percent market share; for others, it has more than 60 percent market share. Only for lithium, nickel and cobalt mining does China have a share lower than 20 percent.[24] Then again, Chinese companies have significant stakes in lithium production outside the country. It has been observed that by 2024, Chinese interests will control more of lithium mining than the country needs for domestic purposes.[25]

In fact, Chinese dominance is an outcome of deliberate activity. The country's most important battery manufacturer was set up in 2011 only. A decade later, the company' scale makes it difficult for rivals to compete. The average size of a battery factory is doubling every four or five years. There are not too many, if any, European manufactures that can double their factory size at the same rate. While the cost of building China's factories is forecast to shrink to by about 15-20 percent in the coming years, the cost of new European battery plants is double that of Chinese compared to output.[26] Chinese domestic industry was prioritised with heavy local requirements, and from 2016 South Korea's leading battery makers were cut off from accessing subsidies, thus launching a boom in battery production of Chinese manufacturers. Beijing's cumulative state spending on the electric vehicle sector has been estimated to be more than $125bn between 2009 to 2021.[27]

In the meantime, the April 2024 report produced by former Italian prime minister Enrico Letta 'to empower the Single Market to deliver a sustainable future for all EU citizen' and entitled "much more than a market" mentions electric vehicles twice. The report is the outcome of visits to 65 European cities and more than 400 meetings with trade unions, employers' organisations, third sector and civil society groups and debates held in universities or within think tanks. The report, the outcome of European leaders' thinking, notes that "public charging infrastructure for electric vehicles is developing" and that "EU should enable seamless travel between all European capitals for electric vehicles by ensuring a comprehensive charging infrastructure along connecting routes".[28] It certainly reflects the current posture of European leaders. Does it present a path for the future to cope with technological change in mobility?

It is not to say that the suggestions of the Letta report to reform the EU financial, energy and telecommunications markets are not relevant; it is to suggest that European leaders should think again if they think their responsibility in the current context is confined to

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[22] Edward White, Cheng Leng and Claire Bushey 2023. China's 'battery king' faces scrutiny over EV market dominance. Financial Times, April 4; source: https://www.ft.com/content/9f411244-eb72-493f-86d2-e7bf77de757e

[23] Arjun Neil Alim, Robert Wright, Peter Campbell and Gloria Li 2024. European ports turned into 'car parks' as vehicle imports pile up. *Financial Times*, April 9; source: https://www.ft.com/content/496f3bfa-9f0c-4145-9024-188572a280fd

[24] Wang Xueqiao, Edward White and Gloria Li 2023. Foreign carmakers confront 'moment of truth' in China. *Financial Times*, April 11; source: https://www.ft.com/content/42b0b526-c094-4ed1-9f25-19075e06305b

[25] Edward White 2023. How China cornered the market for clean tech. *Financial Times*, August 9; source: https://www.ft.com/content/6d2ed4d3-c6d3-4dbd-8566-3b0df9e9c5c6

[26] Edward White, Cheng Leng and Claire Bushey 2023, op. cit.

[27] Edward White 2023, op. cit.

[28] Enrico Letta 2024. *Much more than a market – Speed, Security, Solidarity. Empowering the Single Market to deliver a sustainable future and prosperity for all EU Citizens*, April 18; source: https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf

reforming the market and modifying the institutional environments in which companies compete.

It is perplexing that European leaders do not hesitate to pass legislation to enforce new car and van registrations in the EU to exhibit zero emissions by 2035 without addressing the electric vehicle and battery production within Europe in the next decade(s).

The main Chinese battery manufacturer for electric vehicles was set up in 2011 and twelve years later, it has become a multi-billion dollar company. Much can be achieved in the next twelve years. In early 2023, industry observers even predicted that the EU could end its reliance on China for lithium-ion battery cells by 2027 and that China's dominance of battery components could also be cut by two-thirds if only European leaders were to make decisions akin to the ones taken by the US and other governments.[29]

Different European countries offer different kinds of incentives for electric vehicles (tax benefits, purchase subsidies, charging infrastructure incentives, discounts for parking or free parking, etc.).[30] Then again, it requires on behalf of the European leaders another kind of attitude than confining their role to providing institutional environment for electric vehicles in general, and battery production in particular.

Chinese leaders, it seems, have a certain understanding of their role when it comes to supporting the Chinese industry in expanding the domestic production of batteries for electric vehicles; it does not follow Washington Consensus policies. Which approach will European leaders take?

## Waves of technological change in Europe: the case of artificial intelligence (AI)

It seems that leadership in AI is essential to future prosperity. We are at an inflection point for our societies. According to a computer scientist, "what we have seen is genuine breakthroughs in the sense of a step change in capability of AI in the last few years. …" and we now have tools that "didn't even exist a decade ago. … [and what] was just pure speculation and philosophy ten years ago, now we can actually just try out and it's transforming AI into a kind of new science."[31] According to a highly recognized academic in economics, it is a "genuine breakthrough" and "will double the rate of productivity growth".[32] A quick search online on "European Commission artificial intelligence" and "European Parliament artificial intelligence" reveals that European leaders have been active in this domain. The European Parliament approved an Artificial Intelligence Act. It is not that this effort is not adequate. Mustafa Suleyman, a co-founder of one of the world's leading Artificial Intelligence (AI) companies, states that it is "very sensible."[33] Regulations are essential. In fact, in March 2024 Western and Chinese artificial intelligence scientists issued a stark warning and identified "red lines" on the development of AI, including the

[29] Transport & Environment 2023. *Europe could end reliance on Chinese Li-ion battery cells by 2027 – forecast*. Press release, January 24; source https://www.transportenvironment.org/articles/europe-could-end-reliance-on-chinese-li-ion-battery-cells-by-2027-forecast

[30] European Alternative Fuels Observatory ; source: https://alternative-fuels-observatory.ec.europa.eu/

[31] Mike Wooldridge 2023. What is Artificial Intelligence? *Royal Institution*, December 23, min 01:45-01:52 and 09:27-09:47; source: https://www.youtube.com/watch?v=D2JY38VShxI

[32] John Thornhill. 2024. The great American innovation engine is firing again. *Financial Times*, Opinion piece, May 9; source: https://www.ft.com/content/0d39e8f0-38ba-40aa-8ec8-d04e82afb690

[33] What does the AI revolution mean for our future? Mustafa Suleyman and Yuval Noah Harari debate with The Economist Editor-in-Chief Zanny Minton-Beddoes; source: https://www.youtube.com/watch?v=7JkPWHr7sTY; minute 38:33; accessed May 12, 2024

manufcature of bioweapons and cyber attacks.[34] Still, there is an understanding that there is "not a lot" of hope to include China in AI safety and regulation.[35]

Regulations contribute to creating the institutional environment. AI infrastructure and applications, which are introduced and commercialized by firms, require substantial investments.

The algorithms of AI large language models like ChatGPT are trained on massive data sets, which require thousands of expensive advanced semiconductor chips and impressive amounts of electricity. There are world leading EU-based microprocessor companies. In fact, the EU offered since 2020 eight production-related investments with government support incentives of $47bn; it compares well to the US with twenty-six investments and support of $39bn (even though this figure only considers US incentives at the federal level and not the ones offered by different states). Then again, China with up to thirty investments offered incentives to the tune of $142bn.[36] Hopefully, the same pattern will not play out again, namely the pattern of leadership of European (and American) firms (in solar panel production or similar) to be a decade later outmanoeuvred by Chinese companies.

Investment in AI is about fifty times higher in the US than in Europe. Global investment in AI infrastructure is forecasted to reach around $150bn in 2024, primarily driven by the US and China.[37] It is not that European leaders do not know it. A publication of the European Parliament notes that the US is leading private investment in AI (€62.5bn) in 2023, followed by China (€7.3bn) and the EU (€5.5bn). Investments in AI in Europe made by companies and governments are nowhere near the kind of investments that their counterparts in the US and China are undertaking. There is a target across the different EU programmes to fund AI to the tune of €8.5bn over several years, mostly over 2021-2027.[38] [39] The federal government and different states in the US announced projects spending to the tune of $500bn.[40].

ChatGPT and other AI applications like Character.ai are unavailable in China. US counterparts outrank Chinese generative AI start-ups in terms of technological development and total fundraising. As of May 2024 there are 262 start-ups competing to

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[34] Cristina Criddle and Eleanor Olcott 2024. Chinese and western scientists identify 'red lines' on AI risks. *Financial Times*, March 18; source: https://www.ft.com/content/375f4e2d-1f72-49c8-b212-0ab2a173b8cb

[35] Yifan Yu, Sayumi Take, Peter Campbell, Tim Bradshaw, David Keohane and Lien Hoang 2024. Grading the Chips Act and the other costs of AI. *Financial Times*, May 9; source: https://www.ft.com/content/2ab03776-fa1a-407a-861f-e47016157b0a

[36] Yifan Yu, Sayumi Take, Peter Campbell, Tim Bradshaw, David Keohane and Lien Hoang 2024, op. cit.

[37] John Thornhill. 2024, op. cit.

[38] European Parliament 2024. AI investment: EU and global indicators. At a glance: Digital issues in focus, March ; source: https://www.europarl.europa.eu/RegData/etudes/ATAG/2024/760392/EPRS_ATA(2024)760392_EN.pdf x

[39] It not be noted, though, that the relevant budget composed of the different EU funding instruments target amounts of €165bn, including funding concerning digital skills, digital infrastructure, digital transformation, and digitalisation of public services (Papazoglou, M., Torrecillas Jodar, J., Cardona, M., Calza, E., Vazquez-Prada Baillet, M. and Righi, R., Mapping EU level funding instruments to Digital Decade targets, Lopez Cobo, M. and De Prato, G. editor(s), Publications Office of the European Union, Luxembourg, 2023). There's the Recovery and Resilience Facility of the NextGenerationEU recovery plan (https://next-generation-eu.europa.eu/index_en) ; the EU's Digital Decade targets of the Connecting Europe Facility 2 (https://digital-strategy.ec.europa.eu/en/activities/cef-digital); Digital Europe funding programme (https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/digital-europe-programme_en); there are investments related to digital in the context of the current Horizon Europe Research and innovation funding programme, in place until 2027 (https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en), of the Cohesion Policy 2021-2027 (https://ec.europa.eu/regional_policy/2021-2027_en#:~:text=EU%20Cohesion%20Policy%20contributes%20to), and of the European Structural and Investment Funds (https://cohesiondata.ec.europa.eu/).

[40] John Thornhill 2024, op. cit.

bring out home-grown, Chinese alternatives[41] Most European start-ups find themselves that they cannot play in the some league of their American (and Chinese counterparts), unless they seek US-based investors. Chinese leaders make US-originated AI applications unavailable and act.

Analysts estimate that AI-related investments will be twice as high in terms of percentage of GDP in the US compared to other economies[42] and the US economy being larger in size, the total amount and the differential that the US invests compared to the EU and other countries is even more impressive. It has been affirmed that "market forces [in the EU or EU countries] alone are proving an inadequate guarantee of true political independence." [43] A report to the European Parliament on "Artificial Intelligence Diplomacy" noted that the EU has approached "AI primarily from … regulatory angle"[44] Again, the EU seems to follow Washington Consensus policies.

There are structural problems in artificial intelligence in the imbalance between those who develop AI models and control them and those who are affected by them.[45] There are furthermore structural problems in AI investment for EU countries and the EU compared to the US and China. Reports issued by French institutions have been warning for a decade that France and the EU can be regarded as "cyber colonies" in many aspects.[46]

What plan do European leaders have not to lose control over talent, data, and computing power for AI models? What do European leaders expect if they are not willing to undertake the investments that others are making? What do European leaders see as their responsibility if not ensuring prosperity to future generations?

## Europe as "tech laggard" and the role of the institutional environment

In a recent piece in the *Financial Times*, Yann Coatanlem, a serial entrepreneur and investor, specialized in sustainable luxury yacht hospitality, among others, offered an opinion on why Europe is a laggard in tech.[47] Once more, the main culprit is the institutional environment. According to the opinion piece, the "recent wave of tech lay-offs offers insights into some of the key structural weaknesses of the European model." Lay-offs are much simpler, speedier, and less costly in the US compared to Europe; this is the

[41] Eleanor Olcott 2024. Four start-ups lead China's race to match OpenAI's ChatGPT. Financial Times, May 3; source: https://www.ft.com/content/4e6676c8-eaf9-4d4a-a3dc-71a09b220bf8

[42] John Thornhill 2024, op. cit.

[43] Cédric Villani, op. cit.

[44] Ulrike Frank, op. cit.

[45] S. Costanza-Chock 2020. Design Justice: Community-Led Practices to Build the Worlds We Need. MIT Press, Cambridge; MA.

[46] Ulrike Franke 2021. Artificial Intelligence diplomacy: Artificial Intelligence governance as a new European Union external policy tool. Study requested by the AIDA committee, European Parliament. Publications Office of the EU; source: https://op.europa.eu/fr/publication-detail/-/publication/f1ab0057-d55e-11eb-895a-01aa75ed71a1
It references : Communiqué: Publication du rapport du ministère des Armées sur l'intelligence artificielle », September 2019, https://www.defense.gouv.fr/english/salle-de-presse/communiques/communique_publication-du-rapport-du-ministere-des-armees-sur-l-intelligence-artificielle.
It is to be noted that a search for "cyber" or "colo" in the "Rapport de la Task Force IA" does not yield any result. Then again, the expression has already been used in other French publications, namely in a document of the French Senate and in one of a French parliamentary mission: Catherine Morin-Desailly 2013. L'Union européenne, colonie du monde numérique? Rapport d'information n° 443 (2012-2013), March 20 ; source: https://www.senat.fr/rap/r12-443/r12-443.html; Cédric Villani 2018. For a meaningful Artificial Intelligence : Towards a French and European Strategy. A parliamentary mission: source: https://www.jaist.ac.jp/~bao/AI/OtherAIstrategies/MissionVillani_Report_ENG-VF.pdf

[47] Yann Coatanlem 2024. Why Europe is a laggard in tech. Financial Times, February 26; source: https://www.ft.com/content/d4fda2ec-91cd-4a13-a058-e6718ec38dd1

impediment, according to the author, to investment in AI in Europe. He writes, "Meta paused its efforts on the metaverse, laid off 20.000 employees within a few months and boosted its investments in AI." On the other hand, "SAP, Europe's software leader … can only invest in AI at a rate of €500mn a year, compared with the tens of billions being invested by each of the [US Big Tech companies]."[48] [49]

It might be that Meta was able to lay off 20,000 employees within a few months whereas it will take Nokia, SAP, and Ericsson years to implement their restructuring plans for their European operations. Then again, Meta would most probably not have not boosted its investments in AI if it could not have laid off 20,000 employees within a few months. Even if the severance costs had been higher than the reported 4.2 months of median pay, Meta would most probably have boosted its investments in AI.

The gap in financing of innovation between the EU and China and the US is a structural problem as "some €300bn flows abroad every year, from European private investors."[50]. It cannot be solved by individual entrepreneurs or managers whether in charge of a start-up, a big multinational corporation or active as a venture capitalist. The structural problem has to be addressed by policy makers. The institutional environment certainly has to be modified; then again, the gap can hardly be closed in the required time frame by modifying the institutional environment alone.

It is not to say that the institutional environment does not matter; it matters. It is to say that only focusing on enhancing the institutional environment does not solve the problem. If other actors in the global marketplace, such as the leaders in China and the leaders in the US, do not confine their role to providing the correct *Rahmenbedingungen* or the institutional environment, then European leaders will, this article proposes, not have done their job even if they enhance the institutional environment.

## *European policy: a radical change?*

The aspiration of the Chinese leadership are expressed in the following statement: "After basically realizing modernization, we will continue to work hard and build China into a great modern socialist country that *leads the world* in terms of composite national strength and international influence by the middle of the century."[51] China seeks international power through trade. China goes even further. China banned the export of technology to make rare earth magnets and has a ban on technology to extract and separate the rare earth materials. [52] The very same Chinese leader stated that "[a]dvanced technology is the sharp weapon of the modern state."[53]

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[48] Yann Coatanlem 2024, op. cit.

[49] In specific, he refers to: Apple; Alphabet/Google; Amazon; Meta/Facebook, Microsoft, Nvidia; and Tesla

[50] Ursula van der Leyen 2024. *Speech by President von der Leyen on the occasion of the opening ceremony of the Hannover Messe*. April 21; source: https://ec.europa.eu/commission/presscorner/detail/en/speech_24_2201 François Villeroy de Galhau 2024. *France and Europe: from crisis management to a longer-term ambition*. Letter submitted to the President of the French Republic, the President of the Senate and the President of the National Assembly, April 21, page 19; source: https://www.banque-france.fr/en/publications-and-statistics/publications/letter-president-republic-2024

[51] Xi, J. (2022) Hold high the great banner of socialism with Chinese characteristics and strive in unity to build a modern socialist country in all respects. Report to the 20th National Congress of the Communist Party of China, October 16, 2022. Available from: https://www. fmprc. gov.cn/eng/wjdt_665385/zyjh_ 665391/202210/t2022 1025_ 10791 908.html

[52] Siyi Liu and Dominique Patton 2023. China bans export of rare earths processing tech over national security. *Reuters*, December 22; source: https://www.reuters.com/markets/commodities/china-bans-export-rare-earths-processing-technologies-2023-12-21/

[53] Chris Buckley and Paul Mozur 2018. What Keeps Xi Jinping Awake at Night. *The New York Times*, May 11; source: https://www.nytimes.com/2018/05/11/world/asia/xi-jinping-china-national-security.html

The EU commission's 'Fit for 55' package[54] is set to ensure a level-playing field within the EU and will "create a massive market for GreenTech, green products and green solutions" [55] The European leaders currently provide the institutional environment; do they at the same time ensure that European companies will succeed within this institutional environment? China is doing the investments in IA and China enabled and made the investments in solar panels (€170bn) and batteries for electric vehicles ($125bn) that allowed Chinese manufacturers to obtain a leadership position
Edward Luttwak pointed to 'the logic of war in the grammar of commerce'[56] Albert Hirschman, reflecting on national power and trade, wrote in his book on the topic that: "Foreign trade has two main effects upon the power position of a country. The first effect is certain to be positive. … foreign trade enhances the potential military force of a country. The second effect of foreign trade from the power standpoint is that it may become a direct source of power. … a method of coercion of its own … economic pressure can take the place of bombardments, economic pressure that of saber rattling. … relationship of dependence… ."[57] China, and the US aim to exert international power through trade to degrees that European leaders are currently not pursuing.

Of course, European leaders can decide that solar panels, batteries for electric vehicles, and artificial intelligence are not the wave of technological change they want European companies to dominate. They might have other technological waves in mind. If so, it would be beneficial if they were to clarify which ones these are and what plans they aim to put in place to have European companies dominate them. European leaders could explain to what degree they are willing to approve wealth transfer (in solar panels, batteries for electric vehicles, and artificial intelligence) from Europe to China and the US. At the same time, European leaders could explain to what degree they are willing to have the European industrial structure (in solar panels, batteries for electric vehicles, and artificial intelligence) shaped by the industrial policies of China and the US.

## Conclusion

Management scholars investigate the success of firms in the face of alien, novel technologies invading their business. The success of firms is not confined to the ability of individual managers or the decision-making processes and operating routines of the company leaders. Firm success in innovation is shaped by the regulatory environment, too (Coeurderoy and Murray, 2008; Durisin, Calabretta, and Parmeggiani, 2010). A firm with superior management, but competing in a less adequate or 'wrong' business ecosystem will not achieve the success of firms with similar or even inferior management, but which are supported by another kind of business ecosystem.

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[54] European Commission 2023. *Commission reports on EU policy initiatives to promote investments in clean technologies*. Press release, October, 24; source:
https://ec.europa.eu/commission/presscorner/detail/en/ip_23_5245
European Commission. *Fit for 55: Delivering on the Proposal*. source: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal/fit-55-delivering-proposals_en; accessed on May 22, 2024

[55] Kurt Vandenberghe, Director-General DG CLIMA, European Commission at the "Ideas Lab 2024 - Morning plenary: What future for EU industrial policy?" organized by the CEPS Think Tank; source:
https://www.youtube.com/watch?v=hK3IQORsUEk; min 1:09:48-1:09:52; accessed May 22, 2024.

[56] Luttwak EN 1990. From geopolitics to geo-economics: Logic of conflict, grammar of commerce. *The National Interest*, 20, 17–23.
Luttwak EN 1998. *Turbo-capitalism: Winners and losers in the global economy*. Weidenfeld & Nicholson, London, UK.j

[57] Hirschmann AO 1945. *National power and the structure of foreign trade*. University of California Press, Berkeley, CA.

One can understand and even empathize with the current attitude of European leaders who confine their role to providing the institutional environments, convinced as they are that it is up to managers to make the required investments in novel technologies to outmanoeuvre competition through innovation. It is certainly ideologically appealing; Washington Consensus policies represented the 'Zeitgeist' of the global order that emerged after the Second World War and that dominated European or Western policy thinking for decades.

Yet, the approach might turn out to be practically failing and it might not allow European firms to compete in the marketplace. A break away from the current practices of operating has to be done on a European level; no EU country has the market size that enables a firm to make the kind of investments to compete with US or Chinese firms. The future prosperity of Europe's societies and citizens is contingent on both the institutional environment and on investments in new technology. If European leaders do not provide an adequate business ecosystem and do not ensure that the required investments in new technology are made through the different means (of industrial, competition and trade policy) available to them, then they – and not managers or entrepreneurs – will confine Europe to a the status of "Tech laggard" If conditions change, the current operating practices might no longer be the adequate path forward. It might be difficult, but it might be required to break away from them in order to provide a future for Europe as a "global industrial powerhouse"[58] and a future for the next generations of European citizens.

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[58] Ursula van der Leyen 2024, op. cit.

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