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# Enhancing Resilience in Global Value Chains

a comprehensive analysis of reshoring and its implementation  
in the semiconductor industry from a US and European  
perspective

**Supervisor**

Ch. Prof. Stefano Micelli

**Graduand**

Celia Pinto

Matriculation number: 873551

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# ABSTRACT

Reshoring is a concept that has been popular among companies in recent years as a way to address inefficiencies along the whole global value chain. The production element of the business, which was formerly located in developing nations like China, is now involved in the relocation to the home country, known as backshoring, or to third countries, known as nearshoring or friendshoring. Global value chains were significantly disrupted by the financial crisis, COVID-19, and US-China trade war in the macroeconomic and political environment that has characterized the last 20 years, leading to inefficiencies in the corresponding markets and industries. Particularly, the semiconductor industry has been at the centre of a number of conflicts and the deterioration of relations among major powers. The purpose of this study is to determine whether reshoring is possible in the current economic and political environment to enhance the performance of global value chains, and to what extent countries are able to implement this practice. To accomplish this, the work begins by outlining globalization and reshoring from a purely theoretical standpoint. After that, the study analyses the decline of globalization with a focus on the global value chain disruptions brought on by the significant events that had an impact in the previous decades. A close focus is then placed on the high-tech sector and the semiconductor industry in the context of the US-China trade war, from the perspectives of the US and Europe, placing the reshoring process in this context. Finally, a consideration on the feasibility of reshored manufacturing process is presented, pointing out the obstacles of this practice that arise in the 21<sup>st</sup> century, between labour shortages and geopolitical tensions.

## ABSTRACT IN ITALIAN

Il reshoring è un concetto che si è diffuso tra le aziende negli ultimi anni come modo per affrontare le inefficienze lungo l'intera catena del valore globale. L'elemento produttivo dell'azienda, che prima era localizzato in Paesi in via di sviluppo come la Cina, è ora coinvolto nel trasferimento verso il Paese di origine, noto come backshoring, o verso Paesi terzi, noti come nearshoring o friendshoring. Le catene globali del valore sono state significativamente perturbate dalla crisi finanziaria, dalla COVID-19 e dalla guerra commerciale tra Stati Uniti e Cina nel contesto macroeconomico e politico che ha caratterizzato gli ultimi 20 anni, portando a inefficienze nei mercati e nei settori corrispondenti. In particolare, l'industria dei semiconduttori è stata al centro di numerosi conflitti e del deterioramento delle relazioni tra le principali potenze. Lo scopo di questo studio è determinare se il reshoring è possibile nell'attuale contesto economico e politico per migliorare le prestazioni delle catene globali del valore e in che misura i Paesi sono in grado di attuare questa pratica. A tal fine, il lavoro inizia delineando la globalizzazione e il reshoring da un punto di vista puramente teorico. Successivamente, lo studio analizza il declino della globalizzazione, concentrandosi sulle perturbazioni della catena del valore globale provocate dagli eventi significativi che hanno avuto un impatto nei decenni precedenti. L'attenzione si concentra poi sul settore high-tech e sull'industria dei semiconduttori nel contesto della guerra commerciale tra Stati Uniti e Cina, dal punto di vista degli Stati Uniti e dell'Europa. Infine, viene analizzata l'effettiva possibilità di realizzazione del processo di reshoring della produzione, evidenziando gli ostacoli di questa pratica che si presentano nel XXI secolo, tra carenza di lavoratori e manodopera e diverse tensioni geopolitiche tra le superpotenze mondiali.

# INTRODUCTION

The world is at a crossroads at the beginning of the twenty-first century, where the drivers of globalization, advancements in technology, and geopolitical conflicts are converging. A complicated web of interdependencies between countries, sectors, and markets has been woven as a result of globalization, an important and impactful scenario that changed the world starting in the past centuries and now changing its characteristics in current decades. The idea of global value chains (GVCs) has evolved in this age of connectivity as a crucial framework via which goods and services cross international boundaries, altering the economic landscape and reinventing the geography of production. However, it has become more and more clear in recent years that the boundaries of economic integration worldwide are not impervious to change. Global supply chain strategies have undergone a significant reevaluation as a result of a number of important challenges, such as the recent global pandemic that shaped the entire world, the ongoing Russia-Ukraine war, the current trade conflict between the US and China, the need for financial stability after the 2008 crisis, and a recalibrating of risk assessments. A key tendency has emerged in the middle of this transformation: relocation of second degree, involving both reshoring and nearshoring. Reshoring, the process of transferring the production and manufacturing procedures back to the home nation, and nearshoring, a method of relocating businesses to adjacent countries with cheaper labour costs and accessibility to major markets, have gained appeal as a result of the unpredictability and weaknesses highlighted by the worldwide pandemic and geopolitical impacts. This shift indicates a significant break from the conventional thinking of pursuing low-cost labour all across the world. The impact of these disruptions is particularly clear in the semiconductor industry, which drives technological development, innovation, and a wide range of important applications, spanning from automotive technology and telecommunications to AI and national security. The semiconductor sector, with its extensive worldwide supply chains, revolutionary technology, and strategic importance, serves as a valuable

example for investigating the implications of reshoring in a global economy dealing with the uncertainties of the twenty-first century.

In the first chapter of this work, the complicated landscape of globalization is presented, examining its historical evolution and current situation in the twenty-first century. A special emphasis is placed on the reshoring process implemented by companies after the offshoring phase, which aims to explore the motivations, issues, and ramifications of reshoring activities, laying the groundwork for a more in-depth assessment of how reshoring could be a solution to deal with the current global economic environment.

The second chapter focuses on the global value chain disruptions that have occurred during the last two decades, from the 2008 financial crisis to the Russian-Ukraine war. Together with the development of China as a worldwide superpower, the Suez Canal blockage, the unexpected COVID-19 epidemic, and the US-China trade dispute, these events are all examined in detail, with the respective impact they had on companies and markets in all sectors. The semiconductor industry is given special attention, as it has been affected by multiple disruptions in recent years. This chapter explores this industry's weaknesses and how the US and Europe manage this terrain despite shifting international tensions between economic powers.

In the final section, we discuss the reality of relocating production in the twenty-first century. While reshoring appears to be an appealing proposition, it is clear that reaching full feasibility in the near future will bring considerable obstacles. Our research reveals that complete decoupling from China is challenging, and labour constraints in developed countries complicates the success of the reshoring process. This chapter finishes by shedding light on the practical constraints that limit the idealized notion of reshoring in a complex global economy.

# CHAPTER 1: GLOBALIZATION AND RELOCATION OF SECOND DEGREE

## 1.1. A brief timeline of globalization and its development

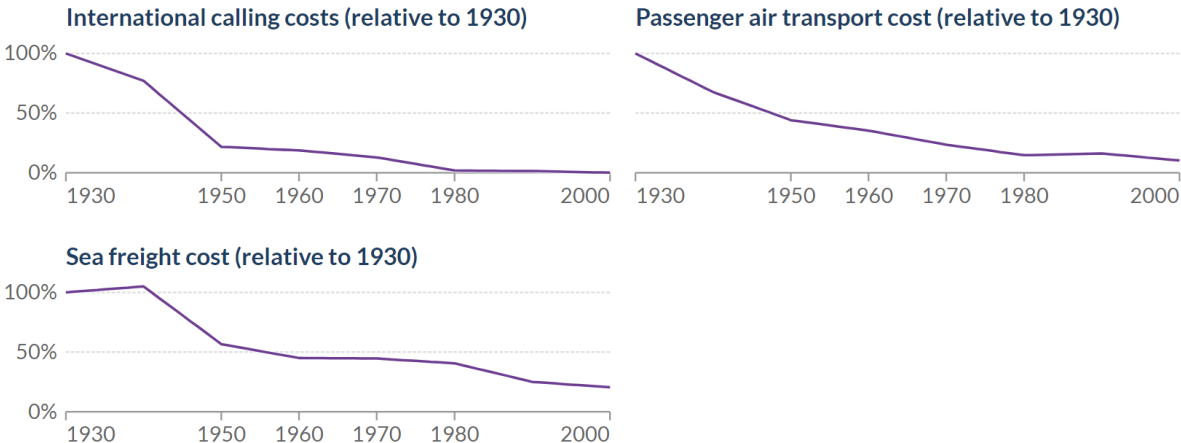
In order to have a clear view on the actual trends on globalization, or de-globalization, and be able to further understand the characteristics of the actual economic situation, it's necessary to go back in the history and analyse how this phenomenon evolved during the last decades, thanks to the studies done by plenty of scholars on the topic. The "economic globalization" is the term used to describe the rising interdependence of world economies as a result of the expansion of international capital flows, the wide and quick diffusion of technology, and the size of cross-border trade in goods and services (Shangquan, 2000). It refers to the integration of the capital, labour, and commodity markets (World Trade Report, 2008). However, the word "globalization" has been used to define also other historical eras that were characterized by the integrations of markets. Based on the studies of Tomas. L. Friedman in his book "The world is flat", there have been at least three globalization eras, each of them characterized by a disruption of the world's equilibria during centuries.

The Globalization 1.0 occurred between 1400 and 1800 circa, when intensive trade between continents began. Here its where the global integration started, thanks to the power of countries and governments, and the world changed its status from being considered "large" to be thought "medium". Distances where still huge but at least driven by wind and steam power. The main focus in this era are national-states, and the primary goal was to comprehend how each country was supposed to fit into the global competition and prospects.

The Globalization 2.0 took place from the XIX century to the end of the XX. The actors of this era were multinational companies and their desire to go global for cheaper workforce and to expand their markets. During the first part of the period, the implementation of railroads and steam engines made transportation costs shrink

rapidly and increase the easiness of movement for goods, services, information, and people. On the second part of the era, the falling costs were those regarding telecommunications, caused by the spread of the telegraph, telephones, televisions, satellites, Personal Computers, and the World Wide Web. The price of air freight in 2000 reached 1/6 of what it was in 1930, and the price of ocean transportation was 50% less than it was then. Computer prices in 1990 were only around 1/125 of those in 1960, and they dropped again by roughly 80% in 1998. The cost of international trade and investment significantly decreased thanks to the "time and space compression effect" of technology, making it possible to plan and coordinate worldwide manufacturing (Shangquan, 2000).

Figure 1: Decline of trade costs



Source: Transaction Costs - OECD Economic Outlook (2007) [OurWorldInData.org/trade-and-globalization](http://OurWorldInData.org/trade-and-globalization)

The world shifted from a size “medium” to a size “small” thanks to these big changes in trade and this was the exact era in which Freedman saw the development of the real global economy, transforming the market into an interconnected global playing field. In this case, the questions which characterized these centuries involved the company fit in the new economy and how it was possible to exploit all the advantages given by the new inventions and opportunities that rose.

Finally, Globalization 3.0 occurred starting from year 2000, however this phase showed completely different characteristics from the previous ones. The focus of the



era are individuals, who cooperate and compete internationally and at the single level. The author introduces the concept of the “flat-world platform”, meaning that distances are set aside easily thanks to the interconnectedness given by the power of a personal computer and the internet. The questions characterizing this epoch are set at the individual level, focusing on the single person and the impact that can be generated globally. Another fundamental characteristic represents the power of non-Western individuals in the global economy, who are now empowered by the flattering of the world, while in the previous globalizations, the market was mostly played only by leading-Western economies and countries.

At the same time, another scholar defines the historical globalization period through the so called “unbundling” of globalization (Baldwin, 2006). The first unbundling occurred from the late 19th century, when transportation costs begin to fall, and it represented the end of the need to produce goods and services close to the customer. This epoch was further divided into two waves, one lasting until 1914 with World War I, and the second starting from the 1960s, after the world recovered from World War II, since wars put different globalization trends on hold. Prior to World War I, global trade as a percentage of GDP increased from 9 percent to 16 percent (Subramanian and Kessler, 2013). In the nineteenth and twentieth centuries, the terms “industrialized” and “rich” were often used interchangeably (Baldwin, 2013). Expanding markets gave businesses and industry the opportunity to take advantage of scale economies in the production of manufactured goods, giving the basis to the creation of agglomeration forces that brought companies and economies to exploit spatial clustering. The main drivers of this phenomenon involved (Baldwin, 2013):

- Large-scale production promoted by inexpensive transportation;
- An extremely complicated production process;
- Proximity reduces the expense of coordinating complexity.

At this point, market was growing internationally, and trade was expanding rapidly due to the cut of tariff and not-tariff barriers imposed by the framework of GATT and

WTO (Shangquan, 2000). However, industries were developing their supply chain only at the local level, creating urban clusters. This favoured the contemporary, innovation-driven growth that began to take off earlier and more quickly in the North (Europe, North America and Japan). Accordingly, the ensuing growth disparities quickly accumulated into the enormous North-South income imbalances that still slightly shape the global economy today.

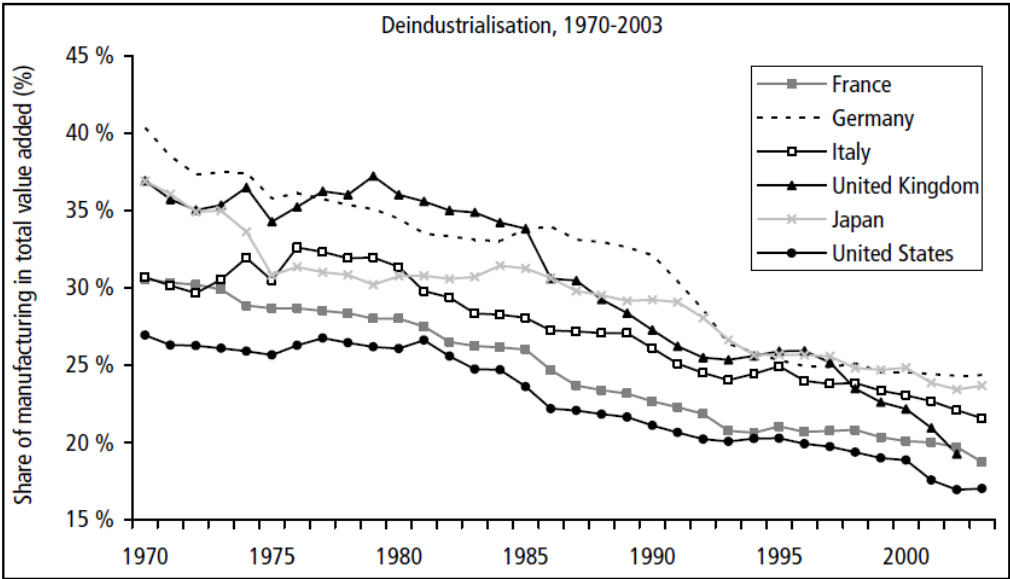
The second unbundling started in the mid-1980s and is the representation of the moment in which the need to place manufacturing stages close to one another came to an end. The global acceleration was driven by information and communication technologies (ICT), and was not focused on the firms or sectors level anymore, but at the individual level, increasing competition among tasks and people. Distances were reduced or even cancelled, and this led to the famous phenomenon of offshoring and fragmentation of value chains, which will be further explained and analysed in the following paragraphs. Some production stages that were formerly executed in close proximity were geographically displaced (Baldwin, 2006). The second unbundling of globalization was characterized by five key facts that you will easily find described below (Baldwin, 2013):

- Reversal of the significant economic disparity between developed and developing countries, and
- South industrialisation & North de-industrialisation.
- Changes in characteristics of trade.
- Trend of joining rather than building industrial supply chains.
- A new liberalization political economy.

The world find itself in a “hyperglobalization” era right after the 1990s, where trade was growing so much more compared to the world GDP (Subramanian and Kessler, 2013). The process of global industrial restructuring and readjustment occurred concurrently with the process of economy globalization. The industrial structures of all the nations have been undergoing readjustment and upgrading along with the

advancement of science and technology and the rise in wealth level. In recent years, many labour-intensive businesses with low international competitiveness have begun to migrate to developing countries from western industrialized countries as they increasingly embrace the era of the information economy. This cross-border shifting mechanism is accelerating the trend of economic globalization (Shangquan, 2000).

Figure 2: Industry as a share of GDP, large OECD nations, 1970-2003



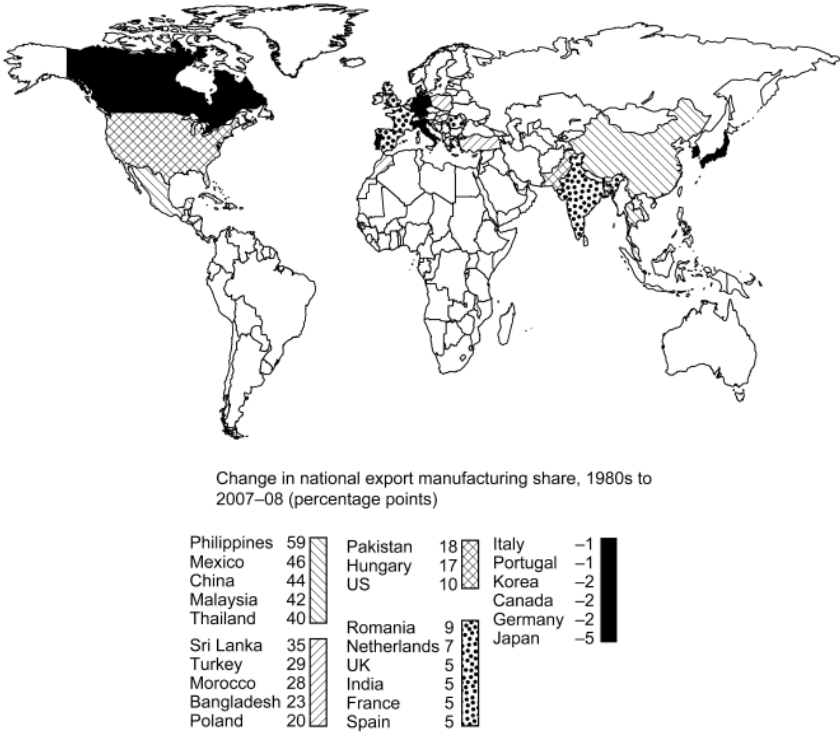
Source: Debande (2006)

There has been a concrete “de-industrialization” of the developed countries and an “industrialization” of developing ones, and globalization of markets was one of the many reasons that led rich nations to make a shift from industry to services (Debande, 2006). Also, ten significant developed nations, including the G7, Switzerland, Sweden, and the Netherlands, accounted for 85.1% of all foreign direct investment in the world in 1995 (Shargquan, 2000), while the G7's share in global manufacturing decreased from two-thirds in 1990 to less than half in 2010, with all of the G7 share loss offset by share gains for a handful of quick industrializers, most notably China (Baldwin and Freeman, 2021).

Increasingly, multinational companies (MNCs) are the primary forces driving economic globalization. They are arranging production on a global scale and allocating

resources in accordance with the profit maximization philosophy. Additionally, their global growth is changing the macroeconomic processes that govern how the world's economies function. There were only over 44,000 MNCs worldwide in 1996, and they had 280,000 foreign subsidiaries and branch offices. Only the top 100 MNCs' trade volume made up 1/3 of all global trade in 1997; the remaining 1/3 was made up of trade between parent corporations and their subsidiaries. MNCs controlled more than 80% of the US\$ 3,000 billion balance of foreign direct investment at the end of 1996. (Shargquan, 2000).

Figure 3: The tight geographical clustering of manufactures export swings



Source: "Trade and Industrialization after Globalization's Second Unbundling: How Building and Joining a Supply Chain Are Different and Why It Matters" Baldwin (2013) Author's calculations on World Bank data.

Note: Data for all nations with (1) population over 10 million, (2) manufacturing export share over 50 percent in 2007-2008, (3) at least 90 percent data coverage from 1985 to 2008.

Another clear representation of the de-industrialization phenomenon can be seen in Figure 3, including data from 1980s to 2007-08. During the second unbundling of globalization, some of these countries' manufacturing export shares increased while

others saw them decline. Developed nations such as Italy, Korea, Japan, Germany, Portugal and Canada reported a decrease in the export share, reflecting the phenomenon of de-industrialization of these types of economies. On the other hand, Philippines, Mexico, China, Malaysia, and Thailand showed the highest percentage variation among all the other nations considered. In particular, China was and still is the leading developing country in terms of trade, surpassing the north Atlantic economies (Baldwin, 2013). Moreover, while G7 was accounting for two-thirds of the world income in 1988, reaching its maximum value, however by 2010 the percentage was halved (Baldwin, 2013), and this data was explained right from the de-industrialization phenomenon.

Furthermore, the renowned "slicing up of the value-added chain" phenomenon, in which individual production stages are located where the production costs are lowest, accounts for a portion of the increase in trade (Subramanian and Kessler, 2013). The entity of trade changed radically due to the internationalizing of supply chains and shape the 21<sup>st</sup> century in a different way (Baldwin, 2013):

- Goods traded now are not only finished products but mostly parts and components of the final good.
- Companies invest internationally on local facilities, employees' training, and technology.
- The utilization of infrastructure services, particularly those linked to telecommunications, the internet, express package delivery, air cargo, trade-related financing, customs clearance services, etc., to coordinate the distributed production worldwide.
- The formal intellectual property and more covert forms of know-how, such management and marketing know-how, that move across international borders.

To summarize these concepts according to Baldwin (2006, 2013), globalization fuelled by lower ICT costs differs fundamentally from globalization fuelled by lower trade

costs. International competition during its first unbundling (before to the 1980s) mostly took place at the sector level (for example, Japanese against Thai autos). International rivalry takes place at a finer resolution during the second unbundling (post-1985) at the level of production stages (Thai automobiles made of Japanese components, and the other way round).

## 1.2. Global value chains and location decisions

The outcome of these disruptions on the evolution of globalization led to the developing of global/international supply chains. For instance, the gearing system for Ford's Lyman automobile is made in Korea, the pump is made in the United States, and the engine is made in Australia (Shargquan, 2000), or even the case of Inditex, global leader in the textile industry, with over 7000 stores worldwide, 1866 suppliers, 7235 factories, and brands like Zara and Oysho among others (Battaia et al., 2020). The "time and space compression effect" of technological development significantly decreased the cost of international trade and investment, enabling the organization and coordination of global production. This kind of worldwide production has only been made possible by advancements in technology, and for some economic operations, the idea of geographic distance and national boundaries became unimportant (Shargquan, 2000). Furthermore, technologies heavily influence economies of scale, scope, and experience, and these are typically shared by cutting-edge businesses in the majority of industries (Mansfield 1985; Pavitt 1998). Besides technology, the new political liberalization economy of countries drove the internationalization path of the world in a significant way. Developing countries around the globe opened up their borders to facilitate foreign direct investments of multinational companies to create new manufacturing jobs and increase the attractiveness of the territory. Joining supply chains rather than building one has never been so easy (Baldwin, 2013).

In addition to the location, the governance model is crucial. Companies must choose not just where to locate their operations, but also whether to retain ownership and

control over them or hand them over to third parties. In fact, the pertinent choices center on the value chain of the company, which is made up of the "technologically and economically distinct activities that it performs to do business" (Porter and Millar, 1985 cited in Mudambi, 2008). Firms consider which nations and areas are anticipated to provide long-lasting advantages when deciding where to locate manufacturing and sourcing (Ancarani et al., 2016). These choices are referred to as outsourcing, offshoring, insourcing, and relocation of second degree, which are business strategies that have an impact on a company's organizational structure (Battaia et al., 2020). In Table 1, four types of value chains decisions are collocated among the variables of control and location, while relocation of second degree and insourcing are concept developed later in this work.

- **Onshore in-house:** represent the decision of keeping the company well structured, all the department connected through a vertical integration control strategy and geographically concentrated.
- **Onshore outsourced:** concern the choice of delegating some functions to partners in order to reach a certain level of specialization in the main function of the value chain, however realizing a concentrated cluster of firms with an aggregation strategy, to better exploit the proximity advantage.
- **Captive offshore:** it is exactly what represent the classical offshoring decision to relocate some parts of the production process outside of the national boundaries based on the aim to reach a specific comparative advantage.
- **Offshore outsource:** the company delegate some functions to external entities outside of the border, disrupting the vertical integration and dispersing the value chain in different location.

Table 1: Strategic choice: location and control

		Geographical location strategy	
		Concentrated	Dispersed
Control strategy	Vertical integration Specialization	1. Onshore in-house 2. Onshore outsourced	3. Captive Offshore 4. Offshore outsource

Source: "Location, Control and Innovation in Knowledge-Intensive Industries", Mudambi 2008

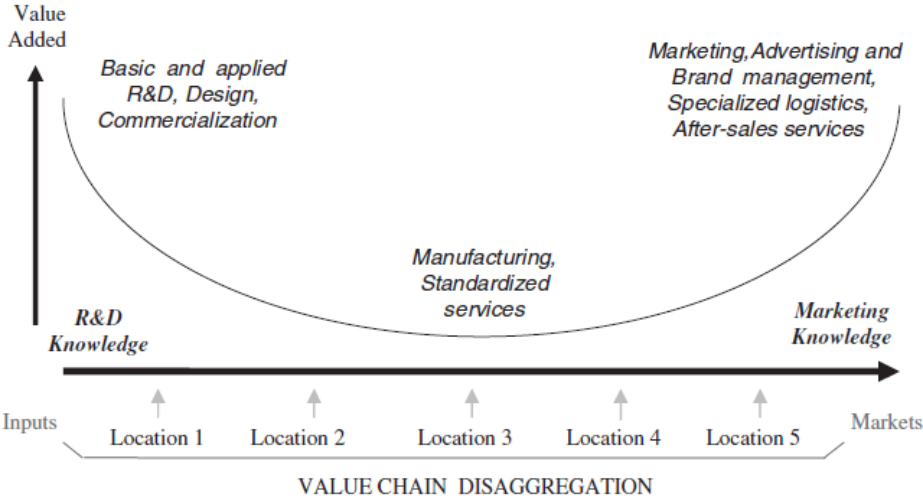
To give a broader view of these decisions, it's useful to analyse these strategies in detail based on definitions of other scholars. Contractor, Kumar, Kundu, and Pedersen (2010) define outsourcing as when a company outsources portion of its operations and it either moves those operations abroad or within its home country. The phenomenon of "offshoring", on the other hand, is defined as "the process of sourcing and coordinating tasks and business functions across national borders" (Lewin, Massini, and Peeters, 2009). Another representative definition is "the migration of jobs, but not the people who perform them, from rich countries to poor ones" (Blinder, 2006). From an ownership perspective, Arlbjorn and Mikkelsen (2014) distinguish between these ideas. Offshoring is associated with moving an owned subsidiary abroad, and outsourcing is associated with handing over ownership and control to a third party.

The upstream (input) end, the downstream (output or market) end, and the middle are the three major categories into which activities inside the firm's value chain can be divided. Design, basic and applied research, and commercialization are typically activities found at the upstream end. Marketing, advertising, brand management, and after-sales services are frequently included in activities at the downstream end of the supply chain. Manufacturing, standardized service delivery, and other repetitive operations that include the widespread implementation of commercialized prototypes are considered middle-class activities (Mudambi, 2008). Value-added is becoming more concentrated at the upstream and downstream ends of the value chain, according to businesses. Application of knowledge and creativity is intensive at both ends of the



value chain (Mudambi, 2007; Mudambi 2008). Regarding the geographical location of each element of the value chain, studies from economists such as Gereffi (1999), Smakman (2003) and Pyndt and Pedersen (2006) present that most of the value chain's activities are concentrated in advanced market economies, while those in the middle are shifting (or have already shifted) to emerging market economies. This phenomenon is well represented in the “smile of value creation” (Mudambi, 2007, 2008). Since a stage's value added is based on costs, when a stage's cost is decreased through offshore (in this case the manufacturing and standardized services), its share in value added decreases (Baldwin, 2013).

Figure 4: The smile of value creation

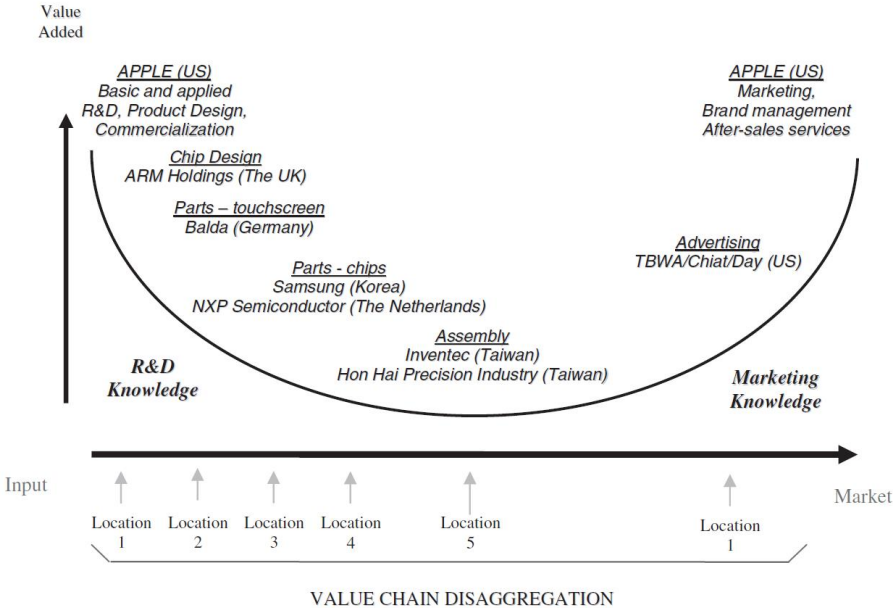


Source: “Offshoring: Economic geography and the multinational firm”, Mudambi 2007

To show an example of a company that apply this vertical disintegration (Gereffi et al, 2005) on its value chain, we can introduce the strategy of Nike. While outsourcing and carefully coordinating production through a hierarchical offshore network of low-cost suppliers, Nike focuses on design and marketing. The brand itself is the primary intangible asset that Nike controls and possesses. The highly innovative design and marketing operations that Nike controls at the two ends of the value chain are important to the asset's worth. In terms of separating the physical from the immaterial components of its business, Nike has been exceptionally effective (Mudambi, 2008).

Over 1 million people work in 930 factories (subcontractors) in 50 nations to produce Nike goods. Just 38,000 people work directly with Nike, mostly in the United States (Locke, 2013). Another case in point of the fragmented supply chain is the case of Apple and the global value of its iPod. The business contracts with several Asian companies, including Asustek, Inventec Appliances, and Foxconn, to manufacture the product, however, this list is not satisfactory, since all the 451 parts of the product comes from different suppliers and companies as well. Also, thanks to three researches operating at University of California discovered that it's complicated to understand where the iPod is actually fabricated, because the value added of each component of the final product is attributed in small percentage to a long chain of suppliers, each of them having a disrupted value chain too (Varian, 2007). Figure 5 represents that “the smile of value creation” reflects on the iPhone as well, with the same logic of the iPod fabrication (Mudambi, 2008). The Apple headquarters in the USA take care of the high-value activities that find themselves at the beginning and the end of the value chain, while economies of scales are exploited in developing countries through a strategy of offshoring, delegating the manufacturing operations to external suppliers.

Figure 5: Value creation in the iPhone



Source: Mudambi (2008), “Location, control and innovation in knowledge intensive industries”

According to MacCarthy and Atthirawong (2003), 13 specific reasons influence the location decisions of companies, and they are listed in Table 2. Operational, strategic, economic, political, social, and cultural issues are covered by factors and sub-factors, which comprise both quantitative and qualitative variables pertinent to internationalization decisions.

Table 2: Summary of major criteria and sub-factors affecting international location decisions.

Major factors	Sub-factors
Costs	Fixed costs; transportation costs; wage rates and trends in wages; energy costs; other manufacturing costs; land cost; construction/leasing costs and other factors (e.g. R&D costs, transaction and management costs etc.)
Labour characteristics	Quality of labour force; availability of labour force; unemployment rate; labour unions; attitudes towards work and labour turnover; motivation of workers and work force management
Infrastructure	Existence of modes of transportation (airports, railroads, roads and sea ports); quality and reliability of modes of transportation; quality and reliability of utilities (e.g. water supply, waste treatment, power supply, etc.) and telecommunication systems
Proximity to suppliers	Quality of suppliers; alternative suppliers; competition for suppliers; nature of supply process (reliability of the system) and speed and responsiveness of suppliers
Proximity to markets/customers	Proximity to demand; size of market that can be served/potential customer expenditure; responsiveness and delivery time to markets; population trends and nature and variance of demand
Proximity to parent company's facilities	Close to parent company
Proximity to competition	Location of competitors
Quality of life	Quality of environment; community attitudes towards business and industry; climate, schools, churches, hospitals, recreational opportunities (for staff and children); education system; crime rate and standard of living
Legal and regulatory framework	Compensation laws; insurance laws; environmental regulations; industrial relations laws; legal system; bureaucratic red tape; requirements for setting up local corporations; regulations concerning joint ventures and mergers and regulations on transfer of earnings out of country rate
Economic factors	Tax structure and tax incentives; financial incentives; custom duties; tariffs; inflation; strength of currency against US dollar; business climate; country's debt; interest rates/exchange controls and GDP/GNP growth, income per capita

Government and political factors	Record of government stability; government structure; consistency of government policy; and attitude of government to inward investment
Social and cultural factors	Different norms and customs; culture; language and customer characteristics
Characteristics of a specific location	Availability of space for future expansion; attitude of local community to a location; physical conditions (e.g. weather, close to other businesses, parking, appearance, accessibility by customers etc.); proximity to raw materials/resources; quality of raw materials/resources and location of suppliers

Source: "Factors affecting location decisions in international operations – a Delphi study" MacCarthy and Atthirawong (2003)

In the light of the aforementioned motivations, three key manufacturing site location factors or techniques appear to be acknowledged in the literature (Johansson and Olhanger, 2018):

- *access to low-cost production input factors* for instance labour, materials, energy, and capital. The location strategy recognizes the pursuit of cost effectiveness as a key component. In fact, the resource-seeking and efficiency-seeking elements, which make up two of the four location advantages in Dunning's (1988, 2015) model, place an emphasis on improving efficiency, gaining access to resources, and lowering costs (Albertoni et al., 2017).
- *Market proximity* with variables like logistic costs, nearer production, regional conditions, trade restrictions, time to market and risk diversification. Being close to the market makes it simpler for the factory to create customized items, guarantee quick deliveries, and lower financial and trade risks. Delivery reliability, logistical costs, and market conditions all often have a positive and considerable impact.
- *access to product and process development competences*: the deliberate search for local expertise, know-how, and technology; proximity to product creation and R&D; and the concentration on core activities. Utilizing local technology resources allows the manufacturer, for instance, to collaborate with colleges and research institutes, tap into local technological expertise, and get access to both

advanced suppliers and trained and knowledgeable workforce. In reality, there is a strong correlation between development competency components and performance in terms of quality and adaptability.

### 1.3. Offshoring – advantages and disadvantages

If we look closer to the offshoring and internationalization strategy, numerous prior researches have generated huge sets of characteristics that may influence migration decisions, attempting to characterize relocation drivers (Johansson et al., 2018). The biggest economic incentives come from the chance for players to benefit from open systems, where superior circumstances for performing certain activities or processes across borders encourage resource allocation (Stojanov, 2017). The following list and explanation of the main advantages and factors that affect enterprises' decisions to locate facilities across national boundaries gives a comprehensive view from the standpoint of the firm (Impact of globalization on location, 2022):

- Cost optimization of production factors: Raw materials, labour, land, and infrastructures may be significantly less expensive abroad. The most common reasons for outsourcing are labour costs and productivity (Kinkel and Maloca, 2009 cited in Battaïa, 2020). For industrialized nations, the reduced resource costs in emerging nations are quite alluring (Johansson and Olhager, 2018). Low labour costs were shown to be the most important benefits for decisions to outsource jobs, according to Johansson and Olhager's (2018) analysis, which also helped to increase labour productivity. Due to this, companies in Western Europe are progressively moving businesses to Eastern Europe, Asia, and Latin America in an effort to reduce labour costs.
- Economies of scale: large worldwide multinational companies with significant levels of economies of scale, such as the oil and petrochemical sectors, have done so by operating along a global value chain, further reducing costs. In fact, by consolidating production in a single place, the fixed costs are distributed

over a greater number of units as the volumes rise, and the cost per unit steadily declines.

- Access to global markets: the epicentre of economic and commercial power operations is shifting as a result of a significant increase in newly industrialized and emerging nations. Brazil, Russia, India, and China (the BRIC nations) are predicted to make up more than 40% of the world's population and 60% of the global GDP by 2050. Companies with current headquarters in developed economies like the US, Japan, and Europe understand that investing in these quickly expanding regions is better than merely exporting to them.
- Bypass protectionism: It is possible to get around import limitations by producing inside the nation or community in question. This is an important justification for foreign investment in the EU trade bloc. To get around trade restrictions, major production facilities for Asian automakers have been built in Europe. Even though the company's headquarters and ownership are outside the EU, cars that are built or manufactured there can be relocated and sold without being subject to import duties or other trade restrictions.
- Competitive strategy: Businesses may opt to relocate operations abroad to get the "First Mover Advantage" or as a defensive measure against rivals who have already made the choice.
- Avoiding excessive government regulation and interference: To reduce what they perceive to be needless regulation and intervention in their economic activities by local and national governments, huge MNCs frequently threaten to relocate. Politicians may occasionally be convinced to amend unpopular restrictions, rules, and laws by threatening to leave office. If these are not changed, the company may really follow out its threat to relocate operations to another nation. When it comes to labour laws and regulations, a corporation that can afford to transfer cross-border enforcement efforts looks for nations with less stringent or much more liberal laws than its own, being able to improve competitiveness (Stojanov, 2017).

- Avoid the saturated domestic market: It is typical for some firms to have trouble growing in a domestic market that is already operating at or close to capacity. This issue has been discovered by supermarkets in various European nations. Chains like Tesco and Carrefour have attempted to expand in new international areas. Location abroad might be employed as an extension option.
- Handle exchange rate fluctuations: companies may set up production sites in several different nations as insurance against fluctuations in one currency versus another.

On the other hand, globalization in the form of offshoring has also downsides for companies pursuing this popular strategy, but also for the countries hosting multinationals, since the world is rapidly evolving, and the company is not the only actor in the internationalization system. Several factors involving culture, regulations, jobs loss, and quality of products can influence the trend on the offshoring success.

- Exploitation of local resources: host countries are often victims of internationalization strategies. Since the companies are looking for the competitive advantage, the offshoring strategy may hide several downsides such as exploiting production-related inputs, dishonest business activities, the shadow economy, exploiting labour, ignoring the activity's negative consequences on the environment, and so on (Stojanov, 2017).
- Ethics, morals and social responsibility: in order to guarantee that businesses and all of their suppliers conduct with the highest ethical integrity and do not aim to exploit labour in the countries where they are placing operations, businesses would be well to exercise extra caution when moving all or a portion of their operations overseas. US companies like Nike have been the target of unfavourable press about the suspected use of child labour and the operation of "sweatshops" in nations like China, Vietnam, Indonesia, and Mexico. This has hurt their corporate reputation and, as a result, their sales. Nike has had to spend millions of dollars trying to enhance their reputation for ethics, but they

haven't been able to convince all of its detractors that they are truly committed to the highest ethical standards (Impact of globalization on location, 2022).

- Hidden costs: is highly common for companies to incur in unexpected costs due to a weak evaluation of the strategy's variables. Hidden expenses might force a renegotiation of the terms during the agreement's execution phase. For some of the participants, on the other hand, these unaccounted expenses will result in a failure to execute economically and efficiently (Stojanov, 2017).
- Cultural differences: If this is not planned for and the appropriate changes are not made, it might become a significant issue. If one is not cautious, issues may arise in the areas of behaviour, eating habits, and dress code. The marketing department, which must consider customer preferences, religious taboos, and customs when deciding on product ranges, is particularly concerned about cultural variations. The HRM department must also be aware of how cultural variations in the workplace might influence interactions and work habits. (Impact of globalization on location, 2022)
- Regulations and legal restrictions: the laws governing health and safety, transportation, ingredients, and diet will vary from one nation to the next. To help them with the locating and settling processes, a company should look for local agents and/or partners that are familiar with the area (Impact of globalization on location, 2022)
- Protection of know-how: delegating activities is a serious risk in terms of business retention and may lead to problems related to the competition in the host country, creating high potential for opportunism (Wiesmann et al., 2017). Outsourced operations abroad may be copied and replaced by local companies, if there is not enough control capacity (Stojanov, 2017).

In sight of these considerations, companies should carefully evaluate the advantages and disadvantages of undertaking an internationalization strategy, being able to consider all the variables of their actions and the consequences. Furthermore, the



reshoring process often begins when global expansion brings about the convergence of economic circumstances between nations, since there are not enough advantages to keep the production abroad anymore. It's common for companies motivated by macroeconomic considerations such as labour cost, price levels, national currency stability, accessibility and prices of energy resources, etc. to lose interest in the strategy followed, since the actual condition of economic instability led to the search for greater risk management (Stojanov, 2017).

#### 1.4. Introduction to RSD

Over the past two decades, supply chains have become more global as businesses have expanded their manufacturing operations outside of their national borders in pursuit of market possibilities, knowledge, or less expensive production inputs (Gereffi and Lee, 2012, cited in: Barbieri et al., 2019), exploiting internationalization strategies such as outsourcing and offshoring. However, the recent discussion of "where to locate manufacturing" has begun to acknowledge that location decisions can vary over time (Brennan et al., 2015; Tate et al., 2014, cited in: Barbieri et al., 2019). Numerous manufacturers have indicated in recent years that they brought back some of their offshored output, either in-sourced or out-sourced. They include industrial colossal like Caterpillar, Bosch, and Philips in addition to several small and medium-sized businesses who are rethinking their global location strategy. In fact, offshored decision reversal is not a recent occurrence. It has been recorded since the 1980s (Mouhoud, 2007), however the cases of companies taking this decision increased in the last few years and now it's a popular topic among scholars, economic press, and companies' reports (Fratocchi et al., 2014). The actual coexistence of back-reshoring and offshoring choices indicates complex dynamics including location, industry, and firm-level factors are at play and demand further investigation (Fratocchi et al., 2014).

On the one hand, based on studies and deep analysis of literature from different authors, Fratocchi et al. (2014) define the reshoring strategy as a "generic change of location with respect to a previous offshore country". This definition is basically the

general word to define any action undertaken by the firm after the first offshoring choice. On the other hand, back-shoring strategy is identified as "a voluntary corporate strategy regarding the home country's partial or total relocation of (in-sourced or out-sourced) production to serve the local, regional or global demands". Moreover, some basic characteristics of back-shoring are identified:

- it is a process that follows the previous offshoring decision;
- it may involve the change in location of one or several stages of the value chain;
- it is simply a choice of whether to move, without considering the ownership entity in the foreign country (in-sourced or out-sourced).

Gray and al., (2013) further define back-shoring in detail (considering it as a general reshoring decision), dividing this strategy into four specific manifestations of it, based on location and control decisions:

- in-house reshoring: a company keeps the operations vertically integrated, moving the activity from foreign countries to the home country.
- Reshoring for outsourcing: a firm owning its operations abroad decide to backshore, outsourcing activities to home suppliers.
- Reshoring for insourcing: companies which previously had their activities outsourced to external suppliers abroad decide to relocate back home to wholly owned facilities.
- Outsourced reshoring: a company keeps the operations outsourced, while moving the activity from foreign countries to the home country.

While several scholars focus only on back-shoring strategies, Barbieri et al., (2019) give a broader explanation of the two different types of RSDs:

- Relocation to Home country (RHC): following the initial localization from the home nation to a foreign country, "relocation to home country" occurs when a corporation transfers its production operations from the first host country back

to the home country. This is defined as the previously explained “back-shoring” strategy.

- Relocation to a Third country (RTC): after the initial offshoring strategy, the company transfers its production operations to another second foreign country instead of returning home. This type of relocation is comprehensive also of the nearshoring strategy, which is defined by Ellram (2013) as the location of a manufacturing plant in the same region of the home country, instead of returning inside the national border.

Table 3: A multi-step representation of the internationalization of production

Step	Location	Definition	Example
Step 1: Initial international relocation of production activities	A foreign country placed in the firm's region	Near-shoring	A French company locates its production activity in Romania
	A foreign country far away from the firm's home region	Off-shoring	An Italian company locates production activity in India
Step 2: Relocation of earlier off-shored production activities	The firm's home country	Back-shoring	A Canadian company initially off-shores its production to Poland and then moves it back in the home country
	A foreign country in the same region of the firm's home country	Near-reshoring	A US company initially off-shores its production to China and then relocates it in Mexico
	A foreign country geographically far away from the host country chosen in Step 1	Further off-shoring	A German company initially off-shores its production to Morocco and then relocates it in India

Source: “When manufacturing moves back: Concepts and questions”, Luciano Fratocchi, Carmela Di Mauro, Paolo Barbieri, Guido Nassimbeni, Andrea Zanoni. 2014

To give these strategies a context, in Table 3 the steps that companies undertake when taking location decisions are represented. Reshoring in the second step is not a final decision; rather, it is a potential stage in the company's long-term internationalization strategy for its production activities that doesn't prevent the company from pursuing

further actions in the future. As an example, an Italian clothing manufacturer offshored and outsourced its production to Far East Asia at the start of the 1990s (Step 1). It changed to Bulgarian suppliers in 2004 (Step 2), nearly reshoring, and largely insourced production to its Italian facility, backshoring. It discontinued its manufacturing operations in Italy in 2012 (Step 3) and moved all outsourced production to Eastern Europe (near-shoring) (Fratocchi et al., 2014).

At this point, the choice of an international location can be thought of as a multi-step process. In their first phase of internationalization companies need to consider two different decisions (as reported above in Table 1):

- The governance structure of the company, meaning a “make-or-buy” decision.
- The geographical location of the value chain activities.

In the second phase of relocation of earlier offshored production activities, the options they have are the following:

- To return all or only some steps of its formerly offshored operations to their original location, implementing the backshoring strategy.
- To near-shore all or some steps of its previously offshored activities to a foreign country situated in the same geographic area as its home country.
- To further offshore, transfer all or a portion of previously offshored activities to a foreign country that is geographically remote from the host country selected in the first stage.

In fact, reshoring often involves extremely particular tasks, therefore it is frequently only partially accomplished by retaining some industrial activities offshore (Boffelli and Johansson, 2020). According to Baraldi et al. (2018), "selective reshoring" refers to the practice of a company carefully choosing which activities to repatriate based on how well they blend with the local operations. Additionally, the business may reevaluate its reshoring approach in later steps, changing the location of its

manufacturing activities, whether they are outsourced or insourced (Fratocchi et al., 2014).

### 1.5. Motivations and location decisions of RSD

In the literature, a wide variety of extremely diverse reshoring motivations have been raised. From the hypotheses that reshoring resulted from managerial mistakes including inadequate planning and challenges generated from the host location, to the possibility that the reshoring originate from the need to satisfy customer's needs (Di Mauro et al., 2018). Motivations for implementing a relocation of second degree can be numerous, and Fratocchi et al., (2016) succeeded in analysing several case studies and articles to frame comprehensively the most important ones. The main theoretical perspectives that ground the framework are reversed and adopted to explain reshoring.

- *Transaction Cost Theory* (TCT) draws attention to the significant coordination and incentive expenses that businesses may incur while operating offshore as opposed to in their home country. More specifically, some academics have noted that cultural and physical remoteness can increase the likelihood of opportunistic conduct by offshore suppliers or proprietary offshore manufacturing locations (Kinkel and Maloca, 2009; McIvor, 2013; Martnez-Mora and Merino, 2014). These could lead to unaffordable costs for negotiating, overseeing, and enforcing cross-border transactions, which would then drive production activities to go back home.
- *Resource based view* (RBV) is liked to reshoring because it concerns for the firms' strategic resources and competencies. The incapacity of the company to develop essential tangible and intangible assets abroad, to move them to the host country, or to access and utilize the resources of the host country to gain a competitive advantage can be reflected in reshoring decisions (Canham and Hamilton, 2013).

- According to *the internalization theory*, the most effective way for a corporation to internationalize its operations is by direct control over limited, firm-specific, knowledge-based resources and capabilities (Rugman, 2020).
- In accordance with the *Dunning paradigm*, reshoring can result from changes in location-specific advantages, such as modifications to the host and/or home locations' characteristics (Ellram et al., 2013), or from a decline over time of the ownership and internalization advantages on which the initially made offshoring choice was based.

Figure 6 represent a clear framework that groups all the possible reasons for reshoring, based on the theories described above, elaborated by Fratocchi et al., (2016). The first variable that shape the elements in the table is the goal to pursue, and it can result in:

- Customer perceived value
- Cost efficiency

Reshoring incentives based on perceived customer value describe the phenomena in terms of the firm's requirement to protect the essential characteristics that motivate and affect the consumers' choice. Based on the various economic theories, reshoring may improve a company's capacity for value creation and competitive advantage maintenance via quality and/or innovation, as well as its capacity to provide consumers distinctive services. Some examples involve the possible low quality of product produced abroad, made-in effect, lack of trained workers and reduced flexibility in the supply chain.

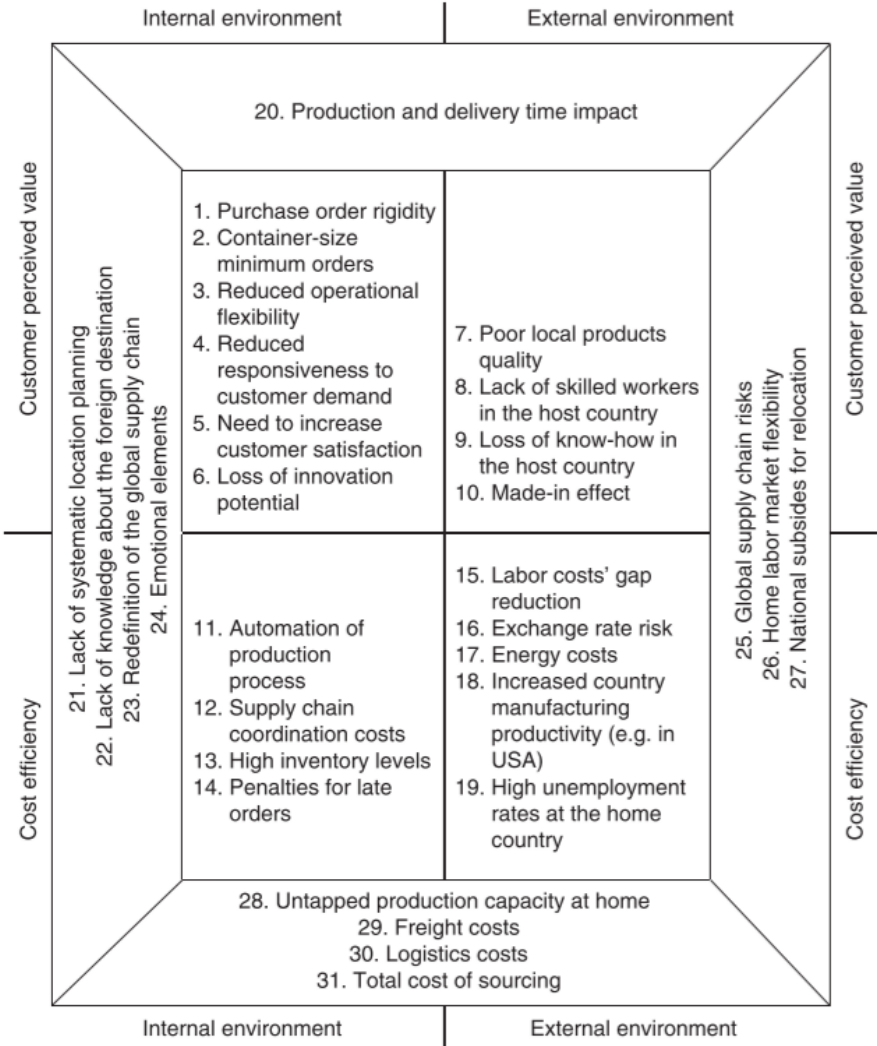
Reshoring is explained by cost-efficiency factors as an effort to achieve more effective coordination and control systems, as well as cheaper production and logistical costs. It derives from the possibility that, due to several factors, moving producing operations domestically may eventually be less expensive than keeping them offshore. They can involve fluctuating production costs, offshore production's hidden costs, the

expense of managing global logistics and relationships with distant places, including supply chain risks.

The second variable involved is the level of analysis:

- Internal environment motivations account for the effects that global operations/configurations have on organizational efficiency, as well as unique resources and competencies.
- External environment motivations reflect the variable attractiveness of the home and foreign countries, which are independent from the firm itself.

Figure 6: motivation for reshoring strategies: an interpretative framework



Source: Fratocchi, L., Ancarani, A., Barbieri, P., Di Mauro, C., Nassimbeni, G., Sartor, M., Vignoli, M., & Zanoni, A. (2016). *Motivations of manufacturing reshoring: an interpretative framework*.

For example, the first quadrant in Figure 6 that cross the need to increase the customer perceived value and the internal environment motivations, return a situation in which a company is dealing with a fragmented and geographically extended supply chain and wants to reach the proximity advantage. This decision might lead to longer lead periods and planning horizons for transportation, which would increase rigidity and reduce operational flexibility. Furthermore, the motivations creating the frame of the figure belongs to different variables at the same time. For instance, production and delivery time impact or even logistic costs can involve both internal and external environments. At the same time, motivations such global supply chain risk may call for both value- and efficiency-driven factors (Fratocchi et al., 2016).

In general, relocation of second degree as back-shoring or nearshoring is determined by three major factors: economic, operational, and strategic (Ricciardi et al., 2015). It's easy to see how likely is to recognise the motivation for RSD in the downsides for offshoring, even if these two activities are not always interrelated.

- **Economic factors:** among influential economic factors, the increase of total production costs in host countries is one of the most leading drivers. Moreover, important are the increase in labour costs in Asiatic countries (especially in China) and in emerging markets, costs of raw materials, fuels and transportation costs, logistic and warehouse expenses, and many more. Hidden costs, which have already been cited among the offshoring downsides, is consequently a motivation for RSD, as well as the preservation of the intellectual property. All these factors led to the reduction of *the total landed cost* (Hackett Group, 2012), which refers to the complete cost of the benefit from raw materials to finished goods and is very significant in the economic calculations of location strategies (Ricciardi et al., 2025).
- **Operational factors:** important is the reduction of the operational flexibility because of the coordination complexity of the supply chain at the international level, due to the spatial separation between technical direction and planning



centres and production centres. This physical distance, together with any communication difficulties resulting from linguistic, cultural, or institutional differences, raises the price of coordination and communication along the whole supply chain, fuels the uncertainty of production and delivery times and results in the loss of information about the manufacturing process, a reduction in innovation, a lack of effectiveness, and a reduced ability to respond to customer demands and market changes (Accenture, 2011, in Ricciardi et al., 2015).

- **Strategic factors:** RSD is usually pursued also for motivations regarding the need to increase the processes control, activities or critical resources which create strategic value. Not to mention the need to improve product quality, which has been revealed to be below the standards required to compete in the market and has adverse effects on a company's reputation, branding, and financial performance (Ricciardi et al., 2015). Unquestionably, the "made-in" factor provides satisfaction because consumers attach a higher value to fully domestic productions, which are increasingly in demand on the market, particularly on the global scale (Musso et al., 2012 in Ricciardi et al., 2015).

To go deeper into the "location advantage" decision that originate from a simple offshoring choice, and then led to a Relocation of Second Degree, Barbieri et al., (2019) cite the work of Dunning (1993). According to what corporations seek when investing in a certain host country, four distinct sorts of location advantages are defined: market seeking; asset-seeking; efficiency-seeking; and natural resource-seeking. Moreover, these location advantages searched abroad by companies come up especially at the time when the host country is able to offer some favourable conditions such as: penetration in the market, reduced costs and efficiency increased thanks to competition on prices, possibilities to gain new knowledge and innovate, and exploit natural resources. Barbieri et al., (2019) show that three out of four location advantages

considered to implement offshoring by companies can influence the choice to either undertake a RTC or RHC in Europe.

1. **Market-seeking advantages:** companies pursuing this location advantage action for offshoring might undertake a RSD to streamline their cross-border operations. Unsatisfactory sales results or decreased cross-border transaction costs as a result of EU membership may start this process.
2. **Asset-seeking advantages:** companies may want to invest in new alternative location (RTC) or go back home because location advantages in the host country were all exploited.
3. **Efficiency-seeking advantages:** in this case, companies may want to change location due to lower than expected success in investments, lower quality and productivity emerge, or new hidden costs are discovered in offshoring.
4. **Resource-seeking advantages:** even if this motivation is not studied by Barbieri et al., (2019), Arlbjørn and Mikkelsen, (2014) affirm that it may eventually play a larger role in reshoring in high-cost nations, due to “automation” developments in manufacturing stages of the value chain.

An interesting point to report in this analysis is the actual correlation potentially existing between offshoring and relocation of second degree, whether these two firms' internationalization decisions are related and consecutive or originate from different context and situations. It is impossible to tell for sure whether reshoring results from changes that are unforeseeable to the common enterprise or from incorrect initial assessments made when the choice to offshore was undertaken (Fratocchi et al., 2016). Based on studies on four companies' offshoring and reshoring strategies conducted by Di Mauro et al., (2018), motivations for offshoring and reshoring may not pursue the same goals: while offshoring strategy is mostly used to satisfy a cost competitive strategy, reshoring is involving a differentiation and strategic approach, mostly based on the value-driven objective. In fact, the choice to bring production back home is a result of the companies' competitive focus shifting to high- and medium-end products,

where being able to quickly respond to customer requests is essential to the ability to charge a premium price. Despite the difficulties that such a decision might pose to the attainment of their competitive aims, organizations focused on value creation (rather than cost-efficiency) strategies ultimately found themselves drawn to the lower costs of offshored sites. Reduced cost differences between locations, customer demands for greater product variety and customization, growing challenges in managing long-distance relationships and operations, serious risks of supply chain disruption, and severe risks of relocation force businesses to change their location choices (Fratocchi et al., 2016). At the same time, it is not a standard rule to consider reshoring a correction activity in direct consequence of failed offshoring, because most of the times it is correlated to changed internal and external factors, not always directly related to the company's operations. Backshoring motives differ from offshore motivations in that they are driven by distinct relevant elements and, most importantly, different strategic objectives. (Di Mauro et al., 2018). However, the correction of misjudged offshoring decisions may be involved among the motivation for backshoring, especially when macro-economic changes are not particularly involved in the context (Gray et al., 2017).

Even if backshoring, and reshoring in general, were to grow to quantitatively significant proportions in the future, relocations would not necessarily decline as a result. The fundamental dynamics of the two processes do not interact, and the two occurrences exist fully independently of one another. Industrial sectors and individual enterprises that go through different periods of their operational life and provide diverse competitive strategies are interested in delocalization and back reshoring. Locational decisions, which are an integral part of an organization's overall business strategy, invariably tend to be guided by the variables from which each firm derives its competitive advantage. Depending on whether these variables are cost- or differentiation-based advantages, decisions will be made in favour of peripheral or central locations within the global geo-economic context. Therefore, businesses choose

which stages of the value chain to outsource and where to place them while also deciding which stages should stay within their own walls (Ricciardi et al. 2015).

Ancarani et al., (2015) decided to analyse the literature on duration of foreign ventures to explain the correlation between the duration of offshoring and the decision to relocate. The information collected are also useful to have a general overview on motivations for reshoring and general characteristics on host country/region, company characteristics, and type of industry involved. Specifically, they gathered information from several studies and secondary data collected from 2011 to the beginning of 2014, including a total of 249 reshoring decisions made by company both in EU and USA. The EU's three countries with the largest numbers of cases—France (21), Germany (12), and Italy (47)— representing the industrialized nations with the highest levels of manufacturing specialization. Regarding the host nation, 77% of cases are about Asia, of which 89% are in China and 11% are in other Asian nations, while 12% are about Eastern Europe, important solely to European enterprises (Ancarani et al., 2015). Given that China has been and continues to be the top location for outsourcing projects, it is natural that the majority of the data concentrates on this nation. Second, even while cost was neither the only nor the key consideration in the decision to back-shore, it is impossible to overlook the reality that from 2000 to the present, the cost of labour in China has quadrupled while remaining largely stable in the United States and in Germany. (Ricciardi et al., 2015). The sample contains a lot of large businesses, notably in the EU (72%). 43% of the sample is made up of businesses that have chosen an offshore outsourcing location. Table 4 additionally lists two more contextual elements (reshoring attributable to the global crisis or to the firm's worldwide restructuring) as well as the most common reasons for reshoring. It turned out that market seeking incentives (total expenses, service to customers, and shipping inefficiencies) and market seeking motivations (seeking strategic assets due to quality problems and the "made-in" impact) are both common. While resource-seeking impulses are minimal,

efficiency-seeking motivations (such as governmental incentives and closeness to clients) are less prevalent (Ancarani et al., 2015).

Table 4: sample characteristics

	ALL (n=249)		U.S.A. (n=131)		EU (n=109)	
<b>Industry</b>						
Automotive	19	7.6%	9	6.9%	9	8.3%
Electronic	40	16.1%	27	20.6%	9	8.3%
Mechanical	37	14.9%	21	16.0%	16	14.7%
Clothing	38	15.3%	10	7.6%	28	25.7%
Furniture	39	15.7%	26	19.8%	13	11.9%
Home appliances	17	6.8%	8	6.1%	8	7.3%
Other sectors	59	23.7%	30	22.9%	26	23.9%
<b>Host country/region</b>						
Host Asia	192	77.1%	118	90.1%	66	60.6%
Host East Europe	29	11.6%	1	0.8%	28	25.7%
Host other	28	11.2%	12	9.2%	15	13.8%
<b>Company and investment specific characteristics</b>						
Governance mode (outsourcing)	106	42.6%	69	52.7%	35	32.1%
Small firms	61	24.5%	47	35.9%	14	12.8%
Medium firms	47	18.9%	30	22.9%	17	15.6%
Large firms	141	56.6%	54	41.2%	78	71.6%
<b>Motivations for reshoring</b>						
Made-in effect	39	15.7%	17	13.0%	22	20.2%
Quality issues	45	18.1%	27	20.6%	18	16.5%
Total costs	93	37.3%	50	38.2%	39	35.8%
Customer services	23	9.2%	10	7.6%	13	11.9%
Delivery delays	43	17.3%	28	21.4%	13	11.9%
Governmental incentives	24	9.6%	13	9.9%	8	7.3%
Proximity to customers	19	7.6%	17	13.0%	2	1.8%
<b>Contextual factors</b>						
Economic crisis	18	7.2%	1	0.8%	17	15.6%
Global reorganization	20	8.0%	10	7.6%	10	9.2%

Source:

Concerning the most popular sector that are involved in reshoring for this specific study, we can see Electronic being the most valuable, followed by furniture, clothing and mechanical (Ancarani et al., 2015).

After analysing the length of offshoring prior to reshoring using a survival modelling approach, Ancarani et al., (2015) came up with six propositions that simply define this correlation, giving further explanations on several factors characterizing the reshoring process that can be useful to better understand the phenomenon in this work. Their empirical research demonstrates that, in line with the OLI paradigm, industry, business, and country-specific criteria are important in determining whether an individual remains short or long offshore. The findings also point to a strong

relationship between duration and reshoring incentives, particularly strategic assets seeking motivations (quality and the "made-in" effect).

1. "Technology-based industries characterised by high level of outsourcing, strong final producers and Original Equipment Manufacturers, and high product customization (e.g. electronics and automotive) are likely to reverse their offshore initiatives on a more timely basis than other industries." First, the length of offshore is substantially influenced by the industry. Our sample's electronics and automotive companies in particular return earlier than those in other industries that compete with them. As market and cost factors change over time, location decisions may become more flexible, leading to shorter stays in particular countries for these types of industries (Ancarani et al., 2015). Furthermore, the European Manufacturing Survey 2012, after observing 3293 case studies, found out that there is a correlation between the technological intensity of the sector and the choice of back-reshoring: the percentage of returning businesses is lower in sectors with lower technological content and increases as the level of technological sophistication rises (Ricciardi et al., 2015).
2. "Shrinking costs differentials between host and home countries accelerates the reshoring of manufacturing." and "Psychic distance between host and home countries is associated with shorter durations offshore." The second noteworthy finding is related to the host country: compared to other regions of the world, China and other Asian countries have much shorter offshore experience durations. The fast decrease in locational advantages of Asia over Europe and the US during the past several years provides a preliminary explanation. According to Pearce (2014) in the study of Ancarani et al., (2015), China's labour expenses have risen noticeably (by around 750% over the past 15 years), while the Chinese Yuan has significantly appreciated versus the US dollar. Moreover, due to varying attitudes and behaviours across trade

partners, disparities in language, commercial practices, political systems, and culture can be damaging to the coordination of labour.

3. "Firm's organizational archetypes giving subsidiaries larger amount of autonomy and focusing on short term financial performance reduce the length of stay offshore". Companies from the EU appear to stay offshore for less time. The differing organizational paradigms used by US and EU corporations to manage their subsidiaries may help to explain this outcome. Particularly, the "multinational" business archetype used by EU firms (as opposed to the "international" one used by US firms) grants subsidiaries a greater level of autonomy but is more responsive to their financial success. As a result, it is simpler to close down or move a subsidiary if it does not function as expected.
4. "SMEs are more prone to earlier reshoring." The length of the offshore experience before reshoring is highly influenced by the business size. Small and medium-sized businesses in particular return sooner than big businesses. The absence of strategic aim that some SMEs exhibit may help to explain this outcome. In the ex-ante examination of offshore projects, SMEs are more likely to make strategic errors that may be fixed by changing one's mind about going offshore (Kinkel and Maloca, 2009). Second, SMEs are more susceptible to external changes as a result of a lack of internal resources such as knowledge, capital, and management expertise, which makes internationalization more complicated.
5. "Reshoring due to quality related motivations is associated with shorter durations offshore". In contrast to resource or efficiency-based explanations for relocations, strategic asset seeking is more important when analysing motivation. In fact, quality appears to be an offshore complication that underlies earlier returns. A business may not be able to respond and mitigate a problem when it encounters quality issues in the early stages of its offshore experience, before it has accumulated expertise and understanding of the external environment, and may instead prefer an exit plan.

6. “Reshoring due to “made-in” related motivations is associated with shorter durations offshore for European firms.” The idea of the “made-in” or “country of origin” impact is connected to brand image and purchase intentions (Diamantopoulos et al., 2011). For many products created in some European nations, such as apparel and leather from Italy, vehicles from Germany, and wines from France, the country of origin has historically had a significant impact on customers' purchasing decisions. Therefore, European enterprises are more prone to consider the loss of the “made-in” image while producing or sourcing elsewhere than American ones. For EU-based businesses, the “made-in” impact is linked to quicker reshoring, but for US-based businesses, the reverse effect is at work.



## CHAPTER 2: GVC'S DISRUPTIONS AND THE "REAL" RESHORING

Relocation of Second Degree as has been previously introduced in the first chapter and as most of the scholars wrote about, doesn't take into consideration the possibility of implementing this strategy with the aim of protect the internal economic situation of a country, mostly from a political perspective. Every significant economic crisis has altered the direction of political and economic strategies, and reshoring is the most common choice among governments in recent times. GVC-based output has been stagnant during the past ten years, but it is still susceptible to exogenous shocks, such as those brought on by pandemics, extreme weather conditions, political unrest, and cyberattacks. The issue on GVC resilience, or their capacity to withstand and recover from shocks, has taken on new urgency given the likelihood that there would be an increase in the number of such threats in the future and, in particular, following the financial crisis of 2008 and COVID-19 in 2020 outbreak. Therefore, it is necessary to think about government measures that encourage GVC resilience, including through reshoring, especially in important economic sectors. (Raza et al., 2021). While so far in this work reshoring has been considered a practice aimed at protecting the "Made-in" of each country, or mainly to preserve the quality of goods and services offered to the client especially in the European context, nowadays reshoring is popular on the literature relating this practice to the change in the GVC's structure of high-technology companies, including semiconductors, electronics, robotics, and many other goods with national security scopes. The current US-China trade war that started in 2018 is at the heart of the "real" reshoring phenomenon. In fact, reshoring, based on what the US affirm to desire to obtain, will help the country to have more independency upon the value chains of fundamental goods, reacquire consistent level of employments in manufacturing in their countries, creating new jobs with the increasing implementation of automation in factories, and gaining back a supremacy position

previously lost, due to the skyrocketing growth of China as a superpower economic rival.

Through a deep analysis of the most important phenomenon occurred in the last decades, we will see the impact of crisis and risks for the GVCs worldwide, highlighting the main consequences of the events for the global economy. Moreover, there will be a focus on reshoring from the point of view of US and China, deeply talking about the undergoing trade war and the implications for Europe. A strong focus will be on the semiconductor industry, understanding the US and Europe role and position in the chip's value chain.

### 2.1. Globalization in retreat and the impact on GVCs

The entire world has experienced a growing backlash over all three components of globalization in recent years: economic, political, and sociocultural globalization (Walter, 2021). Firms reevaluate their strategic choices in response to macroeconomic shocks (Wenzel et al., 2020), and even if globalization had a major success at the beginning of the century, reporting positive data on trade, GDP and FDI all around the world, what was in particular jeopardy was the long-awaited aim of expanding cross-border free trade in products (Saval, 2017). After dealing with one crisis after another—trade tensions, COVID-19 lockdowns, and the shutdown of the Suez channel—supply chain managers began to shift their attention away from maximizing "just in time" delivery and toward planning for "just in case" scenarios. In a June 2021 poll, about 60% of managers reported they had raised key product stocks; a somewhat lower number had switched to dual sourcing of raw materials (White et al., 2022).

There have been several events that caused disruptions in the process such as economic and political events, which lead to a reconsideration of the internationalization practices. Moreover, the "Slowbalization", as it is defined by The Economist, lead also to the "relocation of second degree" practice since the latter is also considered as a consequence of misjudged globalization choices. The "Slowbalization" following the global financial crisis was marked by a prolonged delay

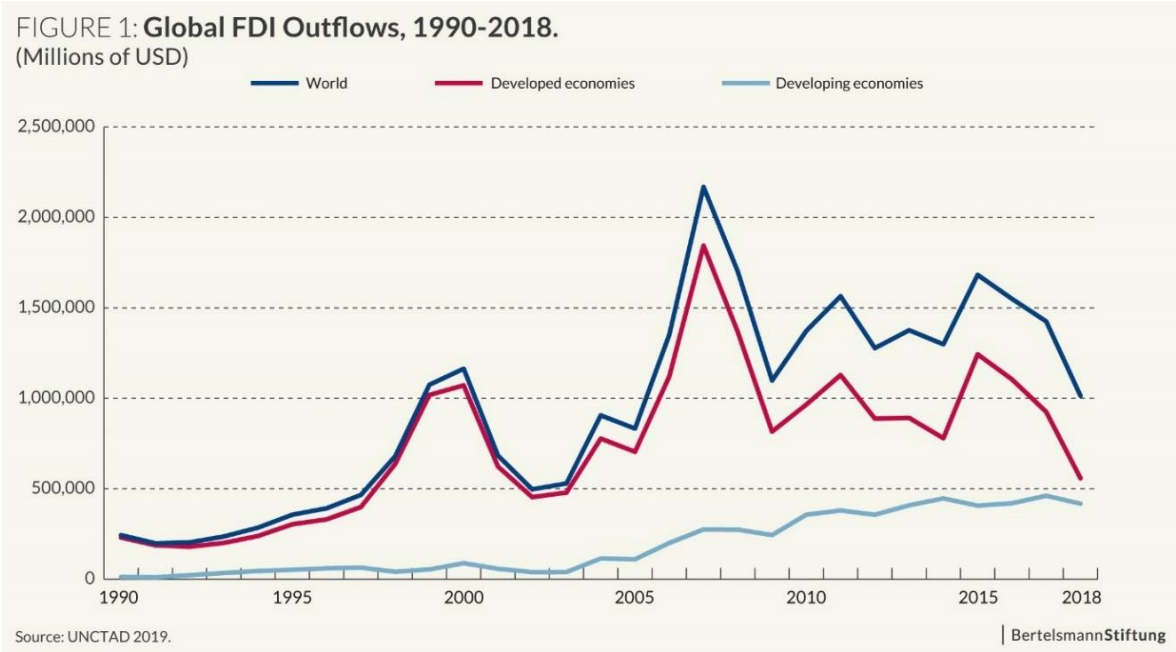
in trade liberalization and declining support from politics for open trade in the face of increased tensions between nations (Aiyar and Ilyina, 2023). In this analysis there will be considered only circumstances characterizing the 21st century, being aware that events such as the First World War and the Second World War in the first half of the 20<sup>th</sup> century were considerably impactful in the failure of globalization at first.

#### 2.1.1. Financial Crisis of 2007-2008

The first huge phenomenon that influenced the course of the globalization expansion in the timeline considered was the 2007-2008 financial crisis, and its impact is analysed by Jordi Canals (2010) in his article from the book "The Multiple Faces of Globalization". The crisis affected the economic situation at a worldwide level, but at the same time, economic globalization has been crucial in the crisis's ability to spread internationally, because countries have been financially integrated among each other due to the globalization process. Global trade has abruptly decreased as a result of the recent collapse of the global financial system, which has slowed the economy. The reduction has also been exacerbated by restrictions on financing to businesses, especially loans to their working capital. Moreover, this decline in economic activity has led to a considerable overcapacity in several economic sectors and a rise in unemployment as a result. In addition to causing a global economic recession, the financial crisis has also highlighted some of the structural risks and weaknesses of economic globalization. These include increased reliance on international trade and increased exposure of domestic industry to excess capacity when economic activity drops suddenly. Foreign direct investments in emerging countries have also declined dramatically as a consequence of rising uncertainty about the worldwide market and demand in the countries hosting such investments, as well as limitations on credit imposed on investment firms in their home countries and the simple fact that investments in emerging countries have become less appealing as the economic scenario has changed. Companies rethink their investment plans, loan decisions, programs for expanding into new markets, and worldwide investment portfolios and

operations (Canals, 2010). In Figure 7 below, we can see how developed countries FDI outflows experienced more fluctuations in the new century compared to the previous decades (Jungbluth, 2019), due to the financial crisis, and the highest decrease correspond to the immediate months after the event in question.

Figure 7: Global FDI Outflows, 1990-2018



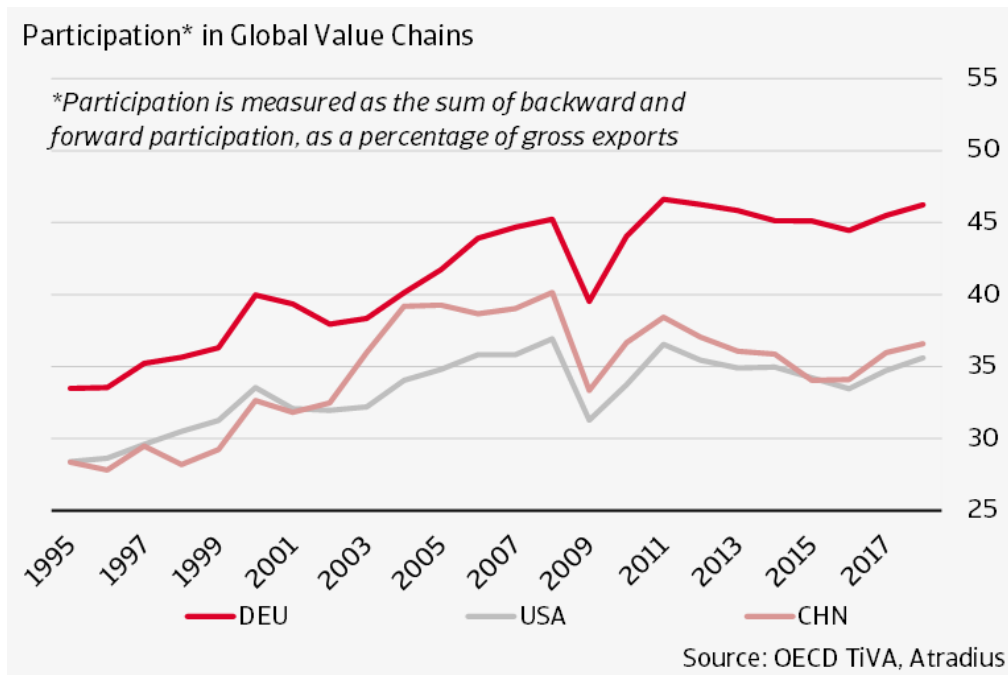
Source: Cora Jungblunth, (2019), "Tracing three decades of foreign direct investment booms and busts and their recent decline"

Altomonte et al., (2011) talk about the "Great Trade Collapse", referring to one of the most notable aspects of the recent global financial crisis. Aside from its scale, the drop in trade during the crisis has been very homogenous across all nations: over 90 percent of OECD nations have experienced a contemporaneous drop in imports and exports of over ten percent. The decline has likewise been rapid, with trade almost halting in the fourth quarter of 2008 (Altomonte et al., 2011). The financial crisis was also the first event in the history that cracked the consensus on globalization among economists; Formerly passionate supporters of globalisation, economists have become some of its most ardent opponents (Saval, 2017).

### 2.1.2. China Factor

The second important phenomenon shaping globalization is the rise of the “China factor”. A process of economic growth in China has been encouraged by the expanding openness of international commerce, particularly China's entry to the World Trade Organization. This trend is based on a very competitive industrial foundation and a little undervalued currency. China is now the largest factory in the world because to its effective production and logistical infrastructure. The position of China as a manufacturing base has been further bolstered by the country's increasing openness of international investment. China has been able to develop this strength as an exporting nation because to the industrial outsourcing that has taken place in the United States and Europe as a result of the quest for lower prices and more production efficiency (Canals, 2010). As we already stated in the previous paragraphs, China and in general the Asian countries are the most popular destination for offshoring activities. For several years, China's share of global FDI inflows has remained stable at around 20%, as well as being successful in foreign direct investment outflows, counting more than 30 percent of these coming from China in 2018 (Jungbluth, 2018). Germany, the United States, and Japan were the three main hubs linking cross-continent trade flows in 1990. China was barely noticeable with virtually little participation in GVCs. However, by 2019, China has surpassed Japan as Asia's core node and the United States as the world's second largest GVC hub, after Germany (see Figure 8) (Smid, 2022).

Figure 8: Participation in Global Value Chains



### 2.1.3. Brexit

Brexit was another disruptive political decision which caused the “globalization backlash”, denoting a substantial decline in public, political, or policy support for globalization (Walter, 2021). Brexit has lowered the UK's trade openness, inflows of foreign direct investment (FDI), and immigration growth. New border frictions and greater transportation costs create new trade obstacles, and FDI inflows are expected not to recover to 1990s and 2000s levels. Since the 1970s, the United Kingdom has regularly drawn more foreign investment than other equivalent countries, resulting in better wage growth, increased innovation and technical development, and greater knowledge and skill exchange. However, FDI has fallen since the Brexit decision, and the UK is not a global leader anymore. Average UK direct investments inflows as a percentage of GDP fell to their lowest point since the 1980s between 2017 and 2020. Reduced openness to trade can impede domestic company competitiveness, stifling innovation. Productivity development might also be hampered by a less varied workforce and lower levels of FDI. The United Kingdom is a lesser participant in the global economy than it was before Brexit, and it must adjust in order to prevent the worst economic repercussions (Posen, 2022).

#### 2.1.4. COVID-19

One feature of the past twenty years of globalisation's lack of resilience is that global value chains were not properly diversified, making them very exposed to shocks such as pandemics or trade conflicts (Razin, 2021), and that's what happened with Covid-19 in 2020, whose effects are still highly impactful in the today's economy. The epidemic forced lockdowns, halting productivity in numerous industries throughout the world (Di Stefano, 2021), in particular the coronavirus has had a negative impact on a wide range of international economic and trade activities, ranging from services in general to specific industries such as hospitality and tourism, healthcare products, and other industries with global value chains such as consumer electronics, financial markets, energy, transportation, food, and a variety of social activities, all of which have been severely harmed. In contrast, the onset of the pandemic had a less harmful and, in certain circumstances, even favourable impact on other businesses. Technology, healthcare, and businesses that benefit from people staying at home, such as delivery services for food, streaming media, and e-commerce retail, are examples. All of these businesses performed well financially through the crisis and recovery phases (Guedhami et al., 2023). Moreover, COVID-19 hit GVCs via numerous pathways (Di Stefano, 2021):

- On the **supply** side, enterprises were forced to delay or stop production due to social distancing laws enforced in their own nation or in the countries where their trade partners were based. While lockdown measures may affect all companies, even non-international ones, previous evidence shows that disruptions to firm supply spread disproportionately through trade relations.
- Another pathway is through pandemic-induced changes in **demand**, which were very variable across industries and nations. Demand for some critical medical supplies increased, whereas demand for personal and recreational activities decreased or migrated to equivalent items and services, such as home delivery vs restaurants. Given the sectoral heterogeneity of GVC involvement,

the sectoral bias of the shock may impact the amount to which international supply networks are susceptible to the COVID-19 recession. While all enterprises in general, considering also the non-international ones, were immediately affected by the decrease in domestic demand, GVC participants also suffered from the decrease in demand for their trading partners.

- There may be a **policy** channel at work in the current situation. Export prohibitions on certain medical goods were enforced at one point, and there is rising push in public debates to renationalize specific productions in the idea that this will provide improved supply security. The mere talk of trade policy changes may have a detrimental impact on GVC operations and trade growth by raising policy uncertainty.

In comparison with the global financial crisis of 2007-2008, the COVID-19 crisis has produced not only a demand side shock but also a supply side disruption. Since the very beginning of the epidemic, the shutdown of manufacturing sectors in China has shifted the conversation to potential supply-side disruptions expressed to other nations via GVCs (Di Stefano, 2021). Baldwin and Freeman (2020) thought that such disruptions would be more severe in countries more closely linked to China via GVC relationships. Emerging nations and economically weak populations will require much more time for recovery from pandemic-induced income and livelihood losses. Following the global decline in per capita incomes in 2020, 40 percent of advanced economies had recovered and, in some circumstances, exceeded their 2019 output levels by 2021. The similar percentage of nations reaching per capita income in 2021 that exceeds 2019 output is significantly lower among middle-income countries, at 27 percent, and even lower among low-income countries, at just 21 percent (World Development Report 2022). Di Stefano (2021) show how diversified GVCs may be a valid alternative to face these types of shocks. Diversification, on the other hand, may indicate higher costs and less stable buyer-seller relationships, particularly for geographically separated GVCs. Finally, policymakers are paying more attention to



reshoring, which is likely to grow among multinational corporations globally. UNCTAD estimated a 30-40% decline in foreign direct investment in 2020 and 2021 in September 2020 (Fortunato, 2020; cited in: Di Stefano, 2021). However, current data and survey results suggest that enterprises are not reshoring as much as was previously assumed (Di Stefano, 2021). According to Gereffi (2020) in Baldwin and Freeman (2021), "the COVID-19 pandemic has rapidly become one of the most significant disruptive events in modern times." Based on the Business Continuity Institute's (BCI) Supply Chain Resilience Report 2021, which polled 173 organizations in 62 countries, almost a quarter of firms suffered 10 or more disruptions in 2020, compared to less than 5% in 2019. Enterprises blamed Covid-19 for the majority of the increase, however Europe-based enterprises also cited Brexit implementation as a significant source of shocks (BCI, 2021; cited in: Baldwin and Freeman, 2021).

#### 2.1.5. Suez Canal Blockage

The Suez Canal is a vital supply chain link, transporting 13.5% of the world's commerce, amounting to approximately 19,000 ships a year, or an average of 51.5 ships each day. On March 23, 2021, the Suez Canal, one of the busiest maritime routes, was obstructed by the Ever Given, a massive cargo ship that got stuck between the canal banks, affecting around 400 boats expected to transit the canal in the East-West and West-East directions. Such vessels faced a challenge in terms of route and timetable usage. This episode influenced the operation of several different other actors of the maritime trade, such as vessels supposed to pass through the Canal, shippers, container terminals and many more (Man-Yin & Yin-Cheung, 2021). The consequences of the blockage were plenty:

- **Global trade disruption:** on those seven days, the blockage stopped about 12% of the world trade. The vessels undoubtedly created a long queue and even though trade had been resumed, the backlog has caused issues with container availability and ship availability in the following days and weeks. The

continents most impacted from the episode were Europe and Asia, since the Americas had alternative routes to exploit (Man-Yin & Yin-Cheung, 2021).

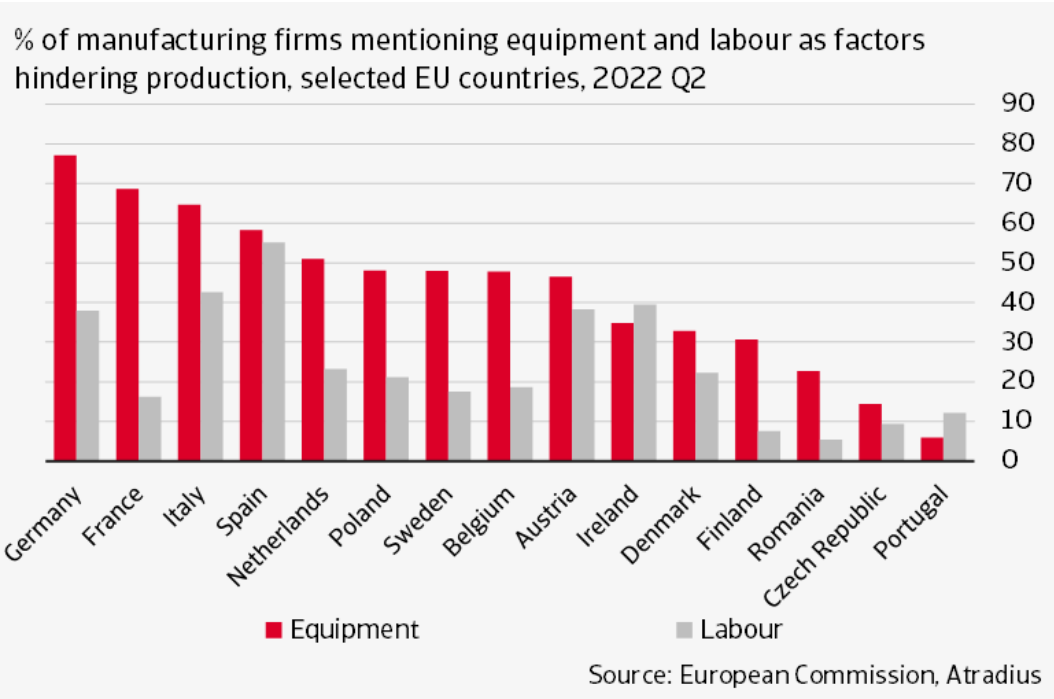
- **Increased costs:** in order to avoid further delays, many ships have to leave their chosen shipping route and deviate to the nearest but longer route - the Cape of Hope. As a consequence, routes distances rose by 4000 to 6000 nautical miles, and transportation costs increased by and five percent (Gao, T., & Lu, J., 2019, cited in: Man-Yin & Yin-Cheung, 2021)
- **Oil prices rose temporarily:** Because of the disruption in goods transit, various commodities became scarce, influencing the pricing of goods such as oil, gas, and consumer goods. For instance, oil prices rose temporarily due to concerns about crude oil shipment delays. This is evidenced by the fact that the gas price on the same day jumped by USD\$0.40 in the aftermath of the event. (LeBlanc, 2021, cited in: Man-Yin & Yin-Cheung, 2021)
- **Legal duties and costs:** The incident sparked claims from insurance companies and prospective legal battles between ship owners, shipping firms, and the canal authorities over who was to blame for the obstruction and its effects.

#### 2.1.6. Russian-Ukraine War

Even before the shock caused by the pandemic was finished, Russia attacked Ukraine on February 24, 2022, escalating the Russo-Ukrainian War that begun in 2014. The conflict caused a tremendous shock to the world economy, particularly in the oil and food markets, compressing supply and driving prices to historic highs. The eurozone has been particularly exposed to the economic implications of Russia's invasion of Ukraine when compared to other economic areas (Arce et al., 2022 cited in: Arce et al., 2023). The trade problems caused by Russia's invasion of Ukraine have exposed the risks of depending on a small number of providers for imports having few alternatives (Winkler and Wuester, 2022). Russia's status as a key commodity provider places it at the heart of a diverse range of global industries. Russia is particularly significant as a supplier of primary and intermediate products and services utilized in the early stages

of manufacture of other nations' exports. Energy, metals, and chemicals, as well as transportation and some business activities, drive this upstream connection into GVCs. For this reason, as a significant commodity exporter, trade interruptions with Russia had and will have a global impact in the form of price increases, particularly for energy items, which influence transportation costs and almost all GVCs (Winkler and Wuester, 2022). Firms have reported equipment or material shortages. In the second quarter of 2022, as reported in figure, an all-time high 51% of EU manufacturing enterprises identified equipment as a factor restricting production, with this figure reaching almost 65% in Italy, 69% in France, and slightly lower than 80% in Germany (Smid, 2022).

Figure 9: % of manufacturing firms mentioning equipment and labour as factors hindering production, selected EU countries, 2022 Q2



However, the problem of raw materials shortage for worldwide companies and nations was not the only effect on global value chains and trade. Most of the developed countries, among which European Unions, Japan, Australia, US and Canada imposed severe sanctions against Russia and its allies (Global Trade Alert). For example, taking into consideration the operations of EU, they implemented sanctions including targeted restrictive measures (individual sanctions), economic sanctions and visa

measures. Going into details for the economic sanctions, a variety of import and export limitations have been placed on Russia by the EU, meaning that certain items cannot be sold by European companies to Russia (export limits), and certain products cannot be sold by Russian companies to the EU (import limits). Those sanctions are designed with the scope of having the greatest detrimental effect on the Russian economy while having the fewest negative effects on enterprises and people in the EU. The EU has prohibited approximately €43.9 billion in exports to Russia and €91.2 billion in imports since February 2022, according to the European Commission. Some worth noticing product listed in the export sanctions include (European Council):

- cutting-edge technology such as advanced semiconductors, software, quantum computers and electronic components;
- energy industrial equipment, technology and services;
- Products and technology used in the aviation and space industries such as aircrafts, engines, spare parts and jet fuel;
- Luxury goods
- Any other good that could increase Russian manufacturing capacity.

At the same time, bans for imports from Russia include some products that can harm their industrial power, since are the clue components of their trade profits:

- Crude oil and refined petroleum products, with some exceptions. The package of sanctions bans the EU from acquiring specific petroleum products and seaborne crude oil from Russia, as well as their import or transfer. Pipeline imports of crude oil into EU member states who, due to their geographic location, suffer from a unique dependency on Russian supplies and have no practical alternatives are anticipated to get a temporary exemption.
- Coal and solid fossil fuels
- Steel, steel products and iron
- Gold and jewellery
- Cement, asphalt, wood, paper, synthetic rubber and plastics

- Seafood and liquor (e.g. caviar, vodka)
- Cigarettes and cosmetics

Furthermore, plenty of international companies and SME decided to suspend their operations in Russia or directly to exit the Russian market to show disagreement with the Russian approach to the war. They closed shops and stopped investments in the country, divesting billions of dollars of assets. Among them, we can find Uber, McDonald's, HP, IBM, Adidas, Shell, BP, Disney and many more (Sonnenfeld and Tian 2022).

#### 2.1.7. Facing risks for GVCs

Covid-19 and the Russia-Ukraine war, and in general all the events occurred in the last decades, are rekindling the debate over whether GVCs have grown too exposed to shocks. Some economists predict minimal change in the structure of GVCs since GVCs have provided several benefits by helping enterprises to source inputs more effectively, get access to expertise and money outside of the domestic economy, and extend their activities into new markets. Others argue that Covid-19 has served as a wake-up call for GVCs to adopt a new risk-reward balance (Smid, 2022). Firms may explore reshoring manufacturing, diversifying suppliers, and stockpiling additional inventory to boost supply chain resilience (Smid, 2022):

- **Reshoring or nearshoring:** Relocation of second degree, as previously stated, impact the fragmentation of tasks and the geographic dispersion, and the major drivers can be the policy environment, and the automation factor in the production process. However, it's crucial to remember that localized manufacturing isn't always less subject to shocks. In the case of a worldwide pandemic, practically every economy is affected by demand as well as supply shocks, even if with varying degrees. Furthermore, numerous types of shocks, such as manufacturing accidents, natural catastrophes, and financial risks, can occur in any place, thus local production is not a guarantee of durable value chains (Smid, 2022).

- **Diversification of supply:** Supply chains with a limited variety of suppliers or buyers can raise the likelihood of disruption and worsen the spread of shocks (OECD, 2021). At this point, diversifying the suppliers at different stages of production in the global value chain system can improve resilience and strength, since a negative shock to supplies from one place can be mitigated by substitute supplies from other locations. Maintaining alternative suppliers, on the other hand, imposes additional expenses on enterprises since they must invest in various suppliers to adjust inputs and ensure that components from various producers fit properly (Smid, 2022).
- **Diversification of demand:** Similarly, on the customer demand side, providers may be vulnerable if they rely on too few clients. A sudden decrease in demand in a market cannot be supported in this circumstance and may have major implications for upstream enterprises serving this market. Concentration, on the other hand, is frequently a manifestation of competitive advantage, specialization, and economies of scale (OECD, 2021).
- **Holding more inventory:** Industries with greater inventories and lower fixed costs tend to suffer substantially lesser financial losses as a result of shocks (Lund et al., 2020). At the same time, profit-oriented businesses will be hesitant to keep surplus inventory since it not only ties up cash but also necessitates managing it, storing it, repairing it, and avoiding damage or theft. Furthermore, many things might expire or become outdated while in inventory. Despite the fact that many businesses increased their inventories and stored up on raw materials throughout the Covid-19 crisis, this is unlikely to become a long-term trend (Smid, 2022).

## 2.2. The “real” reshoring

The reshoring phenomenon, and in general the relocation of second degree, as we already analysed in the first chapter, is a company decision that has been popular for the last decades and discussed by plenty of scholars. However, the “real” reshoring

that is characterizing the last recent years involving specific sectors of economic, political and national security importance, and rival trade countries is much more impactful compared to the relocation of second degree in general, and it deserves particular attention and analysis in this work. Global value chains at the worldwide level have suffered several disruptions in the last decade and encountered serious risks due to the events previously described, with emphases on the Covid-19 crisis, which was the most impactful economic catastrophe and served as the starting point for a real consideration of the possible alternatives for a new GVCs structure (Raza et al., 2021). Due to all these catastrophes, both natural and human-caused, international trade has shifted off the beaten road and is now experiencing opposing tendencies in regionalization or supply chain system segregation (Ahn and Lee, 2021). With reshoring remaining an empirical occurrence of low relevance prior to COVID-19, the prospect for relocating at the sector and GVC levels is analysed in light of current economic developments, digital transformation, and shifting geopolitical environment (Raza et al., 2021).

#### 2.2.1. The position of China and US in the current scenario

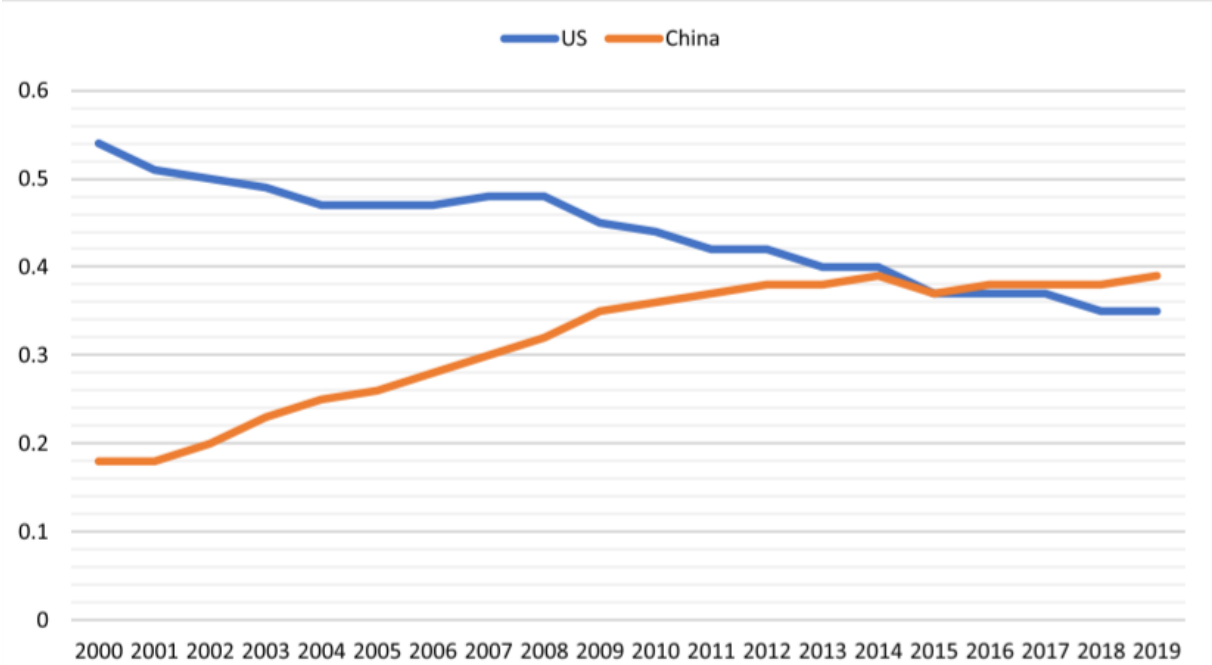
From the 1980s until the early 2000s, the United States tacitly encouraged US multinational corporations' investments in China, particularly considering they led inflation to decline and corporate earnings to increase (Gur & Dilek, 2023) and that's what the whole group of developed countries did back then. Every MNC was trying to lower costs and increase revenues, implementing FDIs in developing nations with low wages and plenty of resources to exploit. Due to the great investments made by rich countries and firms, those nations gained expertise and resources to become the future leading superpowers. In accordance with data coming from Statista.com, the FDI position of the United States in China from 2000 to 2021 has grown exponentially, starting from only 11.14 billion dollars in 2000, and reaching an amount of 118.19 billion dollars in 2021 (Statista, 2023). The rise of China as a new economic rival and one of the world's leading export countries, posed the basis for hatred coming from

the US. Since the 1970s, the United States has primarily focused on the research and development, design, branding, and marketing parts of global value chains (GVCs), while shifting production to low-wage nations. On a per-capita basis, the United States is still strong at manufacturing, and US corporations keep on developing innovations. However, they underestimated the importance of keeping an innovated manufacturing ecosystem inhouse (Pisano and Shih, 2012; cited in: Gur & Dilek, 2023). Moreover, together with the Chinese economy's transformation, the US FDI in China adapted to the new high and advanced technology needs, bringing a huge amount of knowhow in the country and accelerating their rapid technological progress. The main sectors in which China tried, and succeeded, to specialize in are those involved in high technology manufacturing, such as electrical equipment, information technology, numerical control tools and robotics, energy saving and new energy vehicles, aerospace equipment and many other. All these specializations were announced in the Made In China 2025 plan, an effort to maintain China's status as a leader in the high-tech sector worldwide (Institute for Security and Development Policy, 2018). This brought China to be the world's biggest manufacturing power, with 28,7% share of global manufacturing output in 2019, surpassing by more than 10 percentage points the US, which used to prevail before China overtook in 2010 (Richter, 2021). The manufacturing gap between developing and developed nations, and the China's industrial shift from labour-intensive to technology-intensive manufacturing has resulted in more strict investigation of US industries leaving China and a weakening of the United States' relative economic importance in comparison to China's (Gur & Dilek, 2023). According to the Competitive Industrial Performance (CIP) Index, China has surpassed the United States in terms of competitive manufacturing production and exports in 2015-2016 (see Figure 10). Concerning investments in R&D, the ratio as a share of GDP rose from 0.73% in 1991, to 2.24% in 2019, while China's patent applications increased, qualifying the nation as the second country in global rankings for patent applications per 100 billion GDP (WIPO and Statista, cited in: Gur & Dilek, 2023). Last but not least, the proportion of high-tech goods in overall Chinese



manufacturing exports increased from 30.15% in 2007 to 31.27% in 2020. Meanwhile, the US's high-tech export rate fell from 29.87% to 19.48% (The World Bank, n.d.).

Figure 10: US-China CIP Index Score



Source: United Nations Industrial Development Organization (UNIDO)

After analysing some objective data about the industrial and economical position both in China and US, it's important to state that the manufacturing power that made China rise was not enough to avoid other issues in the local economy, which could turn the situation upside down. On the one hand, the country is trying to overcome a local government debt, which has risen sharply as a result of the property collapse, as well as the lingering effect of the expenses of implementing lockdowns due to the pandemic. Local fiscal challenges not only poses significant dangers to Chinese banks, but it also limits the government's capacity to stimulate economy and extend public services. Beijing has so far released a constant stream of economic stimulus measures, involving reductions in interest rates and other actions to support real estate investors and consumer firms. It has, however, hesitated from making any big actions. Economists and analysts says that this is because China has gotten too leveraged to stimulate its economy like it did throughout the financial crisis that struck the world

15 years ago. On the other hand, another important issue that impact the economy is the demographic decline. The elderly demographics of China pose considerable hurdles to the country's economic growth potential. A decrease in labor supply, along with rising healthcare and social spending, could result in a larger fiscal deficit and a heavier debt burden. A smaller workforce may also reduce domestic savings, leading to higher rates of interest and lower investment (He, 2023).

### 2.2.2. US-China Trade War and reshoring

Since the 2008 Global Financial Crisis, the United States shifted its economic goals and policy preferences in an effort to increase its weight in the global economy, lessen dependency on foreign supply networks, and generate more jobs inside its borders. This shift has grown increasingly visible in the aftermath of the previous US president Donald Trump's administration and the COVID-19 epidemic (Gur & Dilek, 2023). The US trade deficit with China, meaning when a country's imports exceed its exports in a specific period, rose following China's WTO entrance in 2001, changing from \$83 to almost \$383 billion between 2001 and 2022 (US Census Bureau, 2023). For this reason, the actual US-China trade war that is shaping the global economy started on January 2018 under Donald Trump, who decided to impose 25% tariffs on billions worth Chinese imports, pursuing a protectionism strategy toward China, and was designed to put pressure on Beijing to alter its unfair trade policies and separate the US economy from China's (Zeng, 2023). We can say that the trade deficit, together with the rising technology supremacy of China and the willingness of US to gain back its economic and political power, may be considered the main causes of this economic war. Clark et al. (2023) affirm that arguments for reshoring gained extreme support in 2021, as the pandemic caused supply chain interruptions in the high-tech semiconductor industry, resulting in uneven availability to vehicles and computers that depended on these chips and bolstering the argument for reshoring as a response to such disruptions. The idea held that if these industrial procedures were done in the United States, the country would be fewer dependent on other nations' pandemic regulations.

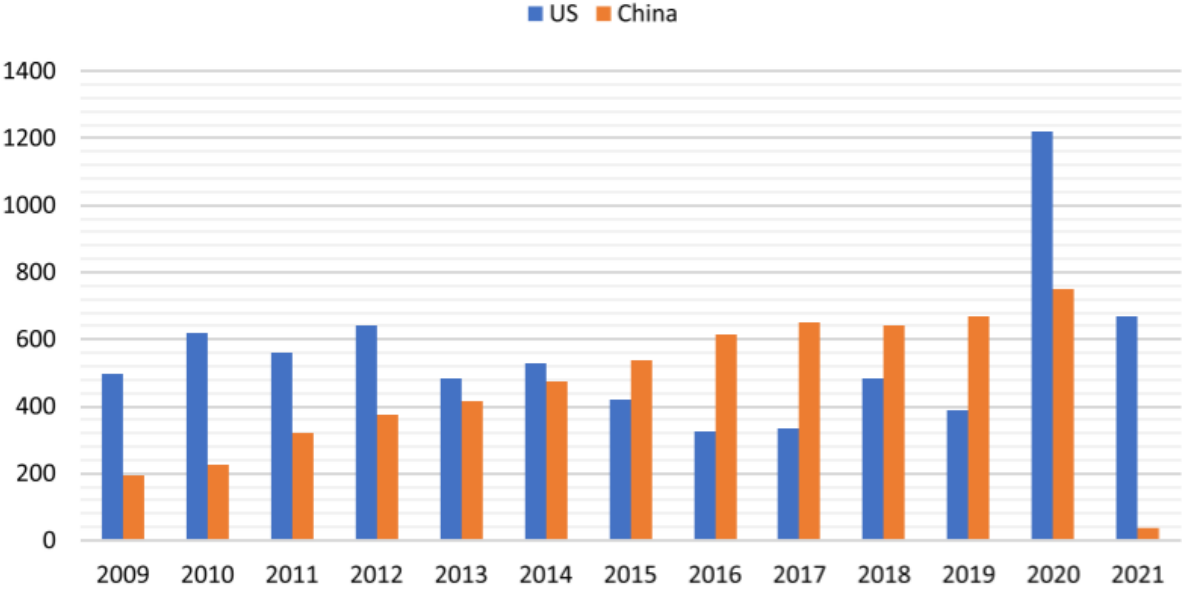
Reshoring, it was assumed, would not only balance the distributional repercussions of globalization-fuelled offshore, but would also give supply chain resilience in the face of a slew of dangers, including the pandemic and rising geopolitical tensions with China (Clark et al., 2023). The Biden Administration launched a supply chain study in June 2021, promising to "strengthen American supply chains to promote economic security, national security, and good-paying, union jobs here at home." invoking the "Made in America" policy well known in US (The White House, 2021; cited in: Clark et al., 2023). In fact, the United States seeks to maintain its relative technical and economic dominance over China by encouraging output, productivity, and innovation, hence creating more employment with acceptable compensation (Gur and Dilek, 2023). The recent method for dealing with industrialization and supply chain management contrasts sharply with previous decades of globalization, during which manufacturing jobs moved abroad as businesses invested in labour-rich nations to keep consumer costs low and their bottom lines padded (Clark et al., 2023).

High technology-intensive companies are more likely to backshore for political or economic reasons, according to most of the literature. Economic reasons, such as automation, improved flexibility, and shorter lead times, tend to push businesses in the mechanical, electronic, and transportation equipment sectors to reshore. Other industries, including those in healthcare, chemicals, pharmaceuticals, aerospace, communication, electronics, automotive, and semiconductors, are more likely to be reshored for political reasons, such as improved regional competitiveness and supply security, or for reasons of national security (European Union, 2021). Moreover, political and economic reasons correspond respectively to the strategies used by US to reach their target. In fact, to reverse the deindustrialisation process and restore manufacturing activities, the United States has pursued two important strategies: neo-protectionism and smart automation (Gur and Dilek, 2023), leading to implement reshoring not only back to US, but also to other advanced nations (Ahn and Lee, 2021).

**Neo-protectionism** has been undertaken ever since the Financial Crisis of 2008, even if with a less obvious impact. US presidents implemented several policies to stimulate domestic production since then. In this historical moment, subsidies, incentives, anti-dumping laws, non-tariff obstacles, and even tariff rises have been introduced as part of a so-called "neo-protectionist" approach to maintain domestic businesses and sectors competitive and to preserve national security (Gur and Dilek, 2023). Figure 11 disproves the claim that protectionist measures began under Trump by demonstrating that trade-damaging policies increased before to 2016. As we can see, 2020 was the year in which there were the highest numbers of protectionism tariffs from US towards China. The Chinese economy was intended to be slowed down, as well as the temptation to shift industries there (Gur and Dilek, 2023). By forging strategic ties with important allies like the EU, Japan, the UK, and Australia, the Biden administration bolstered its protectionist position. It aspires to create economic blocs that only link ally and democratic nations. China's answer was to advocate for a *dual circulation strategy* that emphasized creative innovation, domestic trade, and local markets (Ahn and Lee, 2021). From this idea of signing alliances with strategic countries, derive the new term "friend-shoring", which is deeply rooted in the political driver of reshoring. In fact, friend-shoring can be identified as "the practice of relocating supply chains to countries where the risk of disruption from political chaos is low" (Kessler, 2023). The US Treasury Secretary Janet Yellen recently recommended to pursue "friend-shoring" by shifting supply chains to "trusted countries" in order to allow to "continue to securely extend market access and lower the risks to our economy as well as to our trusted trade partners". In practice, this would entail giving up the straightforward concept of "off-shoring", moving production overseas and substituting the latter with a flexible combination of "near-shoring," "re-shoring," and "friend-shoring". Such a mix would result in a reconfiguration of the supply chain segments, depending on the accessibility of manufacturing factors and locations. It increases the likelihood that a new trading bloc made up of democratic governments pursuing economic and regulatory convergence will form, and the main aim would be creating a new safe

supply chain of strategic goods and services geopolitically reordering the world, adding a geopolitical rivalry to supply chains (Maihold, 2022).

Figure 11: US and China Protectionist Measures



Source: data from: Global Trade Alert, cited in: Nurullah Gur and Serif Dilek (2023), “US-China Economic Rivalry and the reshoring of global supply chains”.

Currently, the United States imposes a 25% duty on around \$250 billion of goods imported from China and a 7.5 percent charge on about \$112 billion of those imports. However, these measures didn’t really have only positive effects on US manufacturing output:

- The products impacted by the 25% tariffs are intermediate components and capital assets, meaning that those measures caused shortages and drove up prices for businesses that needed those inputs to stay in business. These businesses were forced to choose between paying to build partnerships with new suppliers outside of China or continuing to import from China despite the penalty (Bown, 2022).
- If the rise in trade costs due to high tariffs are not offset by decreased producer profit margins, the final customers will see the price of final products rising. These impacts have a negative influence on activity and weigh on investment,

consumption, and employment (Gunnella and Quaglietti, 2019). In comparison to their non-chinese rivals operating outside of the US, higher costs reduce American enterprises' competitiveness in the US and international markets (Bown, 2022).

- Since GVCs are still highly fragmented, intermediate goods cross borders multiple times during the production process to be further processed. This strategy implies the application of tariffs each time the product change country, making the price rise exponentially. Increased manufacturing costs are likely to be transferred down to consumers at various points throughout the value chain, having a negative impact on demand, output, and investment at every level (Gunnella and Quaglietti, 2019).

Along with neo-protectionism, the United States has promoted **smart automation**, whose technologies it has expanded to undermine China's competitive advantage of cheap labour and to make production in the United States even more alluring. Smart automation technology can be used to encourage US multinational corporations to reshore their manufacturing operations, comparable to how neo-protectionist tools can be used to support regional manufacturing and industries. (Gur and Dilek, 2023). Based on data extracted from Statista.com, the Artificial Intelligence funding investment for companies in this sector in the United States rose exponentially in the years between 2011 and 2019, reaching an amount of 16.5 billion dollars in 2019 (Thordmundsson, 2022, in: Statista). The manufacturing sector has incorporated new generation technologies like robots, 3D printing, AI, big data, and the IoT to simplify and optimize production while also lowering the proportion of labour-intensive tasks. By lessening the significance of cheap labour as a competitive advantage, it is anticipated that increasing the weight of high-tech capital in the manufacturing process will sharpen the USA's competitive edge (Gur and Dilek, 2023). The reshoring decisions of US companies that previously offshored to cheap countries in order to invest in low-cost facilities and labour, are

supposed to be highly influenced by these founding offered to increase the amount of high technology in local manufacturing, because the advantages in terms of costs and management of the production process are vast and convenient. As specified by an increasing number of scholars in recent years, its verified that the implementation of automation and Industry 4.0 in general is an important driver for the willingness of companies to relocate their activities with strategies of reshoring in the home country or nearshoring. The positive influence of Industry 4.0 on manufacturing applied to home production site are the followings (Kamp and Gibaja, 2021):

- harmonize the costs of high- and low-cost nations, in this case US and China costs;
- gain advantages from moving manufacturing operations closer to the final consumer, giving production processes better options for flexible planning and on-time delivery;
- By (re)coupling production to a company's key R&D, design, and product development areas, synergies can be created;
- Raise the bar for product and service quality and customization options.

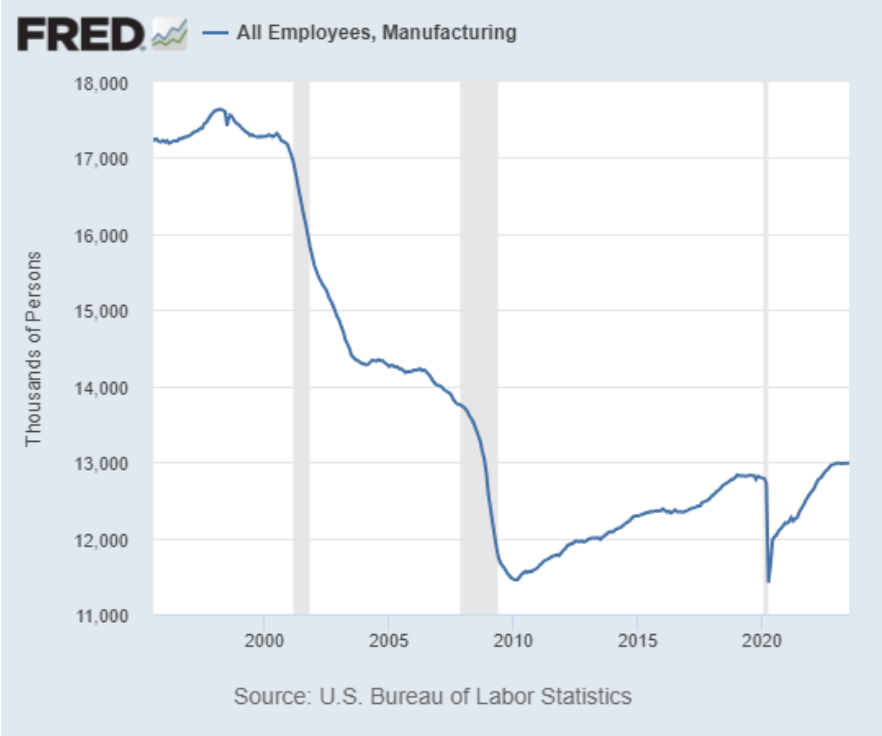
Furthermore, other essential advantages satisfy the need of US to retrieve from the Chinese economy, together with advancing the manufacturing sectors at home:

- Increase the number of manufacturer workers in the country;
- Decrease the dependence on other nations for essential part of the companies' value chain, bringing the production back home;

In fact, together with the plummeting numbers regarding the production facilities presence in the US territories and the slowing productivity and economic growth, the same effect reverberated on the number of manufacturing employees. As it's shown in Figure 12, the data is in sharp decline since the 2000, registering about 13 million

people employed in July 2023, compared to 17,6 million counted in April 1998 (U.S. Bureau of Labor Statistics, 2023).

Figure 12: Numbers of employees in Manufacturing, US



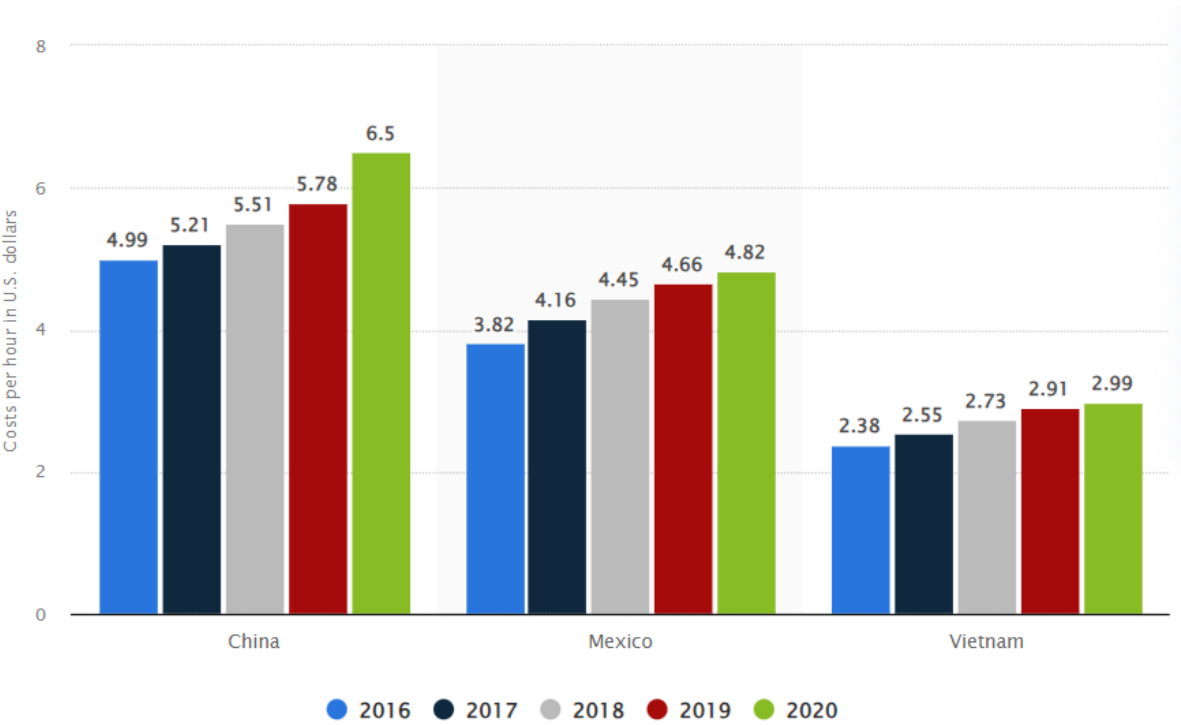
However, since the application of protectionist measures starting after the financial crisis, the number is slightly rising, due to the possible increase of companies applying reshoring strategies, with again a drop during COVID-19, and a recovery to the present day. For this reason, the US government is investing all its energies in applying measures of smart automation and protectionism combined in order to save jobs of the unskilled labour force and to increase the job vacancies in general. Among Donald Trump's most ostentatious electoral promises in his quest to "make America great again" was the restoration of American industry and jobs, and Biden is keeping on embracing a production and investment strategy (Gur and Dilek, 2023).

One of the main reasons that shaped the offshoring decisions of companies in the previous decades was the possibility to exploit cheap labour costs in developing countries. However, the increasing economic position of China respectively made the cost of operating in this country rose, as it is shown in Figure 13, extracted from



Statista.com. The labour costs per hour for employees in China were 6.5 US dollars in 2020, compared to 4.99 just five years before. At the same time, Mexico registered a value of 4.82 US dollars and Vietnam a value of 2.99, both in 2020 (Statista, 2023).

Figure 13: Manufacturing labour costs per hour for China, Vietnam, Mexico from 2016 to 2020



Source: Statista, <https://www.statista.com/statistics/744071/manufacturing-labor-costs-per-hour-china-vietnam-mexico/>

This change in salaries for Chinese workers encouraged the rise of reshoring as an option for companies, leading their decisions toward a choice of backshoring, or even relocation to a third country, taking into consideration nations part of the developing countries group, such as Taiwan, Thailand, Malaysia, Vietnam, the Philippines and Cambodia, since their export structures are comparable to those of China. (Cali, 2018, cited in: Gur and Dilek, 2023).

A real case study as an example of the effect of the technological trade war between US and China, is the case of the multinational company HP. HP Inc is a famous company with its headquarters in California, which develops PC and several related products in the informatic sector. The second-largest PC manufacturer in the world by

shipments after China's Lenovo, in an effort to diversify its supply chain, intends to move some of its consumer laptop production to Thailand and some of its commercial notebook computer production to Mexico. Starting the next year, HP also intends to move a portion of its laptop manufacturing to Vietnam. HP's transfer could be facilitated by the fact that Thailand is already home to a number of PC vendors, while manufacturing in Mexico would enable the business to better serve its main North American market. In light of the geopolitical unpredictability of China and the increasing risks rising for value chains, HP's decision will aid Vietnam and Thailand in developing a supply chain ecosystem for personal computers, making south-east Asia an even more alluring alternative for computer manufacturers. The company, however, affirmed that "China is a very important part of our global supply chain, and we remain deeply committed to our operations in Chongqing.". This reflects the idea that shifting away from China, especially in the sector of notebook computers, is a difficult choice, and the world is still not ready to exclude China from all the operations. "The primary purpose of supply chain diversification is to mitigate risk factors related to US-China tensions, or to take advantage of emerging production hubs in Vietnam and other Southeast Asian countries," said Kieren Jessop (Li & Ting-Fang, 2023).

According to a concern expressed by Boston Consulting Group (2019), the US-China trade disagreement would probably turn into a technological cold war if technology rivalry and trade competition continue at the same time. In other words, if the US tightens non-tariff barriers against China in the high-tech industry, China can stiffen anti-trust regulations against US tech firms and forbid exports of essential raw materials to the US (Boston Consulting Group, 2019, cited in: Ahn and Lee, 2021).

### 2.3. Focus on the semiconductor value chain

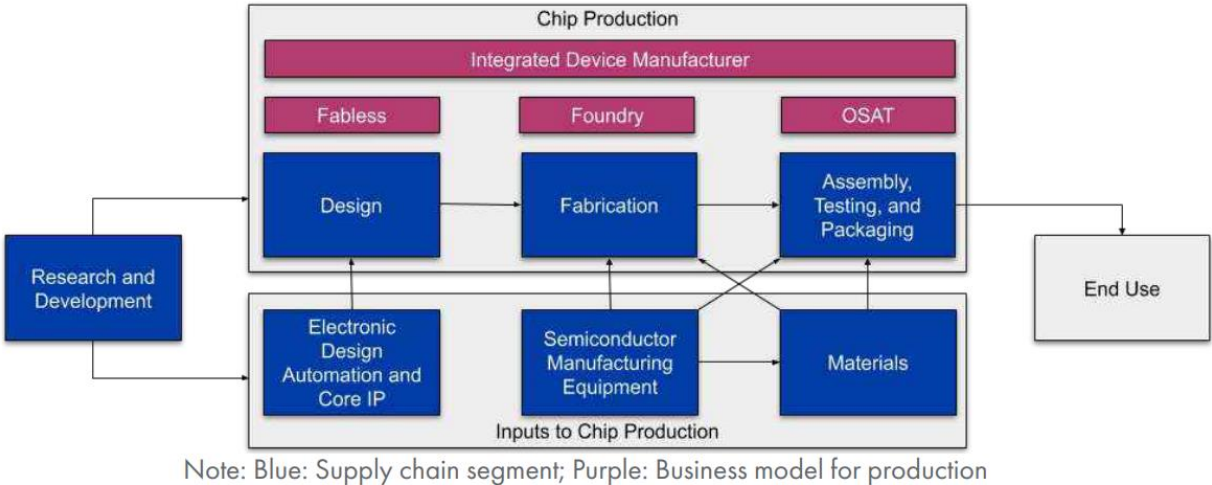
Among all the important and strategic goods and services that US included in its protectionism strategy to bring manufacturing back inside the border, the semiconductor industry in the high-tech sector is the first one worth noting. Almost

all sectors of our global economy are based on the semiconductor technology, and they are included in the top five American exports, right after airplanes, refined oil, and automobiles (SIA, 2023). In an age of digital transformation, artificial intelligence, and 5G communications, the semiconductor sector is essential to both national security and economic competitiveness (Varas et al., 2020). In fact, these components are essential for communications, computing, military systems, clean energy, healthcare, transportation and countless other important daily life activities, and more than 100 billion integrated circuits are currently in use worldwide on a daily basis. (SIA, 2023). Although the United States continues to dominate the semiconductor sector, a position that it has held for almost 50 years, this advantage has been steadily weakened by domestic underinvestment and growing international competition (Allison et al., 2021). On the other side, as it happened for most of the goods in the last decades, we can see the rise of China as threat for the other world economies, including the USA.

The system used to produce semiconductors on a worldwide scale is intricate, interconnected, and difficult to understand. All five of the world's top producers of semiconductors—China, South Korea, Japan, Taiwan, and the United States—are also significant chip importers. Since not all chips are created equal and no company specializes in all types of chips, even the biggest producers are dependent on imports (Hufbauer and Hogan, 2022). No one company—indeed, no single country—is now able to internally carry out all tasks in the supply chain for all sorts of semiconductors necessary for a contemporary economy. Some businesses play a variety of roles, while others are highly specialized. A typical Integrated Circuit (IC) chip's multiple inputs, according to estimates from the consulting company Accenture, must pass through more than 70 foreign borders before it can be sold to customers. The manufacture of semiconductors requires more than 500 separate steps and takes between four and six months, spanning from specialist design tools to fabrication operations and specialized testing facilities. (Thadani and Allen, 2023). Design, fabrication, and assembly, testing, and packaging (ATP) are the three core phases of production. These

steps can either take place in a single company – an integrated device manufacturer (IDM) that sells the chip – or in different companies. In the latter case, a “fabless” firm design and sells the chip while also procuring fabrication services from a foundry and ATP services from an outsourced semiconductor assembly and test (OSAT) company. Some of the inputs needed for production are materials, semiconductor manufacturing equipment (SME), electronic design automation (EDA), and core intellectual property (IP) (Khan, 2021).

Figure 14: The Semiconductor supply chain

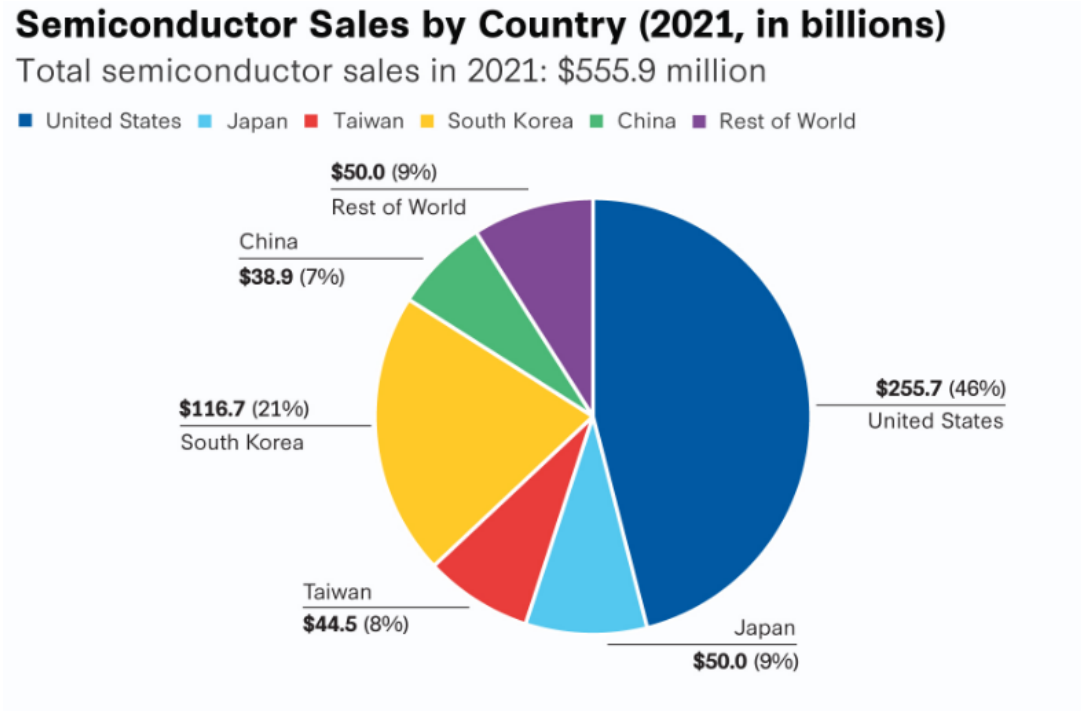


Source: Khan S., Mann A., and Peterson D., “The Semiconductor Supply Chain: Assessing National Competitiveness,” CSET, January 2021

In figure 14 it’s represented the semiconductor value chain with distinction between the three important phases. Moreover, it’s clearly visible the two types of business models characterizing the semiconductor industry. The first is the integrated device manufacturer (IDM) model, where the production process is all integrated in one single company. Examples include big enterprises such as Intel, Micron, Renesas, Samsung, Texas Instruments, and Infineon. The second type of business model is the “fabless-foundry” model, which represents companies that form strategic alliances to design, produce and test, but are involved in only one of these activities (Verwey, 2022). According to the Semiconductor Industry Association (SIA), manufacturing and design contribute equally to 90% of a chip's value, with ATP companies contributing

the remaining 10%. This brief explanation on how the value chain of semiconductors work is essential to understand the position of companies and countries regarding manufacturing capacity and market share. Figure 15 represents the total sales by countries registered in 2021. As we can see, US is the leading country with sales reaching 46% of the total market share of the semiconductor industry. Nearly two thirds of the world's "fabless" market is located in the US, meaning that these companies design and sells semiconductors without having a production site in the US, and this undoubtedly increase the American position in this case. To cite some company names which heavily contribute to the performance of the US, there are Qualcomm, Nvidia, Broadcom and AMD. Moreover, also IDM companies are included in this data with their economic results since they integrate all their operation in the country. The other substantial participants in the market are South Korea, with 21% share, Japan with 8%, Taiwan with 8% and China with 7%.

Figure 15: Semiconductor Sales by Country (2021, in billions)

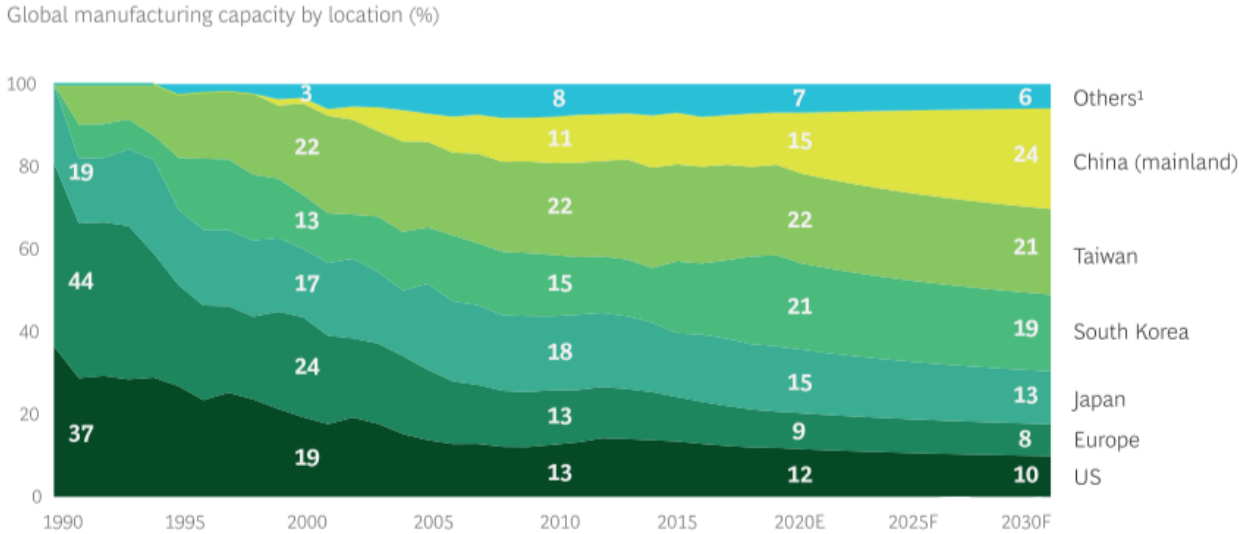


Source:

Thadani, A., & Allen, G. C. (2023). *Mapping the Semiconductor Supply Chain: The Critical role of the Indo-Pacific Region.*

With a steady 45% to 50% share of global revenues, the US semiconductor sector has long been the industry leader worldwide. However, the US's proportion of global semiconductor production capacity has decreased from 37% in 1990 to 12% in 2021. (Varas et al., 2020). For this reason, another important metric to analyse in order to better understand the position of the economies in the world regarding the semiconductor industry is the manufacturing capacity of each nation involved, in Figure 16. China now accounts for 15% of the world's capacity for semiconductor fabrication, starting from 1% in 1990, surpassing America's contribution of 12% (Allison et al., 2021), while Taiwan is still the first country in the rankings, possessing 22% of the global manufacturing capacity. After Taiwan, we can see South Korea with 21%, and Japan competing with China at 15%.

Figure 16: Growth in US Installed Capacity Has Been Outpaced by Asian Countries



Source: Varas, A., Varadarajan, R., Goodrich, J., & Yinug, F. (2020). *Government incentives and US competitiveness in semiconductor manufacturing*. BCG Global

China is the country expected to grow the most in term of manufacturing capacity, with the possibility to reach up to 25% by 2030. Moreover, the country is fundamental to the industry because it is the largest export destination for the other four countries (Hufbauer and Hogan, 2022), thanks to its entire manufacturing sector which include the massive usage of chips. The leading position of Taiwan is well explained by the

presence of one of the main “foundry” companies producing semiconductor in the world, Taiwan Semiconductor Manufacturing Corporation (TSMC). The company sells chips to Apple, AMD, Nvidia, Qualcomm, and many more, accounting for more than 50% of the number of world’s semiconductors produced. South Korea, on the other hand, host the company Samsung Electronics, serving both as a foundry and an integrated devices manufacturer (IDM), producing semiconductors for use in both its own products and those of other businesses. Japan is known for being hosting several fabrication plants especially owned by American and Taiwanese companies, together with the respective Japanese companies. Last but not least, US host the company Intel, which is as well a leading enterprise and has a “IDM” model. Both the monetary value of imported US semiconductors and the fact that many US-based corporations own and run semiconductor fabrication facilities in other nations, such Japan, can be used to explain disparity in the two US data on manufacturing capacity of 12% and the market share value much higher of 46% (World Population Review, n.d.). It’s fundamental to notice that the importance of each country and its position in rankings is also given by the type of chips they produce and the price the product is sold at. While Japan and China are specialized in simpler chips suitable for automobiles, household appliances and consumer goods, sold at a price under \$1, South Korea, US and Taiwan are known for complex, high-value chips, importing simpler and low-value chips from abroad, sold at more than \$2 (Hufbauer and Hogan, 2022). In fact, based on what The Economist report, Taiwan produces 90% of the most advanced semiconductors in the market (The Economist, 2023).

### 2.3.1. GVCs diversification and the US approach

In the last four years the semiconductor industry has been the hottest topic when referring to the companies’ strategy of reshoring, especially in the US-China context, as well as Europe. In fact, starting from 2020, there have been significant global shortages in semiconductor supplies, causing the so-called "semiconductor shortage crisis". The reasons behind the crisis are the Semiconductor Supply Chain complexity

and the geopolitical tensions characterizing the industry. However, the COVID-19 pandemic mostly made the previous ones escalate rapidly (Mohammad et al., 2022). As a result of people asking for product such as PCs and smartphones while stuck at home because to the Covid-19 outbreak, supply chains and chip production were severely disrupted. This increased demand for semiconductors, including memory chips produced by South Korean companies Samsung, SK Hynix, and Micron. Additionally, less sophisticated circuits needed for functions like device power management saw an increase in demand. It caused a significant shortage that persisted through the first half of 2022 of goods like game consoles and even washing machine parts. Additionally, there was a shortage of semiconductors used in automobiles, which caused major automakers to produce fewer vehicles (Kharpal, 2023). Having the COVID-19 originated from China, and Asia in general was the first continent hit by the pandemic, the closure of fabrics and the further implication on the economy deeply impacted the sector, which highly depends in Asia for 75% of the global production of all the types of chips (Varas et al., 2020), as we saw in the Figure 16. Considering that a significant percentage of the manufacturing activity is focused on East Asia, Covid has also shed light on the possible weaknesses in the global supply chains of US semiconductor companies. A worldwide supply chain is more susceptible to disruptions from natural catastrophes, pandemics, or geopolitical conflicts when there is a significant concentration in a single nation or area, as the COVID-19 situation and many other events previously described, has demonstrated. Strengthening supply-chain resilience through geographic diversification is crucial, given the vital importance of the semiconductor sector for the US economy and national security (Varas et al., 2020). For this reason, and taking into account the exposure of the sector to a different series of possible economic and political disruptions, the US government is prone to increment the manufacturing capacity in its country, investing billions of dollars in funding for reshoring on this industry. On August 2022 they announced the CHIPS and Science Act, whose principal point is the huge investment of \$52.7 billion for the advancement of American semiconductor production, research, and workforce



development (The White House, 2022). The consequences on the US economic, social and political status regarding the semiconductor specific industry may be (Aggarwal, 2023; Varas et al., 2020; PwC, n.d.):

- Creation of regional high-tech clusters that produce a prosperous local economy and high-quality jobs: for the local economy, this direct job creation typically has a multiplier effect. Over time, it may also serve as a pull for other value-chain businesses looking to capitalize on cluster effects, such as improved semiconductor ecosystem collaboration, accessibility to the regional workforce and established supporting facilities.
- Complies with the industrial policy of the Biden-Harris administration to improve American supply networks, revive American industry.
- Boost of the US goods trade balance: in 2019, the US had a trade surplus of approximately \$8 billion in semiconductors. By increasing the exports of semiconductor products developed and made in the US, more US-based fabs could increase this surplus.
- Dealing with China's unfair trade practices. Important limitations are included in both the financial incentives and the tax credit in order to stop the Chinese semiconductor manufacturing industry from directly or indirectly profiting from the Act. Expanding semiconductor production in China or any other nations that threaten US national security is not permitted for beneficiaries of funding.

In concrete, beginning with the CHIPS Act's introduction in the spring of 2020 and continuing through the months that followed its passage, in the United States, there have been more than 50 new projects related to the semiconductor ecosystem announced. These initiatives include building new semiconductor manufacturing facilities, expanding already existing ones, and developing facilities that provide raw materials and equipment for chip production. 20 states have announced over \$210 billion in investment from the private sector to boost local manufacturing capacity. As

a result of the new initiatives, 44,000 new, high-quality jobs in the semiconductor ecosystem are expected. These positions will support hundreds of thousands of additional jobs across the whole U.S. economy (Casanova, 2023).

The semiconductor industry already has a thriving set of clusters in the US, including those in and around the cities of Dallas and Austin, Texas, Portland in Oregon, and Phoenix in the state of Arizona. Additionally, the United States has generously subsidized Taiwan Semiconductor Manufacturing Company (TSMC) to construct two new fabs in Arizona through tax credits granted by the US government. It has been stated that the construction of advanced logic fabs in Arizona worth \$40 billion by TSMC, the biggest dedicated semiconductor foundry business in the world, is the first step toward increasing the US's capability for cutting-edge semiconductor manufacture (Varas et al., 2020). Another company investing in the US territory for a new fabrication chip plant is the South Korean Samsung Electronics Co Ltd, which is investing \$17 billion in Texas. The country in question is moreover incentivizing the investment in the territory through the Texas CHIPS Act, setting aside \$1,4 billion for manufacturers to build new facilities and for universities to fund the construction of relevant R&D centres. Texas is home for plenty of investments coming from several big companies and the result of it is the possible creation of more than 8'000 jobs (Tarasov, 2023). Last but not least, another great example of a big multinational investing in US is Intel, planning to spend \$20 billion in Arizona, creating two new fabs which are expected to employ around 3'000 people (Casanova, 2023).

The most important case of sanctions from US towards China is the ban imposed on the company Huawei starting from 2019. Huawei is a top global Chinese supplier of smart products and ICT (information and communications technology) infrastructure. As the Financial Times report, since 2019, Washington has prohibited American vendors from selling to Huawei without export licenses and restricted the company from utilizing any US technology for chip design and manufacture. Washington contends that Huawei poses a security risk and worries that it may aid Chinese

espionage. After the limitations were put in place, Huawei's sales, profits, and market share all fell. The company's once-dominant mobile phone division has seen its unit sales plummet. It had no choice but to stop producing 5G phones due to a lack of semiconductors. The Huawei strategy has placed a strong emphasis on its ambition to replace established western technologies with domestic goods, and the government is helping with great investments to support high-tech research programs. The main objective is helping the company to develop the knowledge needed to produce advanced semiconductors which were previously imported, in order to be able to keep on with the technological development of the whole country (Liu, 2023). Furthermore, the US government imposed sanctions on Semiconductor Manufacturing International Corporation (SMIC), the biggest chip manufacturer in China, in September 2020, claiming military end use in China. Its access to advanced technologies was restricted after it was added to a U.S. trade blacklist, making it difficult for the company to be able to develop innovative chips at a price that is competitive (Chiang, 2023; Ciani and Nardo, 2022).

However, the US are not alone in the willingness to gain a certain independence on the semiconductor value chains and become self-sufficient as much as possible to avoid severe disruptions along the production. In ten years, the Chinese government hopes to achieve 70% semiconductor output self-sufficiency. In 2020 we saw an acceleration of China's efforts to reduce its reliance on foreign chips due to trade concerns and limits on access to vital US technology. Furthermore, China wants to be the global leader in the development of chip technology, which will power key platforms for its economic and technological advancements, including those for 5G and artificial intelligence (Gabriel, 2021). However, the US needs to pay attention when shutting off China's access to cutting-edge semiconductors, since it would be a self-defeating strategy given that the Chinese market accounts for 36% of all U.S. chip sales (Allison et al., 2021).

### 2.3.2. The EU position in the high-tech and semiconductor industry

The European Union find itself in the middle of the biggest trade war of the history between US and China. As we stated in the previous paragraphs for the semiconductor industry, the various nations each maintain a dominant position in a particular chain segment; nevertheless, not one country remains sovereign or independent over the whole chain and the rule is applied also to the European Union. In this sector in particular, the EU is not dominating the market, but it covers a fundamental position in the industry. In the period between 2007 and 2019, European nations grew their reliance on imports (backward integration), but they also strengthened their ties to the rest of the globe by exporting more of their products (forward integration) (Ciani and Nardo, 2022), thus making the GVC more complicated and difficult to disentangle. Over the past ten years, the European chip sector has generated over USD 30 billion in annual sales, directly supporting about 200 000 jobs and indirectly supporting up to 1 million employments through its services and applications. In particular, Europe is specialized in the sale of “discrete” semiconductors, a simple category of chips, and of a more advanced type of the products, called Integrated Circuits, which itself generate \$37 billion market volume in EU in 2023 (Statista, 2023). Thanks to the global market share in these categories, the EU supply to the automotive industry about 37% of the semiconductor produced, and another 25% to other industrial applications (Raza et al., 2021). However, in the case of Europe, despite the high market share reported above for those specific sectors, the semiconductors commercialized are mostly imported from the leading nations, China, Taiwan, Japan, South Korea and US. In particular, the majority of integrated circuits imported to the EU come from Taiwan. The real strength of Europe in this value chain is related to the production of tools and machineries employed in the foundries. When we examine the trade data for the inputs used by chip producers, such as the equipment used to make semiconductors, we discover that the EU is a net exporter of these goods. This is largely because of the contribution of some European manufacturers who have become industry leaders in the previous ten years, including ASML, Rhode and Schwarz, and Trumpf. Once

again, Taiwan is the number one country involved in this trade between EU and extra EU countries, in fact the absence of machine imports from outside the EU is explained by the few foundries currently operating in the EU, which encourages European manufacturers of machines to establish their primary markets in Asia (Ciani and Nando, 2022). The composition of the value chain reflects also the actual position of the EU in the sector. Thanks to the analysis done by Ciani and Nando (2022), we can notice that almost 80 percent of suppliers to European semiconductor companies typically have their headquarters outside of the Union, and 63% of consumers of EU enterprises are based outside the borders. Moreover, EU accounts for a residual part of the total revenue generated by the semiconductor industry in total, registering \$53 billion in 2023 compared to the single Chinese country, which accounts itself for \$179 billion. However, the projected increase in the market volume based on Statista.com for 2027 is 6.64% (Statista, 2023). To cite some companies that make the difference in the semiconductor European market, we have:

- **ASML**, a Dutch company which is one of the top producers of chip-making machinery worldwide, with Intel, TSMC and Samsung Electronics as its main customers.
- German-based **Infineon** is one of the Europe's top manufacturers of semiconductors. They specialize on creating integrated circuits and microchips for a variety of uses, including the automotive, industrial, and consumer electronics industries.
- **STMicroelectronics** is an Italian-French company specialized in the whole value chain of semiconductors (Integrated Device Manufacturing), from the R&D to the commercialization.
- **NXP semiconductors** is a Dutch company specialized in the semiconductor production for sectors such as automotive, communication infrastructure, industrial, mobile and smart city.

In particular, ASML is Dutch leading company which drives the whole European semiconductor market. The company is the only supplier of EUV lithography equipment, a sophisticated projection-system machine able to capture and transfer light, and print the outcome through a complicated process which as a result create the semiconductors. The strongest semiconductor chips in the world are made by these machines using extremely strong UV light, placing the company in a favourable position. ASML generates billions of dollars in revenue yearly and has a market valuation close to \$300 billion (The Generalist, 2023). Based on data coming from Statista, the sales revenues of the company in the world registered in 2022 are concentrated mostly in Taiwan, South Korea, China and United States, leaving a small percentage to the EMEA market. Between 2014 and 2022, ASML's overall net revenue increased yearly. The multinational Dutch corporation generated over 5.9 billion euros in net sales in 2014. This increased to almost 21.17 billion euros in sales by 2022. Taiwan accounts for 8 billion euros generated as sales, mostly due to the partnership with TSMC, followed by South Korea with 6 billion. China takes the third place with almost 3 billion euros (Statista.com, 2023). Since ASML is based in the Netherlands, a country that supports the United States, the US limitations on China have an impact on its company and limit the number of machines it can ship to Chinese clients. In fact, for companies like this, the technological rivalry becomes a deciding factor (The Generalist, 2023).

To summarize, the European market is mainly impacted by companies producing machineries and tools for the production of semiconductors to export to the extra-EU market but lacks manufacturing facilities at the most sophisticated nodes and big IC designers of the calibre and scale of Broadcom, Nvidia, and Qualcomm (Duchâtel, 2022). Europe produces fewer than 10% of the world's semiconductors, and only the larger chips with a diameter of at least 22 nanometres are produced there. Only two firms in east Asia (TSMC in Taiwan and Samsung in Korea) can build cutting-edge chips (at 2 to 7 nanometres), while ASML in the Netherlands is the only manufacturer

of the necessary machinery in Europe sold worldwide (Van Wieringen, 2022). This reflects the initial assumption that each region, country and firm is a fundamental piece of the whole complex market, and it can't sustain itself without creating dependencies with other nations, both upstream and downstream value chain activities.

Singapore, Taiwan, South Korea, China, and the US have recently overtaken the EU in terms of semiconductor manufacturing as a result of the US and Asian semiconductor sectors receiving considerable assistance in recent decades through a range of legislative measures. However, as all the other countries did, also EU is in the process of further investing in the sector to gain more independence in the field and be autonomous to avoid GVCs disruptions. The difficulty of ensuring that Europe has access to cutting-edge technology is "a matter of competitiveness, but also a matter of tech sovereignty," according to President Ursula von der Leyen (Duchâtel, 2022). Following the path of US, also EU started to propose and implement a strategy to protect the semiconductor GVCs and enhance the overall power of the region in the whole market. In order to create a robust semiconductor ecosystem and robust supply chain, as well as to establish mechanisms to foresee, plan for, and react to potential future supply chain disruptions, the EU Chips Act seeks to capitalize on Europe's capabilities and address its remaining vulnerabilities. Europe was no less impacted by the shortages of semiconductors occurred during the pandemics of 2020 which resulted in factories closing and entire sectors struggling to produce without microchips, especially car manufacturers in Europe. Due to the scarcity, 11.3 million automobiles were unable to be manufactured worldwide in 2021, and several Member States suffered a dramatic decrease in their car production. The EU Chips Act was first proposed at the beginning of 2022 and adopted in July this year. By 2030, the expenditures would increase the EU's market share of semiconductors from 10% to 20%, which would necessitate a minimum of four times the amount of the current European chip output, according to growth predictions (Van Wieringen, 2022).

The proposed investment from the public and private sector is supposed to reach 43 billion euros, and the principal allocations and outcomes to serve would be (Van Wieringen, 2022):

- In the short term, the Recommendation's toolkit will make it possible for the Member States and the Commission to coordinate right away. If deemed required, this will enable discussion and decision-making regarding prompt and appropriate crisis response steps.
- In the medium term, the Chips Act would assist the scaling up and innovation of the entire value chain, addressing supply security and creating a more robust ecosystem. It will also strengthen production operations in the Union.
- In the long term, while developing the necessary technological capacities to assist the transfer of expertise from the laboratory to the fab, it will help to keep Europe at the forefront of technology and position the continent as a leader in cutting-edge downstream markets.



## BOX: IN-DEPTH ANALYSIS OF EU CHIPS ACT

To schematize what Europe desire to achieve thanks to the Chips Act, the Commission identifies five strategic goals and the ways to accomplish each of them:

Strategic objective	Means
<b>Technological leadership</b> to protect its investments in cutting-edge technology, manufacturing innovative materials, and equipment.	Invest in <b>R&amp;D</b> to achieve transistor sizes below 2 nanometres, expertise in artificial intelligence, energy-efficient processors, innovative integration of various and new materials, emerging design solutions, and quantum chips.
Strengthen <b>innovation capabilities</b> in the design, production, packaging, and use of cutting-edge, energy-efficient, and secure chips.	<ol style="list-style-type: none"> <li>1. Invest in building a large <b>design infrastructure</b> for integrated semiconductor technologies to collaborate with users and producers on the design and development of chips for European priority industries. Invest in “first of a kind” facilities.</li> <li>2. Standardize certifications for reliable and secure chips</li> </ol>
Boost <b>FDI</b> and quadruple <b>production capacity</b> by 2030.	<ol style="list-style-type: none"> <li>1. Establishing open EU foundries that serve foreign players and integrated production facilities that serve the European market.</li> <li>2. Create a chip fund with the exclusive purpose of boosting investment in high-risk, creative SMEs, including startups.</li> </ol>
Addressing <b>skills shortages</b> , attracting talented people, and fostering the growth of skilled workers.	<ol style="list-style-type: none"> <li>1. Encourage access to training opportunities of all types.</li> <li>2. Encourage the development of a network of competence centres across Europe that will give people access to technical knowledge while also luring fresh ideas and talent.</li> </ol>
Increase the <b>knowledge</b> of the world's supply networks for semiconductors and coordinate the risk assessment.	<ol style="list-style-type: none"> <li>1. Creating an emergency response toolbox with actions including required data collection, prioritizing orders for crucial industries, and group purchasing practices during a supply constraint.</li> <li>2. Enhance preparedness through ongoing monitoring that includes national market analyses, stakeholder surveys, and an entirely novel European chips board made up of senior Commission and Member State officials to implement early warning systems and foresee future disruptions and shortages of semiconductors.</li> </ol>

Source: Van Wieringen, Kjeld. “Strengthening EU Chip Capabilities: How Will the Chips Act Reinforce Europe’s Semiconductor Sector by 2030?”; Think Tank, European Parliament. [www.europarl.europa.eu](http://www.europarl.europa.eu), 7 July 2022.

The EU chips legislation will need to compete with or complement the already successful investment plans in the US and East Asia. To encourage advanced chip manufacturers, such as Taiwan's TSMC, to develop production facilities, the United States and Japan are announcing plans for investments worth US\$52 billion and US\$6.8 billion, correspondingly. South Korea has implemented six to ten percent cuts and other measures in an effort to attract an additional US\$225 billion and US\$450 billion in Chinese and Korean assets over a period of ten years. China is believed to be investing US\$97 billion in local funds over the 2014–2024 timeframe (Van Wieringen, 2022).

The trend toward regionalization of GVCs may be linked to some part to reshoring activities, with high-tech firms being more likely to reshore than those in different sectors. The major driver of reshoring in the semiconductor industry is industry 4.0 and can impact the process in two different ways (Raza et al., 2021):

1. Industry 4.0's good productivity gains might mitigate the factor cost advantages of outsourcing sites.
2. The promise of more adaptable manufacturing techniques could operate as a motivator to transfer production closer to important customers, such as the EU's car industry.

If technological advancements are able to further reduce the production cost advantage currently enjoyed by Asian nations that have a well-established chip manufacturing industry, the increased manufacturing flexibility and shorter lead times anticipated from new production processes could encourage moving semiconductor manufacturing capacity to the European Union. Additionally, it would be in the EU's interest to keep or develop cutting-edge semiconductor production capacity within its borders, taking into account potential supply chain disruptions brought on by geopolitical conflicts in the future (as reflected by USA trade barriers on China). The willingness to be independent from China at every stage of the value chain in the high-tech sector is one significant commonality with US policy (Raza et

al., 2021). As the trade dispute between the two major economic superpowers grew (US and China), Brussels branded China a "systemic rival" in 2019. However, according to Eurostat data, the value of products exported by the largest exporting nation in the world had nearly doubled during the 2018-2022 period (Romei, 2023). While gaining GVCs independence is a key point in almost all the strategies implemented so far, an opposite view is also appealing to Europe. Improving the safety of supply chains by strengthening current overseas dependence on European semiconductor assets is the subject of another key initiative. Imec (Interuniversity Microelectronics Centre) CEO Luc Van den Hove stated regarding semiconductors that the production may be concentrated in Taiwan and South Korea, however having ASML in the Netherlands, there are vital links in the chip sector. The entire globe is dependent on European knowledge of machines. He refers to the term "reversed dependency." This idea blends European competitiveness with global links, which fits in perfectly with the EU's balanced philosophy of open strategic autonomy (Van Wieringen, 2022).

Table 5: Reshoring involvement index of the leading European electronical companies

<b>Companies</b>	<b>A</b>	<b>B</b>	<b>C</b>
Medtronic, Ireland	0	0	0
ASML Holding, The Netherlands	0	0	0
ABB, Switzerland	1	1.5	2
Philips, The Netherlands	1	1.5	2
NxP, The Netherlands	0	0	0
TE Connectivity, Switzerland	1	1.5	2
Infineon, Germany	1	1.5	2
STMicroelectronics, Switzerland	1	1.5	0
DSM, The Netherlands	1	0	0
Nokia, Finland	0	0	0
<b>TOTAL</b>			<b>21.5</b>

Source: Medina, J. S. (2022). From deindustrialization to a reinforced process of reshoring in Europe. Another effect of the COVID-19 pandemic? *Land*, 11(12), 2109

Based on a structured study conducted by Medina (2022) about local companies reshoring in the European region, several cases emerged in particular in the electronical sector, which follows the apparel, appliance and pharmaceutical sectors.

In our case, all the ten largest European electronic businesses by revenue in 2021 shown in the table 5 are partially or fully integrated in the semiconductor industry ecosystem, especially ASML, NXP, Infineon and STMicroelectronics. The analysis shows indexes based on the approach to reshoring and relocating of each company listed. Column A indicates that the corporation published reshoring-related news, Column B indicates that agreements for the transfer or establishment of a fresh manufacturing facility were promoted, and Column C indicates that the reshoring procedure was previously completed, and the new factory was in production (Medina, 2022). The worth noting case is the following: Infineon, a company leader in the semiconductor solution in the European region, find itself in the position of already having announced a reshoring process in Dresden, Germany. The new factory represents Infineon's single-largest investment in company history with a total investment worth five billion euros. By increasing production capabilities at the current Dresden location, Infineon will be able to finish the project swiftly and produce significant scale effects. The first day of manufacturing is anticipated for 2026 and is focusing on creating a smart factory, reflecting the previous assumption that Industry 4.0 is the main reason why companies are actually implementing reshoring in the region. Smart factories can increase growth and efficiency, guarantee high quality while lowering the possibility of human error, provide the appropriate data for analysis and optimization purposes, minimize downtime and delays through predictive maintenance, protect the supply chain from disruptions, provide customized products, satisfy sustainability obligations and ultimately become increasingly competitive (Infineon, 2023). This huge investment followed a new producing facility built and operating in Villach, Austria since 2021 (Medina, 2022).

To help Europe gaining a sustainable position in the whole industry of semiconductors, Intel, a well-known American company leader in the sector, is investing billion euros across the region. The European Chips Act is incentivizing companies to build new manufacturing sites in Europe, and Intel has been attracted

by several countries of the Union. Over 10,000 employees are currently employed by Intel in the EU, where it has had a presence for over thirty years, in particular in a hub present in Ireland, which produce wafers, an essential component for semiconductors. Nowadays Intel plans to invest 80 billion euros throughout the whole semiconductor value chain, from research and development to production to cutting-edge packaging technologies. With this historic investment, Intel hopes to transfer its most cutting-edge technology to Europe, develop a new chip ecosystem there, and answer the demand for a more stable and balanced supply chain (Intel, 2022):

- Intel is planning to build one groundbreaking semiconductor manufacturing facility in Magdeburg, **Germany**, as part of the initial phase, investing 17 billion euros to produce advanced semiconductors.
- The already existing wafer fab in **Ireland** will be expanded through an investment of extra 12 billion euros, preparing to double the manufacturing area in order to increase foundry services and introduce Intel 4 process technology to Europe.
- By constructing its new European R&D base in **France**, Intel intends to add 1,000 new high-tech jobs there. For high-speed computing and AI design capabilities, France will serve as Intel's European headquarters. A wide range of industries including automotive, the agricultural sector, climate, drug development, energy, genomics, life sciences, and security will benefit from these innovations, considerably enhancing the quality of life for every European.
- Intel already has operations in **Poland**, and it is in a good position to collaborate with its locations in Germany and Ireland. In addition, it has relatively low costs compared to other manufacturing hubs across the world and a strong skill pool that we are eager to develop. The aim is to build of a brand-new state-of-the-art semiconductor assembly and testing facility, and solutions in the areas of deep

neural networks, audio, graphics, data centres, and cloud computing are the main areas of focus. It should be opened by 2027.

- For Spain, Belgium and the Netherlands, the company has partnerships with local firms such as Barcelona Supercomputing Centre, the giant company ASML, and Interuniversity Microelectronics Centre (IMEC).
- **Italy** and Intel have started talks to create a cutting-edge back-end manufacturing facility. This factory, with an estimated cost of more than 4.5 billion euros, would generate about 1,500 employments for Intel and an additional 3,500 positions for partners and suppliers, with operations set to begin in 2 to 5 years. With the use of cutting-edge technologies, Intel and Italy hope to make this facility the very first of its kind in the EU. However, the progress of the negotiations is currently unknown, and the possible location could be Piemonte or Veneto, more precisely Verona.

The Intel decision regarding the investments is also based on the effort made by each country to invest in the project, both regarding human skills and location advancements, for this reason Italy, but also all the other countries needs to keep show the economical commitment to attract the company and invest funds to stay in the market. The investments made by private companies such as Intel are planned to reach a sum not even imagined by the union, which will definitely enhance the power of the European market and serve as a catalyst for the further development of the sector.

If we look closely at the Italian market in the semiconductor industry in general, from R&D to the sales phase, the data shows how Italy is ranked second in Europe (after Germany) for the number of microelectronics companies, and it is home to a number of important market leaders, including STMicroelectronics as the main partner, followed by Micron, Infineon, Global Wafers, Lfoundry, and Vishay. If Intel finalize the negotiations and agreements with the government for the new facility in the country, Italy could enhance its position worldwide. The export and import values of

specific semiconductor devices, which total € 792 million and € 1.2 billion, respectively, also support the Italian microelectronics cluster's pivotal role in the world. Behind the well-known Made in Italy excellence in manufacturing, the nation has an extensive network of excellent educational institutions and R&D facilities, as well as a dedicated and loyal workforce that provides top-notch expertise and high-tech cross-sectoral solutions at cost-effective rates. In fact, Italy has one of the greatest talent pools in the European Union, with highly qualified individuals who are capable of developing and enhancing know-how. More than 36 thousand employees are working in the microelectronic sector, creating a production value of almost 7 billion euros (Italian Trade Agency, n.d.). STMicroelectronics, beyond its presence in France, Singapore, and other several countries in Asia, is present in the Italy with two hubs specialized in the front-end phase of the semiconductor production (manufacturing of a semiconductor from a blank to a finished wafer), one in Catania, Sicilia, and the second one in Agrate Brianza, Lombardia, which is being renovated to enhance the production quality and specificity (STmicroelectronics, n.d.).

The opportunities for companies willing to invest in Europe thanks to the European Chips Act are increasing, and the market has possibilities to be expanded due to the massive investment Intel is undertaking in the region. However, the Union is still depending highly on the relationships between US and China and find itself in the middle of the trade war, and the high investment required by companies to build a fab is determinant when deciding where to locate a new manufacturing plant. The main objective is to be able to produce the smallest semiconductor in the market also in Europe, and big companies such as Intel are increasing the market power of the region. The EU aims to expand its portion of the worldwide semiconductor sector from 9% to thirty percent by in the year 2030. To achieve this goal, it must reconsider its approach to microprocessor manufacture and emphasize its strengths, in order to keep up with the superpowers in this sector.





## CHAPTER 3: THE OBSTACLES TO FULLY RESHORED GVCS

What we analysed so far concerning the reshoring process, its mechanisms and the practice adapted to the semiconductor industry is enough to properly introduce the obstacles that countries and companies face when reorganizing their global value chain to opt for a relocation strategy. After discussing in details the geopolitical situation and the industry, it's clear how each country and company will hardly ever be independent not only for the high-tech and semiconductor industry in specific, but for several sectors, if not all. China is projected to be the biggest superpower in the world, surpassing the US, Europe and all the other developed countries leader in several industries, and decoupling from it is not feasible, at least for the next decades. In this final chapter we will analyse the obstacles that countries and industries are encountering while pursuing reshoring at different stages of the global value chain, such as shortages of high-skills employees, high costs, the predominancy of China and the Asian countries, pointing out to the different approach US and Europe are sustaining towards China, using processes of decoupling and de-risking to face the current economical situation.

### 3.1. De-risking versus de-coupling

China, despite the recent blocks imposed by the US and consequently by other countries partners, is still leading the world in terms of economic growth and manufacturing supremacy. As we already specified in this work, data from the United Nations Statistics Division show that China accounts for almost one third of the world's manufacturing output. Manufacturing in China contributed about \$4 trillion in total value added in 2019, accounting for close to 30% of the nation's overall economic output. Today, manufacturing accounts for significantly less of the U.S. economy than it formerly did; in 2019, manufacturing made up just over 11% of GDP (Richter, 2021). For this reason, the world is taking into consideration the possibility to strengthen their global value chains and trying to be as much independent as possible,

especially in those sectors fundamental for the defence and military purposes. The trend goes in the opposite direction of the interdependence among China and the world achieved over many decades, but now crumbling under disagreements. On the one hand, the US has seen a sharp decline in its imports of some Chinese goods, such as semiconductors, some IT systems, and consumer electronics. Even imports of furniture, clothing, and shoes have decreased. On the other hand, more toys, cell phones, video game consoles, computers, and computer monitors are being imported from China than ever before (Bown, 2022). In addition to the economic supremacy of China, being dependent on this country is dangerous for other two reasons (Carboni, 2023):

- The most advanced Western technology could end up in Beijing's arsenal. That is why the United States has blocked the export of sophisticated microchips, asking Japan and South Korea to participate in the embargo.
- The lines between civilian and military use are very blurred, which could force the area of fencing to be expanded. Biden could include bans in the fields of artificial intelligence, quantum computing, clean energy, and biotechnology. The goal is to slow down Chinese innovation so that the United States retains its technological supremacy for as long as possible.

In the light of the current political and economic situation in the world, among wars, discrepancies in the political relations between countries, a post pandemic crisis, and a rising inflation currently impacting the market, the reshoring and independence topics are at the top of the priority list for countries. The United States has often discussed “decoupling”, which is the idea of sharply dividing the economies of adversary nations, specifically with regard to China. The decoupling strategy was started by Donald Trump and continued by Joe Biden, whose work resulted in the most extreme embargo the US has ever imposed against Chinese technology. However, not everyone shares this opinion. In fact, some people even inside American culture believe that decoupling is an unachievable or very difficult undertaking. It is

sufficient to note that U.S. imports of products and services from China hit a record high in the previous year (Carboni, 2023). US is the nation closer, even if not fully able, to implementing this strategy, especially regarding the significant 25% tariffs the US put on imports from China in 2018. On the other side, Europe started to talk about de-risking, in search of a slighter, more cautious strategy in order not to revolutionise in a negative way the economies hardly depending on China. Commission Chair Ursula von der Leyen spoke about it first, then the concept was taken up by Biden and incorporated into the final statements of the last G7 (Carboni, 2023). The notion of de-risking involves targeted action taken for a small number of highly sensitive technologies and is concentrated on reducing excessive dependence through diversification in order to increase national resilience. In the trade relationship between China and the EU, there is a significant imbalance between imports and exports since the degree of openness on the Chinese side is not comparable to the degree of openness on the EU side. However, this year has been admitted that Europe could not completely "decouple" from trade with Beijing. Instead, by manufacturing commodities deemed essential for national security within the EU, it would "de-risk" its economy. Despite the EU eliminating crucial dependences and vulnerabilities, a summit of EU leaders determined that Beijing and Brussels would remain significant trade and economic partners (Romei, 2023).

The disproportionate approach of US and EU is due to the higher dependency of Europe on China compared to the US. According to American bank Morgan Stanley, 8% of the revenues of publicly traded European companies come from China, compared to 4% for American companies. China receives 7-9% of the items exported by both Europe and the United States, although Europe's sensitivity to trade is higher. In comparison to America, multilateral investments in China account for 2% of the GDP of Europe. The more vulnerable country is Germany, followed by the Netherlands, while US registered an exposure of 4,6% of the GDP, less than half of the number registered by Germany, which is 9,9% (The Economist, 2023). The other highly

dependent economy is the Dutch one. An alarm comes from the Dutch Minister of Trade, who, speaking of de-risking, pointed out that Europe's ecological transition is impossible without China. The Asian country dominates some green technologies, such as solar panels and electric batteries for cars, the demand for which is growing a lot to meet Europe's green deal goals (Carboni, 2023). Since the pandemic began, European businesses have begun to diversify their suppliers by "friend-shoring" to allies and "near-shoring" locally, having learned that they must source from more than one country, not just from China. The US is approaching "friend-shoring" too, focusing on countries they can rely on (The Economist, 2023). Reshoring, as it is used in this instance, enables the EU to maintain the industry's value within its borders without relying too heavily on outside suppliers. However, even though Infineon earlier announced a large investment in its own region as specified in the previous paragraphs, it did not dismiss Asian fabs, instead investing more funds to boost the power of its fab in Kulim, Malaysia. Infineon will contribute up to five billion euros over the course of the following five years to the Kulim fab. By the end of the decade, the investment might generate seven billion euros in annual SiC (a special type of semiconductor) revenue, when combined with the conversion of Villach and Kulim to 200-millimeter SiC. With an extremely competitive production base, Infineon will be able to achieve its 30% SiC share of the market target by 2030. The firm is sure that its SiC sales would exceed its objective of a billion euros in the fiscal year 2025 (Infineon, 2023). This approach to the world market demonstrates the strategy of de-coupling, keeping an excellent relationship with Asian countries without being fully dependent on them. A partial return of production to the home region is being demonstrated the most successful approach to a world stressed by consistent disruptions of the value chain. To summarize, the strategy the European Union came up with on March this year is based on three main pillars:

- reduce dependences on raw materials and some technology products.

- limit frontier technology exports, which would otherwise advance Beijing's military capabilities.
- Continue to push Western companies to trade with the vast Chinese market.

How to adjust to shifting economic and geopolitical circumstances is the G7's main concern. In the future, the solution will be roughly determined through unpredictable market changes. In the meanwhile, some economists proposed an approach to prevent GVCs to fall down, governments may simulate and get ready for unexpected shocks and shifting conditions by stress-testing supply systems. They could estimate the robustness of crucial supply networks in the face of both well-known financial crises and emerging non-financial hazards using adverse scenario assessments. The essential calculation is the interval between what is known as a supply chain's "time to survive", or how long it can continue to meet demand following a disruption, versus its "time to recovery", or how much it takes to reduce or adapt the disruption that occurred. The supply chain won't be able to balance supply and demand if the time to recover for a particular plant exceeds the time to survive without a backup plan. Using this method, businesses may build mitigation strategies for the most important supply chain links that could be used in various situations and determine the financial impact of disruptions (Paduano, 2021; Simchi-Levi, 2021). The OECD itself developed a program of policy tools for preparedness and responsiveness to build resilient supply chains, which is based on four steps to carefully follow for the tool to work: identify potential risks, determine the government role in the GVCs, identify strategies and guidelines (every kind of threat assessed should have a risk management strategy in place) and correctly diagnose the shock) (OECD, n.d.).

### 3.2. The workforce challenges in developed countries

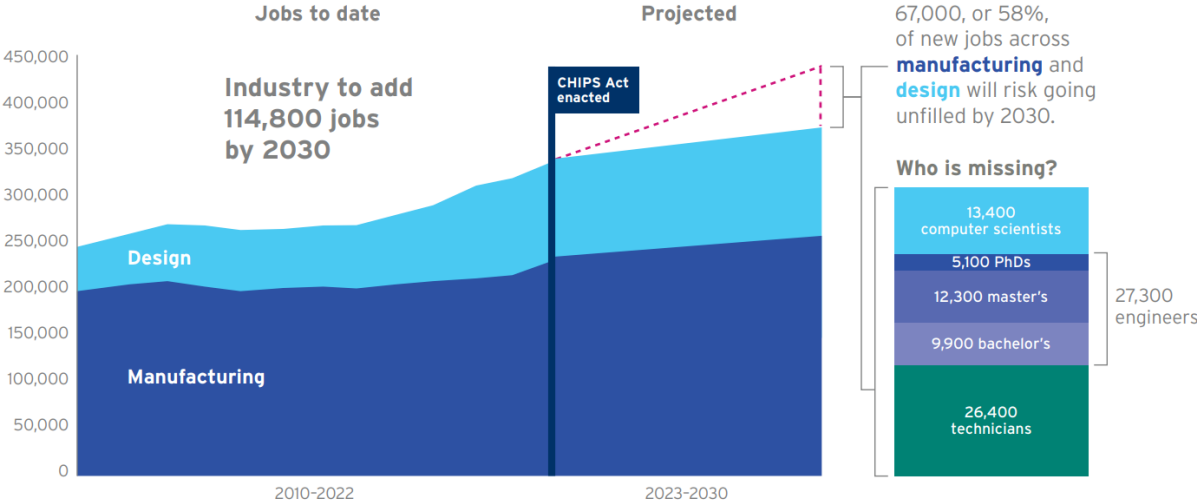
Among all the previously discussed geopolitical tensions and disputes, there are several other issues that countries need to overcome in order to be able to implement the reshoring strategy in its totality, and it doesn't seem that these hard challenges are going to be surpassed easily in the next decades. The industries impacted don't only

concern high-tech sector, which has been the focus of this work, but all the other fundamental industries with globalized supply chains interconnecting different countries. The most impactful crisis that is shaping the current economic scenario and is preventing companies from relocate is the lack of skilled workers, especially in developed countries. This issue represents one of the first reasons why the relocation of the manufacturing departments along the supply chain is hard to implement, and is followed by the high capital intensity needed to build new plants around the world, rising cost of raw materials that is currently ongoing due to the war in Ukraine, and the loss of competitive advantages previously obtained relocating to developing and cheap countries starting from the '90s.

When companies relocated the production phase of the global value chain to poor countries 40 years ago, at the beginning of the globalization process, they were in search of low wages, high number of workers to be employed in fabrics, and low competitive prices for raw materials. However, as data shown previously, the developing countries are not that cheap and easy to access as they once were, especially China (Figure 13). In particular, the issue is concentrated in both low-skilled workers to introduce in the plants, and high-skilled workers for the tech industry. If we go deeper in the analysis of the issue projected to the semiconductor industry, especially in the US market, it's easier to notice the labour gap present in the high-tech sector. A considerable portion of additional chip production capacity and research and development is anticipated to be based in the U.S., in large part due to the CHIPS Act of 2022. However, as the semiconductor ecosystem in America grows over the coming years, so will the demand for individuals with the knowledge, experience, and education required for the innovative chip sector. The Semiconductor Industry Association reported some crucial data on July 2023, affirming that by 2030 they forecast that the employment in the semiconductor industry would increase by around 115,000 jobs, approximately 33% growth, from its current level of about 345,000 to about 460,000. At the present degree completion rates, they expect that 67,000 of these

new opportunities, or 58% of expected new employment risk being unfulfilled. 39% of the open positions will be filled by technicians, the majority of whom will hold certificates or two-year degrees, 35% by engineers holding four-year degrees or computer scientists, and 26% by master's or PhD-level engineers (SIA, 2023)

Figure 17: Historical semiconductor workforce and projected 2023-2030



Source: Semiconductor Industry Association. (2023, July). *Chipping Away: Assessing and Addressing the Labor Market Gap Facing the U.S. Semiconductor Industry*

The issue impacting the reshoring process is well seen in a real case concerning the US and its ambitious program of attracting manufacturing facilities in-house. The big Taiwan company TSMC, with its double investment in Arizona, has trouble finding skilled workers. The launch of TSMC's Phoenix manufacturing facility for semiconductors has been delayed until 2025, according to the company, due to a lack of expertise among American employees. Where will the employees come from to staff the new fabs after they are constructed is the longer-term question. Although the process of making semiconductors is highly automated, each fab still needs hundreds, sometimes even over a thousand, trained workers. American chipmakers are already battling a talent shortage (CSIS, 2022). For this reason, Taiwan Semiconductor Manufacturing Co. is requesting that the US government grant up to 500 extra Taiwanese workers visas, in order to transfer the expertise in the new facility. This approach, however, goes against the main aim of relocating the production part of the

value chain, based on the US view: increase the employment rates of the US (Zinkula, 2023). The Center for Strategic and International Studies affirms that TSMC is encountering challenges also in finding construction workers they need to build the fabs. The development of TSMC's new Arizona fab is now being done by 6,000 people, but the company now reports that equipment installations won't start at its predicted date originally anticipated. Similar circumstances exist in Ohio, where Intel is constructing major fabrication facilities at two locations close to Columbus. These facilities are going to need 7,000 construction workers, an employee base that labour unions and state officials claim Central Ohio lacks (Shivakumar et al., 2022).

The shortage of jobs impacting the economy as a whole is much larger than the personnel shortfall facing the semiconductor industry. By the year's end of 2030, the overall U.S. economy is predicted to generate an additional 3.85 million jobs that require technical skills. 1.4 million of these new positions risk being unfilled if we don't increase the pipeline for such workers' education (SIA, 2023). The U.S. may not be able to fully realize the capacity development, supply chain resilience, and leadership in technological innovation anticipated in the upcoming years if nothing is done to address the shortage of workers with the necessary skills and qualifications to fill the jobs created by this growth. The recommendation made by the SIA to solve this problem in the US economy are the followings:

- Support regional collaborations and initiatives that aim to expand the pool of qualified technicians for the semiconductor industry and other sophisticated industrial sectors.
- Expand the domestic STEM pipeline for the engineers and computer scientists required by the semiconductor sector as well as other key future economic sectors.
- bolster the U.S. economy by retaining and luring more foreign students to pursue postgraduate degrees.



US is not the only country facing the talent shortage, which is also affecting South Korea's and Taiwan's cutting-edge manufacturers, even if with a less impactful effect. According to reports, Taiwan's semiconductor manufacturing industry was over 30,000 workers short in the final quarter of 2021. The semiconductor industry in South Korea is expected to face a shortage of at least 30,000 qualified employees over the next ten years, with domestic institutions only graduating less than half as many students as the sector requires. An exceptional lack of qualified semiconductor workers is impeding China's efforts to become a significant competitor in the global semiconductor sector; a recent university research indicated that the worker gap exceeded 300,000 (Shivakumar et al., 2022).

Another point to consider when combining reshoring, job growth and industries based on manufacturing concerns the application of automation in the production process and its consequences. The introduction of automation in general, artificial intelligence and robots is nowadays giving companies the competitive advantage hardly desired, since this strategy reduce costs and allows to offer the final product at a lower cost compared to companies employing more humans than machines. The high-tech industry and the semiconductor sector in developed countries in general are massively investing in automation, and the challenge is to properly combine the need to stay aggressive on the market and the target to rise the numbers of manufacturing workers and increase the levels of employment. In a moment of labour shortages, the question that arises is: will robots automate occupations and eliminate the issue of worker skill shortages, or may this technology actually enhance workers' jobs qualities and assist businesses in luring more motivated individuals? The solution is not easily findable in all industries. Many people like to believe that technology is predestined, and that all wise organizations are going to replace the employees with technology immediately as automation becomes more affordable than labour for those duties that make up a certain profession (Waldman-Brown, 2022). However, automation may have a significant impact on job reallocation in the near future, instead of job losses. Jobs are

changing and new opportunities in services and high technology took the place of merely manufacturing workplaces, sometimes even enhancing the number of employees in a manufacturing plant applying automation in different forms. There are numerous instances of businesses increasing their workforce through automation. To satisfy the growing demand, Utah-based Wing Enterprises made an investment in welding robot systems, which enabled them to grow from 20 to 400 workers. Other manufacturers have made investments in labor-saving technologies like collaborative robots or Internet of Things sensors that can give repair technicians up-to-the-minute information (Karp, 2021). However, this kind of shift has the potential to be quite disruptive. It is common for workers who change industries to need new skills, as well as to maybe relocate to new employment and occasionally new geographic areas (Bessen, 2019). This results in a change in skill requirements from companies, since robots and AI is lead by humans and needs to be controlled and handled by people with the right level of knowledge. The rapid change is competences the market require from people and students is rapidly evolving, unfortunately not at the same pace of humans skills, resulting in the many job vacancies previously presented, especially in the US. Workers with the necessary technical credentials who are eager to learn new technologies and, ideally, stick around long enough to make a contribution intelligently to factory improvements are needed by manufacturing companies if they want to remain globally competitive. The requirement for better-trained as well as more motivated workers will probably to be comparable across different industries as the economy undergoes digital revolutions that automate routine operations while increasing the need for problem-solving. But in order to fulfill these future expectations, we'll need to implement rules that enable managers to view their employees as assets that should be gradually built up rather than costs (Waldman-Brown, 2022).

### 3.3. Conclusions

The manufacturing industry is in period of deep changing, confronted with an intricate set of issues as well as possibilities as it navigates the route of reshoring in the light of the current geopolitical scenario and imminent labour shortages. Starting from a period of profound globalization, where each country was deeply rooted to achieve the most from outside its borders in terms of labour, raw materials, markets, and competitive advantage, now it seems like each geopolitical and economic event is trying to reverse the process and bring each nation to be more independent possible. This thesis investigated the theoretical implications of reshoring, its motivations and downsides, the application of this practice in the current geopolitical scenario and the interconnected issues and their consequences for the future of the industries verting on manufacturing as their core activity in the global value chain.

In particular, the semiconductor industry has been for decades an essential component of technological innovation, fuelling the digital era by producing critical components for all types of electronic gadgets. However, due to cost benefits and supply chain efficiencies, a major amount of semiconductor manufacturing arose in Asia, being the cheapest location for such a peculiar sector. The industry's globalization resulted in spectacular growth, but it also exposed weaknesses linked to geopolitical tensions, due to its extremely complicated value chain, involving rare raw materials, extremely high need for high skilled workforce, and the need of large investments in R&D. As a strategic response to such vulnerabilities, the reshoring strategy, which involves relocating semiconductor manufacturing to domestic or allied countries, arouse interest in many companies and developed countries. Many governments and businesses have prioritized supply chain security and reducing reliance on potentially unstable regions, applying restrictions to countries such as US did towards China. Reshoring has the potential to improve resilience and security, however it doesn't come without obstacles.

One of the major constraints to reshoring manufacturing is the power China and in general the Asian countries are gaining at the expenses of US and Europe. Trade conflicts and export bans have the potential to interrupt the flow of vital components across the industry's intricate global supply chain. It is a hard endeavour to strike the right equilibrium among national security concerns and global cooperation and innovation, and the complicated relation between US and China is not helping the process, leaving the European Union in the middle. Instead, the two countries are in a power war to obtain the supremacy of the manufacturing capacity, especially in the chips market, and this incorporate all the other nations allied with both countries. China's dominance in the international supply chain for chips and a variety of other industries is evident. The vastness of its production capabilities, access to extensive resources, and massive consumer market have strengthened its position in the global economy. Because of this profound integration into the global supply chain, decoupling from Beijing is a hard and intimidating process, which is not possible to be implemented in the short term, at least without interrupting the most profitable economic activity of the developed countries. The world is currently depending on China and not even the limitations countries are imposing to it are supposed to strongly damage its economy, since they are already trying to archive independence by their own. Attempting to decouple from China risks generating considerable disruption to global commerce and supply systems, potentially causing financial consequences seen globally. Furthermore, China's technological superiority and ongoing investments in R&D make it an essential partner for collaboration and innovation. It seems like the de-risking approach Europe came up with could increase the possibilities of obtaining a national security independence on essential production processes, together with keeping China a good trade partner, but its unknown how long this political technique can accomplish the Chinese market.

Labor shortage is the other key limitation to the manufacturing industry's efforts to reshore production operations. These shortages affect a wide range of industries,

including skilled employees, technicians, engineers, and researchers. The semiconductor industry, known for its advanced technology, exemplifies the strong demand for highly qualified workers. However, solving this shortage will not be easy. It requires resources, time, and a collaborative effort from both the public and commercial sectors to develop a competent work force. Instruction and professional development initiatives must be adjusted to match the changing needs of the industry, while also encouraging innovation and cultivating talent. Both companies and countries need to invest in the development of a strong workforce, which needs to be prepared to the high amount of technology knowledge needed to handle the level of automation introduced in all sectors.

To conclude, the initial consideration of reshoring as scholars analysed in the last 20 years is narrow and in constant evolution, since it implies the central role of the disruptions occurring in the world. Pursuing the goal of reshoring in the manufacturing industry, especially in the semiconductor sector, is not an easy task and straightforward as it may look. Labor limitations put the sector's potential to scale up local manufacturing at risk, while the industry's complicated web of interdependence with China, now a global giant, poses a strong hurdle to decoupling. To be successful in this ambitious effort, stakeholders in the sector must adopt holistic strategies that include workforce development, innovation, and international diplomacy. As we continue to negotiate the constantly shifting dynamics that characterize the global manufacturing scene, we must strike a delicate balance between safeguarding supply chains and sustaining an open attitude of global collaboration and innovation, in order to save the global value chains from impactful circumstances that could damage international relations.



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