The Made in China 2025 amid hyperglobalization: upgrading, intangible assets and internationalization strategies

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Abstract
This paper investigates the Made in China 2025 (MIC2025) initiative and how it tackles some of the challenges of organizing international production networks amid hyperglobalization. First, we added a descriptive analysis based on value-added trade measures to illustrate some aspects of the Chinese specialization pattern, drawing on the ICT industry as a case study to discuss the growing importance of intangible assets and how Chinese firms improve innovation capability through internationalization strategies. Second, we discussed MIC2025's background, reviewed its strategic objectives, and explored its main challenges. Our findings suggest that the Chinese government aims to improve Chinese enterprise's ability to manage power relations in global innovation governance through innovation capability and upgrade in key industries, as is the case of the ICT sector. In that sense, building local technological capacities and strengthening value chain stages, as well as the internationalization of Chinese companies, are crucial bases of the recent Chinese structural transformation.

Resumo
Este artigo investiga a recente política industrial chinesa, *Made in China 2025* (MIC2025), e como essa aborda alguns dos desafios da organização de redes de produção internacionais em meio à hiperglobalização. Primeiro, elaboramos uma análise descritiva baseada em indicadores de comércio em valor-adicionado para ilustrar alguns aspectos do padrão de especialização chinês, utilizando a indústria de Tecnologias de Informação e Comunicação (TIC) como estudo de caso para discutir a importância crescente dos ativos intangíveis e como as estratégias de internacionalização das empresas chinesas impulsionaram sua capacitação inovativa. Segundo, exploramos o contexto histórico do MIC2025, seus objetivos estratégicos e principais desafios, para então explorar algumas facetas de sua dimensão externa. Concluímos que o governo chinês buscou melhorar a habilidade das empresas chinesas de gerenciar as relações de poder na governança global da inovação por meio do desenvolvimento de capacitação inovativa e upgrade em setores-chave, como ilustrado pelo caso TIC. Nesse sentido, a construção de capacitações tecnológicas locais e o fortalecimento de etapas da cadeia de valor, bem como a internacionalização das empresas chinesas, são consideradas bases cruciais da recente trajetória de transformação estrutural chinesa.

Keywords: Made in China 2025; global value chains; industrial policy; intangible assets; ICT.

Palavras-chave: Made in China 2025; cadeias globais de valor; política industrial; ativos intangíveis; Tecnologias de Informação e Comunicação.

JEL: O25; 03; F6; F19.

Área ANPEC: Área 9 - Economia Industrial e da Tecnologia.

1. Introduction

"Hyperglobalization" marks a new phase of trade integration in the 21st century, in which world trade has grown faster than world GDP. Among other aspects, hyperglobalization reflects the widespread fragmentation of production processes across borders and the increasing share of global output and trade by developing countries, especially China, with similar goods and services crisscrossing global borders in a magnitude never seen in the previous era of globalization (ECLAC, 2016; SUBRAMANIAN; KESSLER, 2013). Concurrently, there is a change of paradigm from "centralized" to "decentralized" industrial production through the digitalization of production processes based on devices autonomously communicating with each other along the value chain (OECD, 2017; GTAI, 2014). The combination of disruptive technologies creates new patterns in countries' structural transformation and allows countries to pursue trajectories of increased local value addition. In this development, China seeks to close its technological gap in smart manufacturing and promote a broad-scale and economy-wide upgrading of industrial systems within the following decades.

As a crucial mark of China's current industrial and innovative policy, the Chinese government launched the 'Made in China 2025' (MIC2025) initiative in May 2015, revealing an ambitious plan to guide China's industrial modernization and lessening its dependency on imported technology. The first of a three-stage plan, the MIC2025 is a ten-year action plan to transform China into a global leadership on several hi-tech fronts developed on the mainland. Under the guise of a trade war, Beijing tried to play down MIC2025 by ordering Chinese state media agencies to avoid mentioning their strategic plan (LENG; YANGPENG, 2018). Nevertheless, in line with China's policy direction, it seems the end of the Chinese poor-quality and low-cost massive manufacturing era may be in sight.

This paper seeks to discuss the MIC2025 initiative and how it tackles some of the challenges of organizing international production networks in the age of hyperglobalization. In a nutshell, increasing participation and value capture in GVCs based on vertical specialization will become more difficult in the next coming years. This means that export-oriented strategies in narrowly specialized GVC segments (¨export plus-plus¨) may find less space to be successful. On this note, UNCTAD (2020) suggests that the dynamics of productive specialization, especially from developing countries' perspective, are linked to the overall directional trend in international production towards shorter and less fragmented value chains, higher geographical concentration of value-added, and declining international investment in physical productive assets. As will be seen, in addition to the internationalization of Chinese companies, building local productive and technological capabilities and strengthening value chain stages are critical dimensions of China's development path in the age of hyperglobalization. We argue that the internationalization project of Chinese companies is also a backbone of the national technological modernization strategy, and this process has enhanced the acquisition of foreign technologies through mergers and acquisitions (M&A), concurrently with the strengthening of research and development (R&D) and the generation of indigenous innovation in high strategy-priority areas in more recent years. Following, we choose the information and communications technology (ICT) industry as case study because it provides valuable insights about how Chinese firms improve innovation capability through internationalization strategies.

This paper addresses the MIC20215 initiative with a view to stressing its outward-looking dimension and considers that it challenges the narrow vision of GVC upgrading, for which upgrading for some nations comes to some degree at others' expense. GVC upgrading is mostly framed in terms of comparative performance in capturing a greater share of value-added along international supply chains. This understanding ignores the dynamics related to the pace of technological change and does not address the social dimension of upgrading or its political implications (see MARCATO; BALTAR, 2020). Moreover, the potential gains regarding knowledge creation and absorption may be crucial to maximizing the benefits of participating in international production chains. Hence, there are other relevant factors behind GVC upgrading, such as the State's influence in shaping global production systems and the importance of building a local innovation system to perform economic upgrading. In that sense, we show that China's policy orientation has faced the complementarities between supporting innovation capabilities and GVC upgrading, managing to overcome the potential effect of locking in the monopoly power from intangible asset creation.

First, this paper explores China's goals of increasing international competitiveness through climbing up the value chains and meeting quality or other standards required in international markets. As the rise of GVCs has gone hand in hand with the growing importance of intangible assets, we draw some lessons from the debate on how intangible assets shape global value chains, focusing on China's technological learning pathways and the ongoing emergence of Chinese brands into international markets. More specifically, Chinese mobile phone manufacturing provides some lessons for successful experiences of potential trajectories to increase local value addition. In brief, the issue of internationalizing their brands, and not being doomed to act as contract manufacturers, illustrates the crucial role of governments in fostering technological capacities that are key to the upgrade. Further, bearing in mind that international trade and investment have commonly been regarded as two alternative internationalization strategies of companies, it will be argued that China has oriented its policy decisions towards investments in innovation capabilities. This strategy aims to acquire technologies, the know-how of specific assets owned by foreign firms in the emergence of GVCs, which has increased the complementarity between international trade and investment. Drawing on MIC 2025's outward-looking dimension, we show that Chinese companies' investments have been a crucial part of the strategic aim to manage power relations between firms of its international production networks and increase control over the market by reducing the number of rivals through M&A. Our results suggest that establishing government-led investments in indigenous industries played a crucial role in how China responds to manufacturing challenges amid hyperglobalization. If anything, investments in intangible assets enhance the Chinese economy's ability to create and absorb knowledge and help embed this knowledge into domestic production and further global competitors.

In addition to deepening indigenous innovation in high strategy-priority areas and strengthening all value chain stages, the internationalization of Chinese companies is taken as a backbone of China's technological modernization strategy, as the latter has enhanced the acquisition of foreign technologies in previous years. More notably, we consider that the MIC2025 marks a turning point in the Chinese economy's institutional configuration, coordinated by the Chinese State and aligned with the global innovation governance, from the strategy of acquiring strategic assets to support Chinese companies that attempt to upgrade their production capabilities in international production networks towards the local development of strategic assets. In doing so, our narrative about the Chinese government's industrial development strategy to reduce its reliance on foreign technology and develop indigenous technologies and innovation capabilities goes beyond the narrow lenses of a trade dispute[1].

The content of the paper is as follows. The next section provides an analysis of China´s participation in value chains and some highlights about the growing importance of intangible assets. Our analysis is illustrated by original stylized facts elaborated using OECD-WTO´s Trade in Value Added (TiVA) (2018 edition) database and Thomson Reuters data, in addition to several case studies by academic literature and information from international organizations. Based on government documents, Section 3 sets the scene of MIC2025 by providing its background and reviewing its strategic objectives, as well as exploring some of its main challenges. Section 4 provides snapshots of MIC2025's outward-looking dimension. Section 5 concludes the article.

2. China's role in the age of hyperglobalization: insights from the ICT sector

Globalization is a multifaceted phenomenon, as highlighted by Baldwin (2011), and therefore the most recent wave of globalization - hyperglobalization - concerns a particular historical period that started in the early 1990s. Subramanian and Kessler (2013) describe seven features of the age of hyperglobalization, focusing on its trade aspects: i) the 1990s' rapid rise in trade integration ("hyperglobalization"); ii) the importance of services ("dematerialization of globalization"); iii) the widespread embrace of openness ("democratic globalization"); iv) the similarity of North-to-South trade and investment flows with flows in the other direction ("crisscrossing globalization"); v) the rise of China as mega-trader; vi) the proliferation of regional trade agreements; and vii) the decline of barriers to trade in

[1] About the China-US trade tensions, Tam (2019) corroborates the conventional thesis that international trade is a positive-positive game, concluding that the US would not gain at the expense of its trading partners by restraining imports without sacrificing exports simultaneously. From the point of view of the political economy of the trade dispute, Dean Baker's understanding of the insufficiency that the use of the category ¨country¨ brings to explain the entitled ¨US -China trade war¨ is another interesting perspective on the superficial treatment that the narrative ¨us¨ versus ¨them¨ carries. See Baker (2018).

goods, although barriers to trade in services remain high. More broadly, ECLAC (2016) includes the surge in cross-border data flows since the 2000s as an important feature of hyperglobalization. Some recent developments, such as the COVID-19 pandemic itself and the technological war between the United States and China, may have helped to embody the general view that hyperglobalization has peaked.

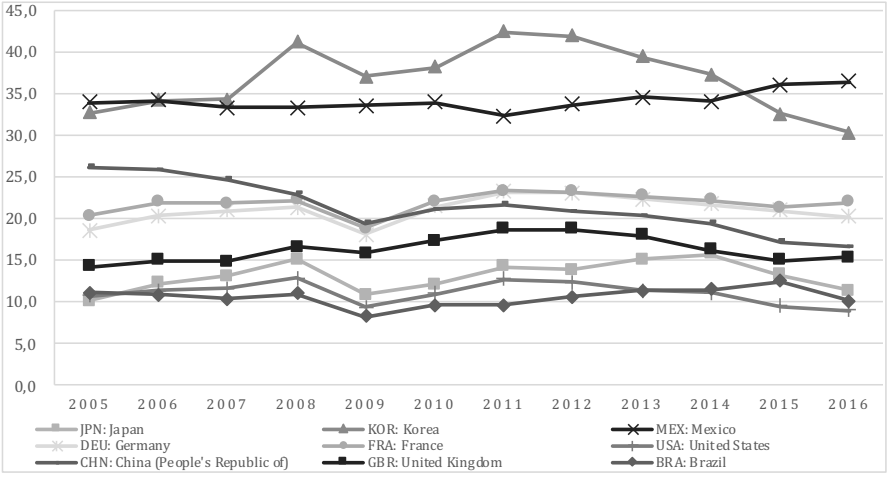
A major driving force of hyperglobalization is the slicing up of value-added chains. The surge of production fragmentation into various stages internationally dispersed has potentially opened opportunities for many firms in developing countries to engage in activities without having to complete entire production processes. Recently, debates have questioned whether this is truly a worldwide process that involves every country or region across the globe (ITO; VÉZINA, 2016; DEGAIN; MENG; WANG, 2017). Globally or regionally oriented, there are several critical issues to resolve about GVCs, including the factors behind the gains of international competitiveness among countries.

China has emerged as a mega-trader in the process of hyperglobalization regarding size and interconnectedness. Over the past decades, China became an important hub in traditional trade and simple GVC networks through rapid industrial upgrading (LI; MENG; WANG, 2019). This reflects its rapid industrialization process and growing trade openness and may suggest that China is rapidly catching up in terms of contribution to advanced countries' exports of high technology goods (RIAD et al., 2012).

While global production fragmentation has allowed countries to rely less on domestic inputs for production, China was an intriguing exception. Based on an input-output approach, Koopman, Wang and Wei (2012) found that China has increased its domestic value-added ratio in exports to gross exports (DVAR) between 2002 and 2007. Based on firm-level data, Kee and Tang (2015) confirmed the upward trend found in Koopman, Wang, and Wei (2012), suggesting that the rise in China's aggregate DVAR was mainly driven by the process of substituting domestic for imported materials by individual processing exporters, both in terms of volume and varieties. Figure 1[2] illustrates that China's experience may indeed be an intriguing counterexample to the general trend of increasing FVA over the period analyzed by those authors. However, the Chinese example has been followed by other countries over the most recent years – South Korea, for example, had decreased its foreign value-added share of gross exports from around 42% in 2011 to around 30% in 2016.

The decline in China's FVA, or that Chinese exports have incorporated a smaller share of foreign value-added, could be attributed to a combination of factors, including China's moving up the value chains. Even though fluctuations in commodity prices can also affect these trends, a possible explanation is the increased domestic sourcing of intermediate inputs. China has experienced significant structural change over the last decades, with the country declining its role as predominantly an exporter of textiles and moving to its role as an exporter of high-tech products (OECD-WTO, 2015). That may also increase the domestic value-added content of China's exports across nearly all sectors but especially in hi-tech sectors through increased specialization in higher value-added activities.

Figure 1. Foreign value-added share of gross exports (%), selected countries, 2005-2016.



[2] We selected countries that presented different patterns of specialization in GVCs, bearing in mind the extent of the difference between measuring in gross terms and value-added trade varies across countries depending on the extent of a country's involvement in GVCs.

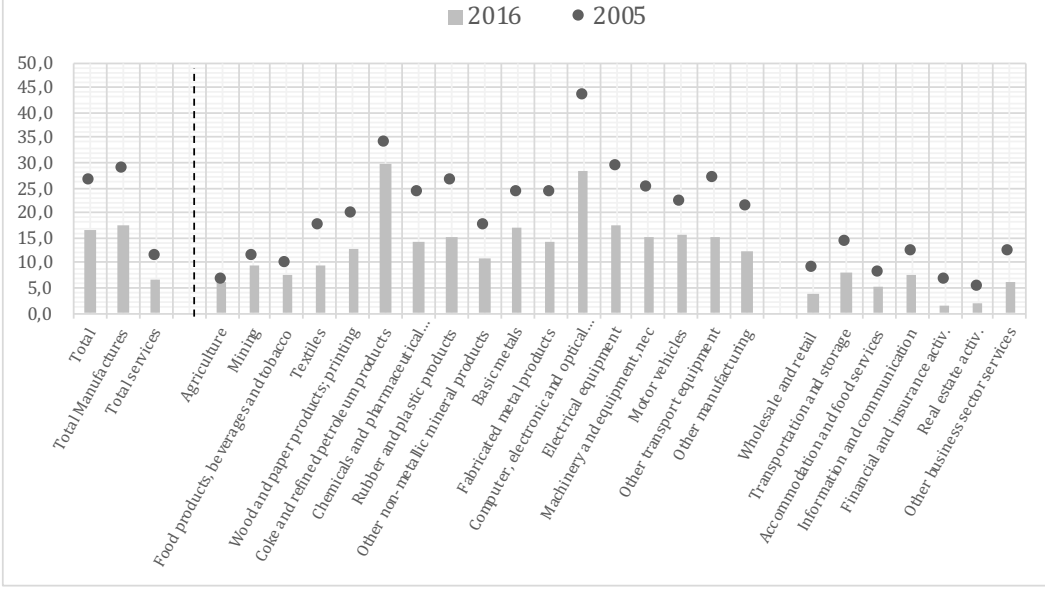
Source: Own elaboration based on OECD-WTO TiVA database (December 2018).

Following a brief increase in the aftermath of the global financial crisis, the foreign value-added (FVA) content of exports[3] declined for most countries (Figure 1). In China's case, the foreign value-added share of gross exports declined from 26.3% to 16.6% between 2005 and 2016. Regardless of the several explanations concerning the recent trade slowdown causes, there seems to be less room in the world economic scenario to integrate into GVCs through exports-plus-exports.

Constantinescu et al. (2015)'s findings support the idea that China's structural transformation may be an important reason for the recent global trade slowdown. They suggest that a few countries with a larger share in world trade and/or faster economic growth relative to the rest of the world have played an important role in the recent shift in world trade-income elasticity[4]. China accounts for 13 and 32 percent of the world trade elasticity change in the long 1990s and 2000s. Existing studies showed similar findings, suggesting that China has played an important role in the recent trade slowdown, with its trade elasticity sharply decreasing from 1.8 (1980-2007) to 0.8 (2012-2015) (IRC TRADE TASK FORCE, 2016).

The current weakness in China's import growth may be seen in the face of changing national development strategy. China has appreciated its currency and has diminished its export markets' expansion process in recent years (IRC TRADE TASK FORCE, 2016), alongside changing its final demand composition and rebalancing away from investment and exports toward domestic consumption-led growth[5]. This process may have contributed to the current sluggish in world import growth, considering that investment is more trade-intensive than consumption and the Chinese economy's size (BOZ; BUSSIÈRE; MARSILLI, 2015). The Chinese expanding in-house production of capital and intermediate goods, which is illustrated by the increasing domestic value-added in Chinese firms, is an important phenomenon behind the recent weak global trade dynamics and the recent trade slowdown (IMF 2015; KEE; TANG 2015; NAKAJIMA et al., 2016). That said, the 'China-factor' (the Chinese movement towards services and products finalized domestically) should be considered with caution, given that the import intensity of Chinese demand (consumption and investment demand) has been falling since the early 2000s (TIMMER et al., 2016).

Figure 2. China´s foreign value-added share of gross exports (%), by industry, 2005 and 2016.



Source: Own elaboration based on OECD-WTO TiVA database (December 2018).

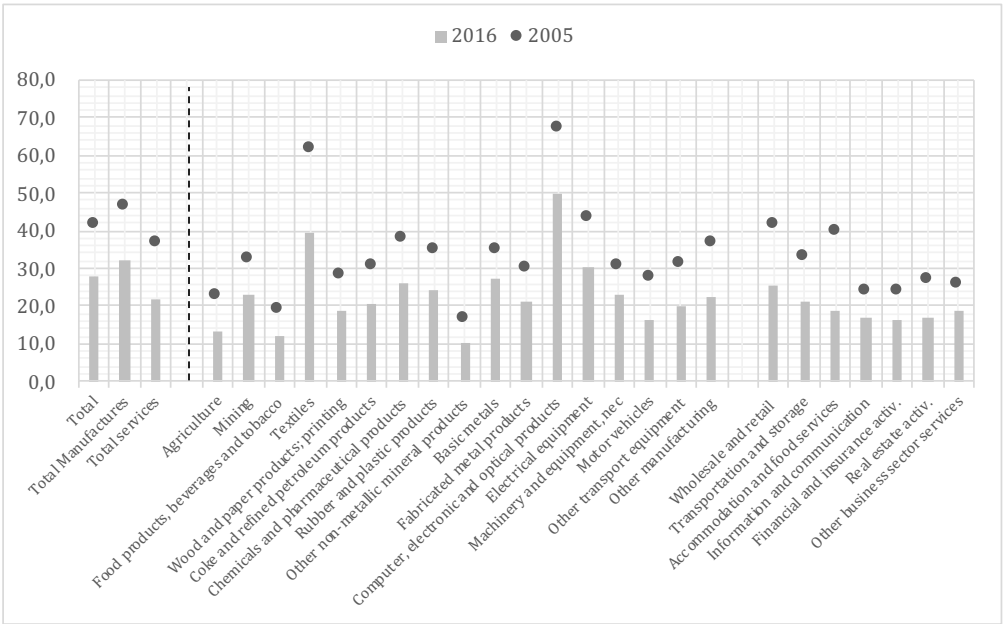
[3] This measure is often referred to as the import content of exports and is considered a measure of 'backward linkages' in analyses of GVCs.

[4] In a nutshell, the recent literature about the current slowdown in global trade uses the term 'trade elasticity' to refer to the long-term responsiveness of imports to changes in income or in relative prices.

[5] It is worth noting that, according to Bazan and Navas-Aleman (2003), successful experiences of upgrading in developing countries are domestic-market oriented or export to other less developed economies.

The pattern of China's foreign value-added content of exports differs across industries (Figure 2). In 2016, the greatest intensity of FVA in an industry's exports was in Coke and refined petroleum products (29.7%), followed by Computer, electronic and optical products (28.3%) and Electrical equipment (17.6%). China has added more domestic value precisely in the sectors that led to creating of global value chains, with the ICT and electronics' FVA dropping by almost 15 percentage points. Overall, the manufacturing industries' role as users of foreign inputs was more significant than service sectors. However, the declining trend was also more preeminent for manufacturing sectors between 2005 and 2016.

Figure 3. China´s re-exported intermediate imports as % of intermediate imports, by industry, 2005 and 2016.



Source: Own elaboration based on OECD-WTO TiVA database (December 2018).

The increasing use of intermediate imports embodied in exports is usually posed as a source of international competitiveness. Figure 3 depicts the imported intermediate inputs embodied in exports as a share of total intermediate imports across industries, measuring the importance of intermediate imports to produce goods and services for exports. This indicator has an economy size bias since the smaller the country, the larger the share of imported intermediates used in production as a share of total intermediate inputs. However, this does not explain its magnitude or trend completely, as changes over time can also reflect changes in trade specialization. The share of re-exported intermediate imports in China fell between 2005 and 2016, from 41.8% to 28%. The reduction in the share of intermediate imports that are re-exported may mean that more imported parts and components are being used to make goods consumed domestically. If we look only at the numerator (REII, re-exported intermediate imports), then changes in re-exported intermediate imports may reflect changes in the position of a country in GVCs. At the same time, we see that the foreign value-added share of gross exports (often referred to as 'import content of exports') is decreasing over time (Figure 1), which shows that China's exports are increasingly relying on parts and components produced domestically, rather than importing them from overseas.

That said, when Figures 1 and 3 are combined, it may reveal that China is changing its role as "Factory world", given the lower importance of intermediate imports to produce goods and services for export, strengthening of China's local-linkages, and this may also be associated with China's rebalancing away from exports toward domestic demand-led growth.

Over time, China increasingly entered the more technology-intensive upstream production stages. The sectors that most drive high-tech industrial production were precisely those that China considerably expanded its competitive domestic production capacity. Even those sectors whose competitive dynamics were traditionally associated with low Chinese wages seem to be undergoing major changes. Between 2005 and 2016, two of the originating industries with the largest declines in the shares of intermediate imports used in China's exports were Textiles (22.6 pp) and Computer, electronic and optical products (17.2 pp.)

also show the highest levels. Although this pattern differs across industries, China has declined its role as the final point in Factory Asia.

China's production has advanced to other stages located more at the beginning of the GVCs, while deepening its importance on the cross-country production sharing and becoming less dependent on intermediate imports embodied in its exports (BALTAR; MARCATO; SARTI, 2018). Benguria (2014) discussed that intermediate imports might play a crucial role in export diversification and transitions along supply chains towards producing more downstream products. In that sense, the decline in re-exported intermediate imports in China may have impacted the exports of Chinese trade partners, especially East and Southeast Asian economies, and the potential Chinese capacity to produce new products, especially those located further downstream along value chains.

Existing studies have shown some signs that GVC participation may have a limited contribution to developing countries' industrial modernization. This research strand aims to establish links between the theoretical framework of National Innovation Systems and GVCs (PIETROBELLI; RABELLOTTI, 2011; DE MARCHI; GIULIANI; RABELOTTI, 2018; LEE; SZAPIRO; MAO, 2018; FAGERBERG; LUNDVALL; SHROLEC, 2016). The different capabilities of firms to upgrade, or their ability to learn, may explain the differences between the roads to raising international competitiveness (GIULIANI; PIETROBELLI; RABELLOTTI; 2005). However, generally, multinational companies tend to prevent their suppliers in developing countries from catching up with them (HUMPHREY; SCHMITZ, 2002). This reinforces the importance of building a local innovation system to perform economic upgrading (see LEE; SZAPIRO; MAO, 2018), bearing in mind that innovation systems become increasingly complex and intertwined, with regional, national, and international levels of integration of innovating activities (HOTZ-HART, 2000).

In the case of China, Silva (2020) debates to what extent being at the technological frontier is a process that depends only on the interaction of internal agents and to what extent industrial and innovation policies should focus only on its endogenous development without worrying about the presence of domestic companies in other markets. The globalization process of research and development (R&D) remains concentrated in the United States, Europe, and Japan (MIRANDA, 2014), which makes the internationalization of Chinese companies, in line with local capacity-building efforts in China, as or more relevant than the promotion of technological activities of multinational companies in China.

2.1. China's Mobile Phone Manufacturing: intangible assets and upgrading

The emergence of GVCs has gone hand in hand with the growing importance of intangible assets in economic activity (WIPO, 2017). Whether goods are globally or regionally produced, intangible capital accounts for part of each stage's value-added of the production process. Chen et al. (2017) provides an estimate of the share of intangible assets for 19 manufacturing product groups and find that intangible capital accounts for a higher share of value-added than tangible capital for all groups, even though it varies greatly across product groups. Intangible assets can be distinguished between two types: i) knowledge assets consist of technology, design and organizational, logistical, managerial, and related know-how, which are non-rival in nature and can be spread across several locations; and ii) reputational assets cover consumers experiences related to a company's brand and image, which is rival in nature and may not easily flow from one place to another (WIPO, 2017).

Durand and Milberg (2020) investigated the effort by lead firms to capture market power in the provision of and production of intangible assets. The authors build from Pagano´s (2014) notion of "intellectual monopoly capitalism", where government protection of intellectual property has the effect of locking in the monopoly power from intangible asset creation. Durand and Milberg (2020) argued that intellectual monopoly reinforces the deepening of the so-called smile curve[6], placing upward pressure at both ends of the curve, where control over intangible assets is concentrated. One marked consequence of the intellectual monopolization in GVCs is the highly unequal distribution of Intellectual Property Rights

[6] First proposed in the 1990s by Acer´s founder, Stan Shih, this curve in the shape of 'U' represented the company's strategy of upgrading from assembly to higher value-added activities in the value chain of computers. Since then, it has been broadly used to show the value-added potential of each production stage along the GVC. However, the "smile curve" has several limitations especially at the economy-wide level. See WIPO (2017) and Degain et al. (2017).

(IPR) rents, which, together with financial rents, facilitate capital centralization and act reducing power control of those that control production (MEDEIROS; TREBAT, 2017a; 2017b).

Important to our purposes, under China's Patent Law, it is now easier for domestic retaliation by Chinese companies that face overseas IPR lawsuits from foreign competitors (MCGREGOR, 2010). Although an uneven geographical distribution of intangibles-intensive firms across the globe - with a great concentration in industrialized countries - can be seen, China has succeeded in upgrading in global value chains by building their own intangibles. Especially in the case of Chinese firms from the ICT sector, the emergence of some Chinese brands into international markets, following a path of upgrading from OEM (Original Equipment Manufacturer) to ODM (Original Design Manufacturer) and then OBM (Original Brand Manufacturer), illustrates a change on the basis of competition from cheap labour advantage (price) to technological innovation and design. This change is consistent with OEM mode's inability to support sustainable growth in China (LIU; ZHENG, 2013; DIEPPE et al., 2018). Of course, the ongoing process of upgrading from being merely assemblers or distributors on behalf of foreign companies to become OBM is widespread and depends on several industry-specific factors. OEM will continue to exist in China and OBMs, but the Chinese government has encouraged Chinese firms to internationalize their own brands and change production and innovation patterns.

The Chinese mobile phone manufacturing provides a more nuanced understanding of potential trajectories to increase local value addition, which is here seen in the light of the complementarity between investments in manufacturing and innovation capabilities[7]. Following the dynamic capabilities framework, which focuses on innovation (both technological and organizational) and market disequilibrium, we use the concept of capabilities, rather than resources or products, to explain the challenge of achieving superior fit with shifting environments (see TEECE; PISANO; SHUEN, 1997). In other words, we consider that it is not simply a matter of a national strategy to become more competitive in higher value-added activities but of actively promoting import substitution and the densification of value chains in China and, in doing so, building a domestically integrated industrial chain, as it will be discussed in the next section.

One should note that GVC upgrading is usually associated with "moving into higher value-added stages". Among the four types of (economic) upgrading[8], functional upgrading occurs when firms increase the overall skill content of activities, i.e., firms are increasing value added by changing the activities that are performed by the firm or by moving the locus of activities to new segments of a GVC associated with higher value-added. Nevertheless, functional upgrading can occur in at least two different ways: specialization (substituting an activity for another) or vertical integration (adding new capabilities to a firm or cluster) (BARRIENTOS et al., 2010). Despite the entry/exit in higher/lower value-added stages logic of the first way of functional upgrading, the MIC2025 is closer to vertical integration logic and has set ambitious targets to promote import substitution, strengthening all value chain stages.

Sun and Grimes (2017) argued that, despite its ongoing dependence on foreign technologies and intellectual property (IP), China has been upgrading its ICT sector by participating in GVCs. From a microlevel analysis of the role of China in the GVC of Apple, Inc., the authors discussed that Huawei and Xiaomi illustrate the undergoing processes of technological improvement and innovative transformation in the Chinese ICT industry. Instead of calling to mind the (overstressed) case of Apple's value chain (DEDRICK et al., 2010), other interesting facts are represented by Chinese companies' internationalization strategies.

Before the 1990s, China participated in mobile phone value chains headed by foreign MNCs. According to Zhu, Xu and He (2018), many companies depended on imported design houses and foreign manufacturers, preferring not to invest in R&D and technology innovation. The authors argued that, given the Chinese national policy that provided licenses to domestic companies to make mobile phones in the

[7] Our study does not intend to analyze the reasons behind the successful entry of Chinese manufacturers into the mobile phone industry. In this regard, Zhu et al (2006) point to some factors, such as firms' responses to the characteristic market demand, the distinctive features of the technology such as modularity, and to evolution of the regulatory framework.

[8] See Marcato and Baltar (2020) to find more about the other three trajectories (process upgrading, product upgrading, and chain (or inter-sectoral) upgrading).

1990s, some Chinese manufacturers were able to capture a considerable market share, especially by taking advantage of their sales channels. Nowadays, it is no longer only about "Manufacturing China". In fact, Chinese mobile phone companies could extend their activities to industrial design, integrated circuit design, and even operating systems for smartphones.

In the face of different development paths in the ICT industry, Zhu, Xu and He (2018) argued that there are three kinds of innovative manufacturers – ZTE, Lenovo and MI. First, ZTE (Zhongxing Tongxin) represents the successful horizontal expansion of a telecommunications equipment manufacturer's leading provider. The company has built its success in the mobile phone business due to its manufacture of customized cell phones for telecommunication network operators and has used its experience in incremental innovation in telecom equipment manufacturing to move to an innovation-oriented strategy of business[9]. ZTE engaged in a dual (inside-out and outside-in) internationalization strategy, that is, the company goes abroad to increase competitiveness and compete at home at the same time against foreign competitors (PRANGE; BRUYAKA, 2016). The authors showed that, in the mid-1990s, ZTE increased its foreign assets and operations, as it realized that sophisticated product knowledge had to be acquired from foreign competitors abroad. Besides that, ZTE showed an almost equal focus on activities in China and abroad between 2010 and 2015, and the company capability base for product developments results from collaborative research with foreign partners.

The second kind of innovative manufacturers is illustrated by one of the world's largest IT vendors, Lenovo, and the company entered the mobile phone manufacturing sector in 2002. Back at that time, Lenovo used mobile phone design schemes in Japan and South Korea and ended up closing this business. It was until smartphones' era begin that Lenovo decided to return to the mobile phone sector. Due to its information technology capabilities, regular programs of learning and innovation, brand awareness, and widespread marketing channels in the personal computer business, Lenovo became successful in the smartphone industry[10] (ZHU; XU; HE, 2018). Furthermore, MI Corporation has the largest market share (15% in 2015) and was founded only in 2010, as a mobile internet service provider and smartphone software developer, and then extended it to mobile phone manufacturing. MI has its own mobile operating system (MIUI), which has been updated through inclusive innovation and helped build its reputation. The company adopted an e-commerce model with zero inventory management, outsourced its production to Inventec and Foxconn, and 400 suppliers (ZHU; XU; HE; 2018).

China's mobile phone market has changed considerably in recent years. ZTE and Huawei, for instance, are changing market competition (LEI, 2007), and are gaining momentum in the domestic market. Companies in telecommunications tend to adopt both inside-out and outside-in internationalization strategies and both ZTE and Huawei illustrate dual internationalization strategies that balance inside-out and outside-in orientation (PRANGE; BRUYAKA, 2016). China's indigenous innovation strategy has used market demand to drive technological innovation, and one of the most significant strategies is government-led research consortia. Huawei and ZTE are key-players in a government-organized and –supported research consortia in a mega-project developing next-generation telecommunication technology (LIU; CHENG, 2011).

To overcome the technological barriers imposed by foreign companies, Sun and Grimes (2017) proposed that Chinese ICT companies learn from Huawei's internationalization success, as the company used a mixed strategy of creative human resource management to stimulate innovation and a consumer-oriented business model. With Chinese brands dominating a larger share of the market, conflicts over technology patents between domestic companies and MNCs have escalated (ZHU; XU; HE, 2018). Some scholars argue that this competitive pressure has led to the development of in-house technologies and the ongoing emergence of Chinese brands into international markets, while other authors doubt the development of in-house core technological capacity by Chinese firms.

The case of Huawei illustrates this issue. According to WIPO (2017), Huawei exemplifies the case of increasing in-house production of technologically sophisticated components as a major goal of R&D-

[9] In recent years, ZTE established eighteen state-of-art R&D centers in China, France and India, obtaining a large number of mobile phones technology patents and turning to the high-end segment of the mobile phone market (ZHU; XU; HE, 2018).

[10] Another important move was to acquire Motorola in 2014, since the company would save about 20 percent of the production costs given certain patents that would no longer have to pay.

intensive enterprises. Unlike other firms in China, Huawei has focused on building its extensive relationships with operators worldwide and it did not act as a contract manufacturer for Western firms. The report claims that Huawei was successful in catching-up because of its technological capabilities and creating its own technological path rather than remaining a technological follower. Hence, Huawei has evolved from a supplier of telecommunications equipment and low-end mobile phones to a lead supplier of high-end smartphones, creating innovation capacity and related intangibles, such as its brand.

Oppositely, some scholars highlight the Chinese on-going high level of dependency on foreign sources of technology. Inomata and Taglioni (2019) argue that none of the top Chinese brands (Huawei, Oppo, Vivo and Xiaomi) have core technological capacity in-house. Based on recent developments of China's automotive and electrical equipment industries, the authors consider that these successful Chinese firms rely on knowledge-intensive intermediates and globally available technology and, in that sense, have not indigenized production in China. Instead, these Chinese producers manage to upgrade through building their own brands and developing complementary skills, such as design and marketing capabilities. Although it is difficult to establish causal relationships, we draw on Zhu et al (2006)'s findings to argue that successful firms have identified local demands and transform them into end products.

In the context of policy concern, Inomata and Taglioni (2019) claim that policy makers should encourage firms to be full partners in global technology ecosystems and to pursue open source innovation solutions, rather than helping domestically-owned firms to become technologically standalone – the so-called "techno-nationalism"[11]. However, such interpretation without further qualifications could lead to misunderstandings. Overall, China is breaking out of the trap of processing trade[12] and is boosting its innovation capacities through active policies aiming at raising domestic value-added in manufacturing exports, as well as relying on the Chinese ability to develop independent financing mechanisms and acquire control over foreign assets (UNCTAD, 2018). Although China has increased its participation in more sophisticated tasks, it is not clear to what extent Chinese companies can substitute for foreign companies in upgrading in the ICT-sector. However, what is clear is the Chinese government's determination to increase intellectual property accumulation and push for indigenous innovation. The next section analyzes the recent Chinese government initiative to enhance Chinese innovation capabilities.

3. "Made in china 2025": beyond techno-nationalism

In May 2015, the State Council published the MIC2025's strategy to guide China's industrial modernization and reduce China's reliance on foreign technology imports. Based on the results of the Manufacturing Power Strategy Research Project, the Ministry of Industry and Information Technology (MIIT) worked with 20 government agencies over two and a half years, with input from 150 experts from the Chinese Academy of Engineering (CAE), to formulate a long-term strategic plan for transforming the Chinese manufacturing industry. In a broad sense, MIC2025's guiding principles support indigenous innovation[13], emphasizing quality over quantity, greening development, optimizing the Chinese industry structure, and strengthening human talent (KENNEDY, 2015; NING, 2018; U.S. CHAMBER OF COMMERCE, 2017).

MIC2025 is considered a demand-driven innovation policy given that government procurement is associated with indigenous innovation requirements and local content (MACEDO, 2017). The expansion of Chinese industry's local content is based on the strengthening of research and development (R&D) and the generation of indigenous innovation in high-priority areas, which are linked to the dynamism of the national economy, the Chinese population's well-being, and national security. The understanding that the core of each country's competitive strength is intellectual innovation, technological innovation, and high-

[11] Historically, Western analysts used the term techno-nationalism to describe the relationship of technology and nationalism primarily in relation to Japan and now China (see Edgerton (2007) for further discussion on the contradictions of techno-nationalism and techno-globalism). Nowadays techno-nationalism may be seen as a manifestation of the anti-globalization blowback, and it links technological and innovation capabilities to a nation's national security, economic prosperity, and social stability (see CAPRI, 2020).

[12] Compared to non-processing exporters and non-exporters, the processing exporters in China, which are mostly foreign-owned, are characterized by lower productivity, lower profitability and lower wages (UNCTAD, 2018).

[13] "Indigenous innovation refers to enhancing original innovation, integrated innovation, and re-innovation based on assimilation and absorption of imported technology, to improve our national innovation capability" (The State Council 2006, 4).

tech industrialization is in the origins of the quest for indigenous innovation[14]. Previously to MIC2025, the core of Hu-Wen administration's (2003-2013) approach to innovation and technology upgrading (the National Medium- and Long-Term Plan on the Development of Science and Technology (2006-2020)) recognized China's "relatively weak indigenous innovation capacity", "weak core competitiveness of enterprises", and the lag between China's high-technology industries and those of developed countries (OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE, 2018).

The transition of China's capital accumulation strategy from low-cost production and export superpower to global leadership in advanced technologies takes place in the wake of its economic growth slowdown, rising wages and demographic challenges[15], and Chinese consumers growing more sophisticated. As Malkin (2018) points out, China is looking for other growth sources that enable the Chinese economy to overcome its "middle-income trap". More than merely absorb or adapt technologies, MIC2025 aims to automate entire industries and bring whole production processes in-house. China has endeavoured to replace foreign with Chinese technology at home and to move forward for Chinese technology companies to enter international markets (WÜBBEKE et al., 2016).

MIC2025 is a top-down strategy, and its design meets the Chinese need to build up entirely new sectors, elevate the position of Chinese industries in GVCs and meet quality standards required in international markets[16]. Despite its name, MIC2025 outlines an ambitious technological path to China, in which the year 2025 marks merely an intermediary step of this trajectory. Step 1 is to join the ranks of manufacturing powers by 2025, and step 2 is to become a mid-ranked manufacturing power by 2035. The third step is to join the top class of manufacturing powers innovation-driven by 2049. MIC2025 defines: "(…) By the 100th anniversary of the founding of the New China, we want to build our country into an industrial powerhouse leading the development of the global industrial sector" (STATE COUNCIL, 2015). Despite this statement's broad perspective, Table 1 is useful here, as it provides some metrics for industrial performance.

To become a leading technology and innovation location worldwide by the first half of the 21st century, MIC2025 elected nine major "strategic tasks and focal points": 1) increasing the innovation capacity of local manufacturing; 2) deepening the integration of informatization and industrialization (smart manufacturing); 3) strengthening the industrial base; 4) improving Chinese quality and developing own brands; 5) nationwide implementation of environmentally friendly production (green manufacturing); 6) promoting development breakthroughs in ten key areas; 7) promoting in-depth restructuring in the manufacturing sector; 8) actively developing service-oriented production and product-oriented service; and 9) increasing the level of internationalization in the manufacturing sector (STATE COUNCIL, 2015; JUNGBLUTH, 2018).

MIC2025's strategy is broad-reaching and task 6 (promoting development breakthroughs in ten key areas) listed ten strategic advanced technology manufacturing industries: 1) New-generation information technology (advanced IT); 2) Automated machine tools and robotics; 3) Aerospace and aeronautical equipment; 4) Maritime engineering equipment and high-tech shipping; 5) Modern railway transport equipment; 6) New-saving and new-energy vehicles and equipment; 7) Power equipment; 8) Agricultural machinery and equipment; 9) New materials; and 10) Biopharma and high-performance medical products. These high-technology fields can be arranged in four groups: i) new information technology; ii) new materials; iii) biological medicine and medical devices, and iv) high-end equipment; with the latter being considered as crucial to the national economy and defense (STATE COUNCIL, 2015; NING, 2018).

The ICT sector is one of China's priority development industries. Previous literature has documented China's 'attracting-in' (yinjinlai) and 'going-out' (zouchuqu) strategies used to catch up with advanced economies in the ICT industry as two crucial components of China's opening-up policy since the early 2000s (ZEMIN, 2009; 2012). This strategy advocated import substitution of low-and medium-tech products

[14] Jiang Zemin, General Secretary of the Communist Party of China Central Committee, keynote speech National Technological Innovation Conference, August 23, 1999.

[15] The growth rate of China's working-age population (15-59 years old) turned negative in 2012.

[16] About the complexity of different modern industrial policy packages, see UNCTAD (2018).

at earlier development stages while promoting export and outward FDI policies that aimed industrial growth in international markets. Ning (2009) argued that China's strategies had enabled domestic firms' activities to move toward the center of ICT's industry global competition, and China's nationalist industrial policies at that time partially explain this problem. Basically, the idea of self-sufficiency was inconsistent with the emerging pattern of global production networks and China's strategy devoted much attention to manufacturing technologies and tangible assets. In contrast to China's previous opening policy, MIC2025 ultimate objectives are devoted to intangible assets and build up indigenous technological capability. Apart from China still having much catching up to do, the ICT sector illustrates some of the major recent accomplishments concerning Chinese companies' ability to develop innovative products and compete domestically and abroad. The development logic of Chinese leaders was an internationalization strategy to stimulate indigenous production capability and foster the competitiveness of Chinese multinational corporations.

Closely related to the development of smart manufacturing, new information technology has been given priority as it enables China's digital upgrade. In the wake of hyperglobalization, China aims to become a manufacturing powerhouse and a "cyber power" with Chinese companies moving up the capabilities ladder from producers to creators. This means that Chinese companies will no longer mainly operate in lower-end market segments, competing only indirectly with foreign R&D, while foreign R&D competes against other foreign R&D in higher market segments as in the last two decades (PRUD'HOMME AND ZEDWITZ, 2018; VON ZEDTWITZ, 2004). China will have to manage its ability to develop innovative products, to create internationally well-known Chinese brands and to build modern industrial production facilities (WÜBBEKE et al., 2016).

The outcomes of MIC2025 will be evaluated by 12 key performance indicators in the areas of innovation, quality, digitalization of industry, and environmental protection. Table 1 illustrates these indicators and the targets for the years 2020 and 2025, besides the years of 2013 and 2015 for comparison.

Table 1. The 12 key performance indicators of MIC2025.

Indicators	**2013**	**2015**	**2020**	**2025**
Innovation capability				
1. Share of R&D spending of operating revenue (in %)	0.88	0.95	1.26	1.68
2. Invention patents per 100 million CNY total revenue	0.36	0.44	0.7	1.1
Quality and Value				
3. Manufacturing quality competitiveness index*	83.1	83.5	84.5	85.5
4. Growth of manufacturing value-added (in %)	9.7	5.9	7.9	9.9
5. Labor productivity growth (in %, annual average)	7.3	6.6	7.5	6.5
Digitization of Industry				
6. Broadband internet (penetration in %)	37	50	70	82
7. Use of digital design tools in R&D (penetration in %)	52	58	72	84
8. Use of numerical control machines in key production processes (penetration in %)	27	33	50	64
Environmental Protection (*green industry*)				
9. Decrease in industrial energy intensity (in % compared to 2015)	-	-	-18	-34
10. Decrease in CO2 emission intensity (in % compared to 2015)	-	-	-22	-40
11. Decrease in water usage intensity (in % compared to 2015)	-	-	-23	-41
12. Reuse of solid industrial waste (in % of total waste)	62	65	73	79

Source: State Council, National Bureau of Statistics. *Notes: *accumulated indicator based on data from 250,000 enterprises; criteria include current implementation of quality management and supervision as well as potential for future quality improvements.

However, the main document of MIC2025 shows very few concrete targets for Chinese products. For example, one specific goal is to increase the domestic market share of Chinese suppliers to 40% 'self-sufficiency' by 2020, and 70% 'self-sufficiency' by 2025 in core components and critical basic materials in a wide range of industries (WÜBBEKE et al., 2016; OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE, 2018). Following MIC2025's formal issuance, several supplementary semi-official documents were published, including the "Made in China 2025 Key Area Technology Roadmap" (MIC2025 Roadmap). The MIC2025 Roadmap or Green Book sets explicit market share targets for strategic sectors and technologies to be supplied by Chinese producers (U.S. CHAMBER OF COMMERCE, 2017; OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE, 2018). Among the semi-official targets for the domestic market share of Chinese products, it is worth highlighting for our purposes the case of mobile phone chips (35% by the year of 2020 and 40% by the year of 2025), in addition to other highlights, such as: new energy vehicles (70% and 80%, respectively), high-tech ship components (60% and 80%, respectively), new and renewable energy equipment (80% by the year of 2025), industrial

robots (50% and 70%), and high performance medical devices (50% and 70%)[17]. It is worth noting that the definition of domestic production is not clear, though following industry-specific policies suggest that it excludes foreign companies that manufacture entirely in China (U.S. Chamber of Commerce 2017).

Premier Li Keqiang's announcement of MIC2025 was followed by many critiques regarding its sectoral self-sufficiency targets. Although the MIIT states that the MIC2025 Roadmap is a scientific document with no policy implications, Vice-Premier Ma Kai has publicly endorsed its approach (U.S. CHAMBER OF COMMERCE, 2017; WÜBBEKE et al., 2016). In an attempt to fulfill China's WTO obligations, the official narrative insists that MIC2025 will not adopt a new system of local content. Curiously, the domestic production targets in MIC2025 do not consider Taiwan's production, which Beijing considers part of China. If China includes Taiwan, the localization targets in wireless telecoms (including semiconductors), for example, would probably already be achieved (ADDISON, 2018).

China has several powerful policy instruments at its disposal for MIC2025 implementation. Localization targets are only one tool used to help Chinese manufacturing firms move up the value chain and build innovation (both technological and organizational) capabilities. The State Council (2015) included various policy tools, such as implementing several regulatory measures and providing financial support. Malkin (2018, p.3) listed some of these tools: 'i) Strengthening Intellectual Property enforcement, promoting commercialization of Intellectual Property rights (IPRs), lowering the costs of protecting and applying for IPR for small and medium-sized enterprises; ii) increasing credit flows to the private sectors (the plan mentions setting up a "national manufacturing credit database", which appears to be a manufacturing sector credit rating systems) and enhancing private enterprises' access to equity and direct credit; iii) greater regulatory oversight over product quality and re-regulation of foreign and private investment; iv) using fiscal tools such as public-private partnerships and R&D subsidies and special funds for SMEs to increase investment in manufacturing facilities upgrading; v) deepening the high-tech manufacturing talent pool by improving the quality of education at the vocational training and university level and by encouraging cooperation between universities and manufacturing enterprises; vi) acquiring foreign technology through overseas FDI; vii) better integrating civilian and defense-based manufacturing; and viii) reducing restrictions on, and regulation of, FDI' (MALKIN, 2018, p. 3).

China is implementing regulatory changes and introducing standards that can be used to disadvantage foreign companies in MIC 2025 sectors, diminishing access by foreign producers to the Chinese market, and providing access to technology from abroad. Many of these measures are often related to national security, such as the National Security Law (NSL), the Cyber Security Law (CSL), the National Cyber Security Strategy, and the Secure and Controllable (U.S. CHAMBER OF COMMERCE, 2017). For example, the Banking Guidelines[18] set criteria for the banking industry to be considered "secure and controllable", such as requiring domestic IP and domestic encryption.

One of the strong points of MIC2025 is its long-term planning and its large government funds and subsidies that provide capital to achieve domestic dominance and global competitiveness and support foreign technology acquisition. The Chinese government subsidizes Chinese products and supports Chinese enterprises with direct capital injections and preferential loans in several industries (WÜBBEKE et al., 2016). There are several sources of government funding, including China's policy banks and local government funding, to provide capital to Chinese enterprises to scale up local operations, invest in smart manufacturing and acquire foreign technology through M&A (MALKIN, 2018). Table 2 shows a non-exhaustive list of various sources of public funding to support MIC2025. Some Chinese media reports estimate nearly 800 state-guided funds with a total value of RMB 2.2 trillion to support Chinese enterprises' technological upgrading (US CHAMBER OF COMMERCE, 2017).

Table 2. Sources of funding for MIC2025.

Source of funding	Total estimates	Description

[17] See Wübbeke et al. (2016).

[18] According to the US Chamber of Commerce (2017), this measure was nominally suspended in April 2015, but companies still report its implementation.

Advanced Manufacturing Fund	$ 3 billion	Promote upgrading of labor-intensive, low productivity, manufacturing facilities in modern, machine-intensive ones. Covers all industries in MIC 2025.
State Development and Investment Corporation	$ 6 billion	Financing to robot- and AI-related manufacturing operations
Several Opinions on Finance to Support Industry Stable Growth, Restructuring, and Improving Profit	unclear	Encourages banks to provide financial support to develop indigenous brands and increase export credit insurance for indigenous IP and strategic and emerging industries
Industrial transformation and upgrading fund	unclear	Sets to increase industrial products quality and strengthen indigenous innovation, and indigenous brands
National Emerging Industries Investment Guiding Fund	$ 6 billion	Aims to support strategic and emerging industries and high-technology industries
Major technology equipment insurance compensation system	unclear	Loans to support the use and promotion of robotics
IC Investment Fund	$ 150 billion	Uses fund to finance investment M&A for companies and technologies in the semiconductor industry
MIC 2025 Strategic Cooperation Agreement (between China Development Bank and MIIT)	$ 44.8 billion	Provides financial support to implementing the MIC 2025 plan
The Special Constructive Funds	$ 270 billion	Provides financial support to a number of policy initiatives, including MIC 2025 and Internet Plus
Shaanxi MIC 2025 Fund	$117 billion	Provides financial support around 100 projects in 14 areas
Gansu MIC 2025 Fund	$37 billion	Provides financial support to over 600 major projects
Anhui Manufacturing Development Fund	$ 4.36 billion	Promotes Anhui's transformation from a big manufacturing to a strong one
Sichuan MIC2025 and Innovation-Driven Project Guiding Fund	unclear	Funding for R&D in ten development areas in the Sichuan MIC 2025 Action Plan
National Integrated Circuit Fund	$31 billion	M&A financing for acquisitions in the semiconductor industry
Emerging Industries Investment Fund	$2.28 billion	Loans to support high-tech industry product development
Special Constructive Fund	$270 billion	Funding for numerous MIC 2025-related projects
Nanjing Economics and Technological Development Zone	$ 1.3 billion	Create a "National Artificial Intelligence Industry Base"
Beijing Technology Innovation Fund	$3.17 billion	Funding for optoelectronics technology, big data, new materials, clean energy, AI, advanced manufacturing, health care, information technology, quantum computing

Source: Estimates and descriptions drawn from Malkin (2018), Wübbeke et al. (2016); US Chamber of Commerce (2017); China Money Network; and state-owned media sources.

3.1. Snapshots of MIC2025's outward-looking dimension

The global system of international production has traditionally attracted a lot of policy attention. The worldwide fragmentation of international production has been followed by the fragmentation in international economic policymaking, that is by fragmentation in economic cooperation and by systemic competition between economic powers, which can be seen as a shift away from multilateral cooperation towards bilateral solutions and increased protectionism especially in the case of trade and investment policy (UNCTAD, 2020). As far as there is no consensus on whether we are facing a new industrial revolution or in a period of accelerated change driven by the digital revolution, what matters most is that new technologies are transforming how goods and services are produced, depending on the industry-specific deployment, and can reshape the creation of manufacturing and innovation capabilities. In the case of China, the challenge is to advance from "Made-in-China" to "Innovated-in-China"; conversely, many industrial countries worry that, even with mixed success, China's state-led model will result in greater Chinese control of high value-added and newly emerging industries, unfolding geopolitical claims beyond the U.S.-China trade talks. The purpose of this section is much less to discuss China's role in the global imbalances than to provide snapshots of MIC2025's outward-looking dimension.

China becomes an active investor in greenfield projects abroad, mergers, and acquisitions over the last two decades. As the first wave of China's overseas investments flowed into mostly resource-based activities in developing countries, over the past few years, however, China's overseas investments are increasingly targeting high-tech industries in advanced economies (HANEMANN; ROSEN, 2014). MIC2025's task 9 ('Increasing the level of internationalization in the industrial sector') announces that direct investments abroad are keen to accelerate China's technological catch-up and leapfrog stages of technological development. To achieve this, 'Companies should be supported in making acquisitions, investments in companies, founding start-ups and setting up research and development centers, testing facilities and global sales and service systems abroad' (State Council 2015). In the course of this outward-looking dimension of MIC2025, Chinese companies are acquiring core technologies through investments abroad that are partly supported and guided by government intervention (WÜBBEKE et al., 2016).

These state-led foreign direct investments could help China to overcome the technological lead of industrial economies. One of the instruments for implementing MIC2025 consists of Chinese M&A transactions abroad. By the time Trump was elected president, Chinese companies had acquired ten European and US makers of advanced automation equipment between 2015 and 2016 (WÜBBEKE et al., 2016). Jungbluth (2018) investigated the Chinese M&A transactions with a share of at least ten percent in German companies between 2014 and 2017, finding that 64 percent (112 of 175) can be assigned to one of the MIC 2025 sectors. Even before Premier Li implemented MIC2025 in 2015, there were signs of an increasing number of Chinese M&A transactions in Germany. This is particularly evident in some of the ten MIC2025 sectors that Germany has significant competitive technological advantages, i.e., 'energy-saving and new-energy vehicles', 'electrical equipment', and 'high-end numerical control machinery and robotics'.

Chinese companies are expanding their global presence based on an aggressive strategy of using M&A. After having grown to a significant size at home, Chinese M&A has broadened its geographic reach. Based on data from Thomson Reuters Datastream, we found that the United States and Germany are two of the top three targets for Chinese acquirer transactions, with 48 and 19 numbers of transactions, respectively. We considered M&A transactions (of partial interest and majority assets) involving Chinese firms since MIC2025 was launched (deal status: completed, announcement date: after May 19). To name a few headline deals in recent years, ChemChina's US$43 billion deal with Syngenta; Shuanghui International's purchase of US-based Smithfield Foods; and Midea's acquisition of one of German's most innovative engineering companies, the robot maker, Kuka (MCKINSEY, 2017).

However, there are critical uncertainties associated with Chinese investment in Germany and the United States, especially in key technologies. Considering the German economy, Jungbluth (2018) highlights two aspects: first, the political influence that the Chinese government plays on M&A transactions and thus the presence of distortions through politically subsidized purchase prices. Second, China and Germany lack reciprocity, as China protects strategic industries from foreign access; meanwhile, Chinese companies can invest without major restrictions in Germany. These have led Germany to strengthen its legislation for the screening of foreign M&A transactions. As argued by Jungbluth (2018), despite a clear quantitative asymmetry in mutual investment relations between China and Germany, and even other countries, it is less its quantity than its quality what matters in the analysis of Chinese investments abroad.

The US is considered the largest recipient of Chinese investments abroad, several of them aimed at acquiring technology companies focusing on areas targeted by MIC2025, $180 billion between January 2005 to January 2019 (JOSHI, 2019). However, the author pointed to an American pushback since 2016, and several deals were turned down by the inter-agency Committee on Foreign Investment in the United States (CFIUS). For instance, in 2016, Philips NV to a Chinese venture-capital firm ($2.8-billion deal), Fairchild Semiconductor International to China Resources Microelectronics Ltd and Hua Capital, Western Digital Corp to Beijing-based Unisplendour Corp ($3.78 billion) – all of them were blocked by CFIUS. Besides the acquisition of strategic assets, greater efficiency-seeking is another key driver of Chinese FDI in the US, as illustrated by Huawei's local operations in Silicon Valley and Baidu's artificial intelligence lab in California (HANEMANN; ROSEN, 2014).

Existing studies suggest that the success of MIC2025 will be mixed. Wübbeke et al. (2016) critique its design and implementation, highlighting an inefficient allocation of funding and local governments' overspending. On top of that, the authors highlight the impact of contextual factors on China's economy, such as the latent impact of automation on the labor market and skill shortages that may decrease most Chinese companies' ability and willingness to invest in an expensive upgrading of production equipment.

Malkin (2018) recognizes that the regular claims around MIC2025's formal and informal regulatory barriers to foreign direct investment in several sectors are valid. However, the author considers that the critiques regarding the unfairness of China's joint-venture-based technology transfer regime, and how China aims to sideline foreign firms and push their Chinese counterparts at the higher-value added part of global value chains, are too simplistic. Even more interesting, the author argues that foreign firms remain an integral part of China's growth model and to resolve the concerns of a leader's industrial economies regarding the MIC2025 it will be necessary global trade governance reform. However, this should address

the needs of developing and middle-income economies in acquiring foreign-owned technological components and know-how.

4. Conclusion

This paper fills a gap in the study of China's technological modernization strategy, as it offers a complementary view of the MIC2025 initiative and a better understanding of its outward-looking dimension. China's moving up the capabilities ladder from producer to creator is taken as a central dimension of China's structural transformation and it is understood in the wake of the challenges to achieving autonomous technological dynamism. We argued that building local technological capacities and strengthening value chain stages, as well as the internationalization of Chinese companies, are crucial bases of the recent Chinese structural transformation.

Drawing on the literature about the Chinese specialization pattern and intangibles in GVCs, we added a descriptive analysis based on some traditional GVC literature indicators. In particular, we explored value-added trade measures to illustrate some aspects of the Chinese specialization pattern and its international competitiveness gains, drawing on the ICT industry as a case study to discuss the growing importance of intangible assets. Through this paper, MIC2025 represents the recent Chinese government initiative to enhance Chinese innovation capabilities. As we aimed to understand its importance in the context of the battles amid hyperglobalization, we studied MIC2025's background, reviewed its strategic objectives, and explored its main challenges.

In general, our results showed that China has increasingly relied on domestic inputs for local processing and has added more domestic value in those typical GVC-intensive industries, such as ICT, while enhancing competitive domestic production capacity in the most high-tech upstream production stages. Among other things, China became less dependent on intermediate imports embodied in its exports while deepening its importance on vertically integrated production networks. In the wake of the global trade slowdown, the Chinese experience shows that government-led investments play an essential role in supporting national companies to upgrade their manufacturing and innovation capabilities and face global competitive pressure.

Some Chinese companies have succeeded in upgrading in GVCs by building their own intangibles. This clearly does not mean that acquiring foreign technologies through mergers and acquisitions is less critical. Particularly, the Chinese mobile phone manufacturing provides some lessons for successful experiences of moving into higher value-added stages. Over the last years, China's mobile phone market has changed considerably, reflecting different development paths and internationalization strategies by innovative Chinese companies. While growing competitive pressure from battles over technology between Chinese companies and MNCs, we witnessed the in-house development of core technologies and the on-going emergence of Chinese brands into international markets, as exemplified by Huawei's case.

We find that China's ICT sector has acquired significant knowledge from foreign companies and now has turned to transition from low value-added tasks to high value-added and intellectual-property-intensive tasks. To achieve greater levels of indigenous innovation and technological autonomy, the MIC2025 has emphasized innovation localization at the same time as China stresses innovation globalization. In other words, the Chinese government aims to improve China's ability to manage power relations in global innovation governance through its innovation capability and upgrade in key industries, as is the case of the ICT sector.

MIC2025's background shows that promoting indigenous innovation is a central issue of the Chinese industrial and innovative policies, based on the idea that nowadays the core of each country's competitive strength is intellectual innovation, technological innovation and high-tech industrialization. This shows that China is transforming its economy based on labour-intensive manufacturing and export-led growth, and has supported indigenous innovation to improve national innovation capabilities. In addition to MIC2025's long-term planning and large government funds and subsidies, we emphasized that acquiring intangible assets was a key part of China's government strategy to support Chinese companies that attempt to upgrade their production capabilities in value chains. These developments are fundamental to the centralization of profits along value chains, increasing competitive pressure in the international market.

Importantly, GVC-oriented industrial policies seek to promote extra-territorial linkages to improve a country's role in GVC or regional chains. For instance, China has benefited from the creation of regional

supply chains that provide needed inputs for its national export success, such as the East Asian supply base associated with the electronics inputs needed for Chinese smartphone exports (GEREFFI; STURGEON, 2013). In this sense, larger emerging economies have more alternatives to moving into higher value-added stages than smaller countries. Besides turning to manufactured exports, these economies can count on the domestic market when the foreign market is less attractive. On the other hand, small economies can benefit from regional integration, diversifying and adding new capacities that are not available nationwide, to create scale and complementarity that leads to increased production and processing steps and, therefore, increased value-added from exports.

Policymakers should explore the possibilities for a complementary approach to building local manufacturing and innovation capabilities, especially in developing countries. Learning in GVCs is not automatic, nor all countries may benefit from technology and skills dissemination within GVCs (STONE et al. 2015; UNCTAD 2013; NATHAN et al. 2019). In fact, GVCs may also act as barriers to learning for local firms, limiting learning opportunities to few firms and locking firms into low technology and low value-added activities. In the case of developing countries, this reinforces the need to build production, technological and innovation capabilities to avoid a "middle-income technology trap", that is, "a specific structural and institutional configuration of the economy that is not conducive to increasing domestic value addition and to sustained industrial and technological upgrading" (see ANDREONI; TREGENNA, 2020, 324), and to enhance dynamic gains from GVC insertion.

Bearing in mind that the government protection of intellectual property has the effect of locking in the monopoly power from intangible asset creation (see PAGANO, 2014), we build from the notion that intellectual monopoly reinforces the deepening of the so-called smile curve (see DURAND; MILBERG, 2020). The findings of this paper suggest that Chinese companies' internationalization strategies and building local innovation capabilities may also provide a chance to perform GVC upgrading and capture market power to provide and produce intangible assets. That said, policymakers may want to broaden the efforts in support innovation capabilities, considering its complementary approach with GVC integration, as the latter de-linked from the local context may end up locking in the monopoly power from intangible asset creation.

We consider that one-size-fits-all innovation strategies are unlikely to match a locality's unique strengths and weaknesses. That said, policymakers should avoid one-size-fits-all strategies and focus on the fundamentals: building a foundation of manufacturing and innovation capabilities, especially in high knowledge-intensive activities, and considering its complementary approach with GVC integration. This possibility, of course, depends on several factors, among which it is worth highlighting the vertical specialization pattern of a given country.

The reorganization of international production in the next coming years will bring huge challenges and opportunities and may leave developing countries at particular risk. Together with building a degree of local self-sufficiency, there is a greater emphasis on supply chain resilience to systemic risks, which may accelerate an ongoing trend towards reshoring or regionalization of international production (JAVORCIK, 2020; DE BACKER; FLAIG, 2017). This may pressure to increase national autonomous production capacity, especially considering the lessons from the COVID-19 pandemic. An important revelation from the recent pandemic is the importance of value chain resilience and diversification of sources, and the changing economics of international production is expected to prevent new waves of outbreaks. Some of the potential trajectories for international production configurations for the next coming years – reshoring, regionalization, and replication – are pull-back of GVCs. Simultaneously, diversification may mean more locations and suppliers in the value chain with a lower geographical distribution of value-added, downward pressure on investment in physical productive assets, and upward pressure on intangibles (see UNCTAD, 2020). In the midst of the reorganization of international production networks, China has moved along the value chain towards high value-added and intellectual-property-intensive tasks. It is worth noting that the degree of intellectual property has different implications for corporate decisions on coordinating and controlling activities within their international production networks. Governance choices also depend on several industry-specific factors, and this is one reason why this article focuses on the case of the ICT sector.

The ICT sector has stringent intellectual property standards and is likely to become even more rigorous in the coming years, reflecting concerns about national security (widely used to safeguard core technologies and know-how) and foreign ownership of high-tech firms. This means that China's previous path largely based on foreign takeovers is increasingly under surveillance by several countries. With a broader tendency to expand screening of takeovers and tighten investment regulations, this path may also have become even more restricted to other countries and foreign companies, and therefore may deepen intellectual monopolization of international production networks. That said, MIC2025 certainly has a technological disruptive potential with immense collective benefits that are not restricted to China's geographical borders, which clearly does not mean that it will not escalate economic, political, and technological battles for global hegemony.

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