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## **Logistics and the globalization of the automotive supply chain: A case study on the Parts Consolidation Centres in the Seine Valley Corridor**

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### **Abstract**

During the past decades, the geography of the automotive industry has changed considerably. Today (2021) almost half of the production and sales take place in emerging economies compared to about 10% in 2000. Supply chains have been transformed to follow manufacturers towards the emerging economies. While most parts are sourced locally, non-negligible amounts are conveyed in containers from suppliers' plants in the advanced economies. To save transport costs and to ensure the reliability of these pipelines, car manufacturers rely on Parts Consolidation Centres (PCCs), i.e., cross-docking facilities where parts are sorted and packed in containers depending on their final destinations. Through an in-depth case study on the Seine Valley Corridor, this chapter unveils the logistics operations realized at PCCs, creating opportunities for upgrading through innovation and new technologies such as Hybrid and Electric vehicles, but simultaneously underlines the continued prevalence of low value-added logistics operations and the overall instability of demand.

**Keywords:** port, globalization, automotive industry, Seine Valley Corridor, Parts Consolidation Centre

## 1. Introduction

Transport corridor policies aim to improve transport efficiency by fostering economies of scale in freight transportation. The idea is to better utilize the existing capacity of ports and surface transport infrastructure by driving the demand to selected routes. This is easier to achieve under certain conditions, such as when a single shipper generates substantial volumes or when several shippers of smaller size are geographically clustered. The automotive industry is particularly interesting from this perspective, because it brings together large car assembly plants and lots of suppliers' plants often located close to each other.

Traditionally, suppliers were mostly located close to the car assembly plant and parts were carried over relatively short distances. But car manufacturers and suppliers are facing a new challenge in the context of recent globalization. Between 2005 and 2019, the share of emerging economies on the global sales of new vehicles increased from 36% to 49%<sup>1</sup>. To respond to this changing demand, car manufacturers have considerably increased their overseas production capacities, by the means of the construction of new assembly plants or by the extension of existent ones (the so-called 'off-shoring'). Nevertheless, in fast growing emerging economies, supplier networks are still underdeveloped, and a substantial share of key parts is sourced from suppliers located in the advanced economies. Within this configuration, procurement lead times are longer and, in some cases, may take even more than two months for some vehicle parts. The lengthening of procurement delay is mainly due to the slowness of maritime transport, and to production processes involving parts produced in several locations. With many distant suppliers, the organization of the supply chains becomes increasingly complex, involving important stocks, and turns out to be difficult to manage for car manufacturers. To save transport costs and ensure the reliability of these pipelines, car manufacturers use Parts Consolidation Centres (PCCs) – cross-docking facilities where parts are sorted and packed in containers depending on their destination (Itoh and Guerrero, 2020: case study of the PCCs by two Japanese car manufactures). In a world of increasing, intensified competition, the effectiveness of distant sourcing strategies becomes more and more a determining factor, both for customer satisfaction, by reducing delivery lead times, and to cut costs, mainly by the reduction of stocks all along the chain.

In this chapter, we examine the reality of such distant sourcing by maritime transport from the advanced economies to emerging ones by considering the examples of two French car manufacturers which have implemented strategies to minimise transport cost and time from part suppliers located in Europe to assembly factories in emerging economies. It sheds light on the

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<sup>1</sup> Data retrieved from OICA website, the 24.11.2022 <http://www.oica.net>

fact that, in order to consolidate the shipments of many suppliers to assembling factories in emerging economies, PCC either operated by third-party logistics (3PL) providers or directly by the car manufacturers have been located near the ports and we further clarify the functions of this kind of logistics facilities. By examining the ways in which these flows are consolidated, we explore the relationship between shippers, ports and corridor development. The recent increase of the flows handled by these PCCs would provide new opportunities for corridors to develop value-added activities, as those identified by Ng and Liu (2014)'s 'port-focal logistics' concept. Also, further information has been obtained through semi-structured, in-depth interviews with five executives from Renault and Stellantis (at the time of the interview PSA Peugeot-Citroën) and two executives from Gefco, a 3PL provider specialized in automotive logistics formerly owned by Stellantis. Useful information was gathered from managers that possessed expertise knowledge about inquiry<sup>2</sup>. To ensure the reliability of the information provided by these interviews, comparisons have been made with the available data provided by manufacturers' and 3PL's websites. The rest of the chapter is as follows. In Section 2, we sketch a broad overview of distant sourcing strategies in the automotive industry and present a case study of PCCs in the Seine Valley Corridor to explain their role in the logistics networks of French car manufacturers. Section 3 provides a discussion and conclusions.

## **2. Distant sourcing and its implications for French car manufacturers**

### *2.1. The growth in the automotive industry mostly comes from emerging economies*

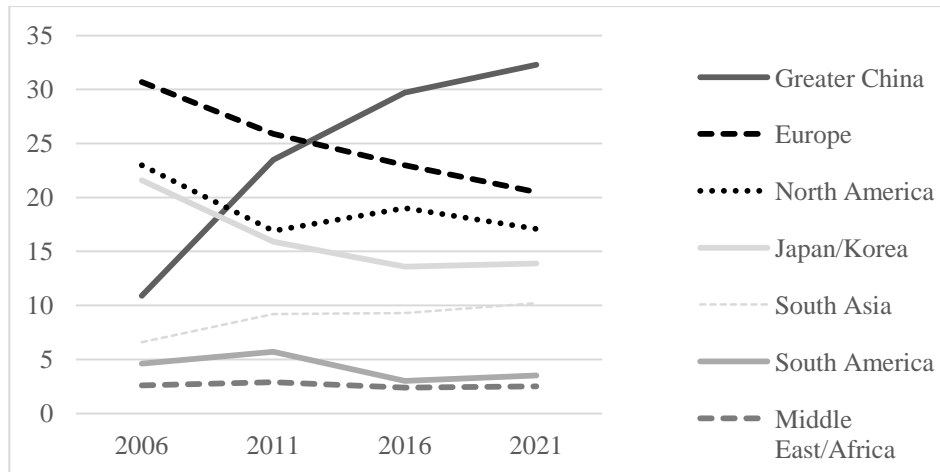
With fast growing demand and low vehicle penetration, the emerging economies drive the growth of global automotive industry. Being the home of almost half of the world's population, China and other emerging economies, such as India have led this growth. Between 2006 and 2021, the growth of the production in these regions was so strong that it eclipsed increases in the advanced economies (Figure 1). The most dramatic example is the Chinese one: in 2010 it overtook the US as the largest country in the demand of new cars (Wang et al., 2013). The sales gap between advanced and emerging economies will probably widen in the next decades, not just because of the large size of the latter but because vehicle ownership remains still very low. In 2019<sup>3</sup>, the number of motor vehicles per thousand inhabitants is 816 in the US, 482 in France, but only 214 in China and 44 in India. The countries in South America are somewhat in-between, with 316 and 366 vehicles per thousand inhabitants in Argentina and Brazil, respectively.

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<sup>2</sup> Since the actual volumes of traded parts, transport costs, and other quantitative data were confidential, we did not manage to conduct any quantitative analysis based on the data provided by them.

<sup>3</sup> Data retrieved from different sources: France, Eurostat 2019; USA, Highway statistics 2019; China, Autonews 2021; India, MoRTH 2021; Brazil, Frota de veiculos 2013; Argentina, World Bank 2013.

**Figure 1 – Share of regions on the Global Vehicle Production (in %)**



Source: Authors, using data compiled by ACEA (2022) *Note: Greater China includes Mainland China, Hong-Kong, Macao, and Taiwan. The production volumes of the latter are marginal as compared to those of Mainland China.*

To respond to the increasing demands, car manufacturers created new overseas production facilities or expanded significantly their operations in the existent ones. The development of production in these regions has been done in different ways depending on the distance to the home-based production facilities of car manufacturers. The car manufacturing industries of Eastern Europe and Mexico have been integrated into the production systems of Western Europe and North America. The other major emerging economies (i.e., China, India, South America and Southeast Asia) adopted a mix of policies of trade and investment liberalization with the creation of protected domestic or regional industries (Humphrey, 2003). On the one hand, quantitative restrictions were abolished and tariff levels reduced. On the other hand, trade-related investment measures have been adopted, such as local content requirements<sup>4</sup>, foreign exchange balancing requirements and duty drawbacks schemes (as well as incentives and subsidies), were used to stimulate domestic production of vehicles and parts (Humphrey, 2003). Consequently, car manufacturers invested heavily in assembly plants in emerging economies.

## 2.2. The pipelines of parts of French car manufacturers to distant assembly factories

### (a) The case of Renault

<sup>4</sup> Local content requirements are policy measures that require a certain percentage of parts used in the production of vehicles to be sourced from domestic-based suppliers.

Renault has been an early adopter of distant sourcing strategy. As early as 1975, a PCC was created in Grand Couronne, in the Seine Valley Corridor, in the vicinity of other factories created by Renault in the late 1950s and 1960s: Cléon (engines, gearboxes), Sandouville (body manufacturing, vehicle assembly), Aubevoye (testing facility) and Dieppe (assembly of sports and GPL cars). The Grand Couronne PCC was in midway between Paris and the port of Le Havre, [along the Seine riverbank](#). In 1971, Renault established a logistics subsidiary, Sofrastock International, to deliver Complete-Knock-Down (CKD) kits to overseas assembling plants from Grand Couronne. The vehicles were shipped unassembled to avoid high taxes on the imports of finished vehicles, or alternatively invested full vehicle assembly plants in the countries where the Minimum Efficient Scale (MES) of production was not reached. As overseas markets expanded, the sourcing system evolved towards hybrid forms of Knock-Down (KD), such Semi-Knock-Down (SKD) where painting, and the assembly of kits are realized in overseas factories, in Maghreb, South America, South Korea. The parts shipped from the PCC are not only those produced by European-based suppliers but also those coming from overseas locations such Brazil, Japan, and India. Towards the end of the last century, Renault expanded its International Logistics Network (ILN) of PCCs to Curitiba (Brazil), Cordoba (Argentina), Valladolid (Spain), Mioveni (Romania), Bursa (Turkey), Pune (India), Busan (South Korea) and Tangier (Morocco). In 1999, the [alliance](#) with Renault-Nissan provided new opportunities for pooling the logistics flows of both manufacturers. However, [more than twenty](#) years after, both networks, Renault ILN and Nissan PCCs, continue to operate independently.

Since the turn of the century, Renault increasingly adopted individual part order (IPO) system to source most of its overseas assembling plants. This means that, instead of CKD kits, individual parts are shipped from ILN Grand Couronne, depending on the needs of the overseas factories, which are also sourced locally by global suppliers and local ones. At the time when this study took place, 15 overseas plants of Renault were sourced from ILN Grand Couronne. About half of the parts sourced from 650 European-based suppliers were repackaged using disposable containers whose resistance might vary depending on the final overseas destination. The average inbound traffic of the ILN Grand Couronne was between 100 and 150 trucks per day, and the maritime outbound throughput was around 10,000 Forty-Foot Equivalent Unit (FEU) [containers](#) (20,000 TEUs) per year. [The FEU containers are carried to the port of Le Havre \(90 km away from the ILN\), where the variety and frequency of containerized services is much higher than in the port of Rouen. One of the river terminals on the port of Rouen was located at the vicinity of the Grand Couronne's Renault facility. Taking advantage of this proximity, river transport from](#)

the port of Rouen has been used for several years in the late 2000s- and the early 2010s<sup>5</sup>, to carry the FEU containers to the port of Le Havre, but the service was stopped and barge was replaced by truck. In 2019, the Grand Couronne site was closed and the ILN activity was transferred to another Renault site in Cleon, less than 15 km from the old site. It is worthwhile noting that the new facility is distant from existing port terminals, so the potential for returning to river transport is very limited.

#### (b) The case of Stellantis

In the case of Stellantis, global sourcing has been implemented more recently. In 2002, during the early stages of economic recovery in Argentina and their rapid growth of car sales, there was a surge in the local demand for automotive parts. Responding to this, Stellantis asked its 3PL - Gefco (during this period 75% owned by Stellantis) to create a distribution depot in Le Havre (cross-docking) to consolidate the maritime shipments from European-based suppliers to its assembling plant in Buenos Aires (Argentina) and the other overseas plants. By using as much as 90% of the volume of the containers, such a new system allowed a drastic reduction of its transport costs. Based on this success, Stellantis adopted shortly after the same channel to supply automotive parts to its new assembly plants in Porto Real (Brazil), Shenzhen, and Wuhan (China), both operated under a joint-venture agreement with the Chinese state-owned corporation *Dongfeng*. The logistics network created by Gefco for Stellantis (PSA branch) is called *PLI (Plate-forme logistique Internationale)* and relied on five PCCs: Le Havre, Soheim (East of France), Shanghai (China), Tarnava (Slovenia), and Mexico City (Mexico).

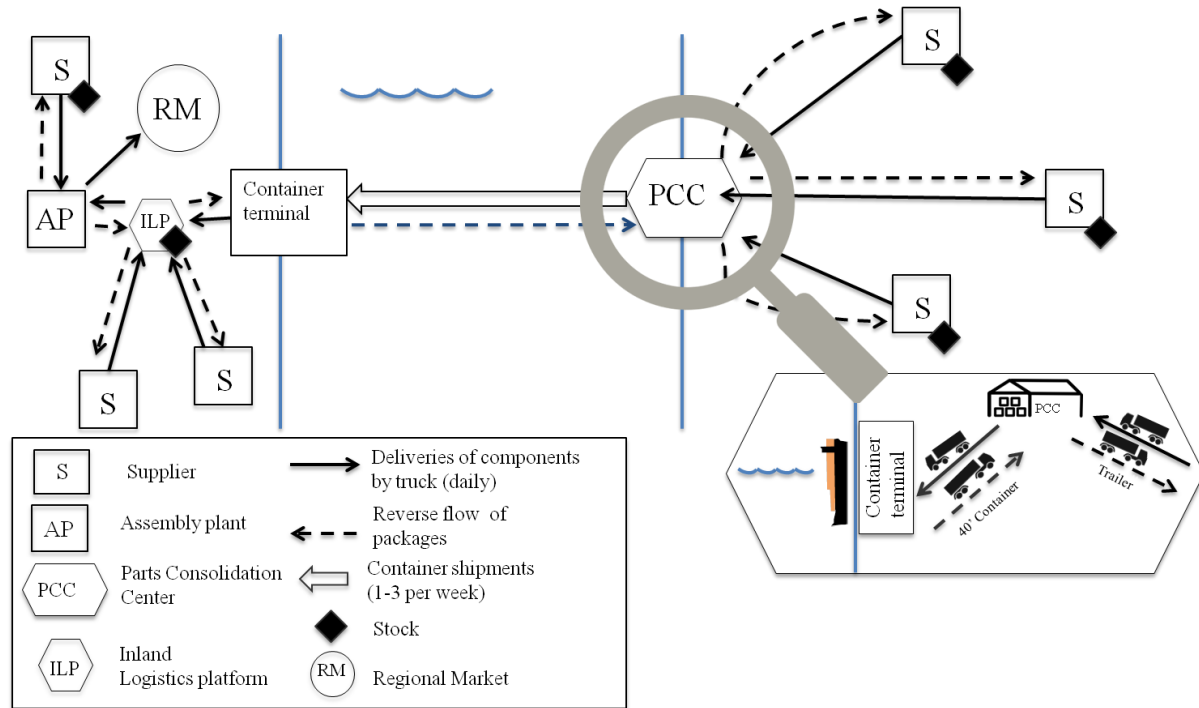
#### (c) the system of PCCs at both manufacturers

Distant sourcing strategies of the French manufacturers share some characteristics (Figure 2). They both rely on PCCs to consolidate their European-based supplies. Road inbound transport between the suppliers and the PCC could be managed either by the manufacturer (Renault) or by a 3PL provider (Gefco), but in both cases, the information flow is exclusively handled by the manufacturers. Parts are shipped by maritime means on a weekly basis, allowing an improvement of the filling rate of containers, which are generally unpacked when arriving at an overseas PCCs or depot. The returnable packages are almost exclusively used for inland transport, since their reverse logistics are particularly hard to manage over long distances (Guez, 2014).

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<sup>5</sup> Renault, l'option fluviale, Le Télégramme, 01.06.2007

**Figure 2 – Situation of Parts Consolidation Centres in the Automotive Supply Chain**



Source: Authors

### 2.3. Focus on the PCC in Le Havre (France) operated by Gefco for Stellantis

About 8,000 different vehicle parts are collected from the factories of each of 800 European-based suppliers and brought by truck to the 38,000 square meters Gefco PCC in Le Havre. A close examination of the PCC reveals three functional classifications:

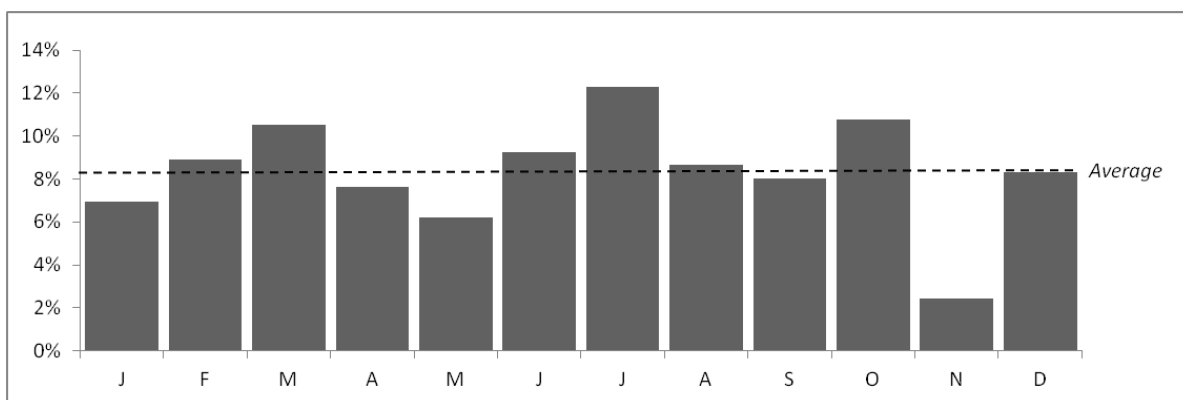
(a) **Shipments to PCCs:** Parts are conveyed by trucks in different ways, depending on the lot size and on the distance to Le Havre. Large lots, which account for 30% of all the cargo handled in the PCC, are conveyed in full trucks essentially from eastern and northern France where several large suppliers are located. The rest of the parts are collected using other methods. The milk-run is used to combine the deliveries of several suppliers located in France and in the neighbouring countries. When parts suppliers are located far away (ex. Central Europe), light vehicles are used to consolidate the flows of parts onto large trucks, through intermediary depots managed by Gefco or by its local logistics partners. [This organization generates substantial empty truck mileage, and the potential for backhaul shipments is limited, beyond the reverse logistics of reusable packages.](#)



(b) **Operation in PCCs:** Parts are delivered to Gefco PCC in Le Havre, from where deliveries in disposable packages are made to overseas car assembly plants on a weekly basis. The average storage time in the PCC is fewer than 48 hours. Among the 300 employees, half of them are temporary staff. The large-scale use of temporary workers results from the high variability of activity in the PCC provoked, on the one hand, by the seasonality of production in overseas factories, and on the other hand, on the working capital management of car manufacturers. Stellantis tries to diminish, as much as possible, of its working capital at the moment of the mid-year accountant closure in order to get lower interest rates to finance its debt. As a consequence, the monthly breakdown of the activity of the PCC is rather heterogeneous, and drops significantly at May and November (Figure 3).

(c) **Maritime transport:** From overseas ports, parts are transferred on trucks and conveyed to assembling factories or to warehouses from which they are delivered on small-lot high-frequency basis to the production lines. In 2014, about 8,000 FEUs were shipped from the port of Le Havre, with about 22% to Buenos Aires (Argentina), 36% to Porto Real (Brazil), 2% to Shenzhen (China) and 40% to Wuhan (China). Most shipments were conveyed into dry or high cube FEU containers, and more rarely by reefer, widely used in the trade with Argentina. Maritime carriers are selected directly by the logistics department of Stellantis. An alternative pipeline exists for emergency supply of parts by airplane, from the PCC in Le Havre to the Charles-de-Gaulle Airport in Paris and to overseas airports close to assemblers.

**Figure 3 – Monthly breakdown of Stellantis handling volumes (% of the annual volume)**

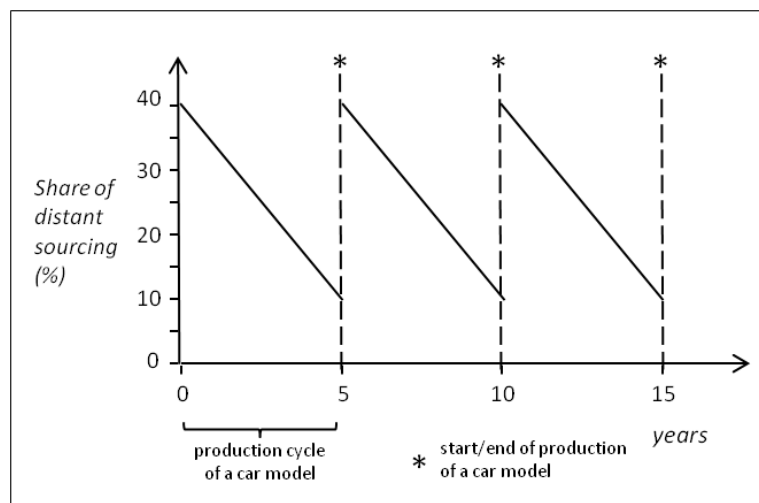


Source: Authors, based on Gefco data

The share of parts supplied by European-based suppliers in the production of cars varies considerably during the production cycle of a car model. At the start of the production, the share of distance sourcing is very high since global suppliers use the same production facilities in

Europe to deliver parts to all the assembling factories. This is the logical follow-up of the tight relationship between manufacturers and their preferred suppliers which also involves earlier stages of joint design (Humphrey, 2003). When the volume of vehicles produced by the overseas assembling plant is large, global suppliers are strongly encouraged by manufacturers to overseas production to avoid import duties, the costs of transport and labour, and to integrate new components in their local Just-In-Time (JIT) strategy. Local suppliers are integrated in at a second stage, partly as first-tier suppliers and mainly as second- or third-tier. However, the shift from distant to local sourcing is progressive and the maximum level of local sourcing is only obtained after several years. At the end of the production cycle of a car model, the rate of local sourcing is generally comprised between 90% and 95%, but, according to the managers interviewed, this figure could be substantially lower for the emerging economies' markets where the supplier base is much less developed. Figure 4 depicts the theoretical evolution of distant sourcing for an overseas assembly plant. Given that the average production cycle of a car model is five years, the share of distant sourcing (share of parts imported from advanced economies) is particularly high when the production starts. Then, if the vehicle model finds a market overseas, suppliers will be encouraged to produce the parts locally to save transport costs, and this will result in a reduction of the share of distant sourcing. The process starts over again every five years (or more) when a new model is launched overseas.

**Figure 4 – Theoretical evolution of distant sourcing for a single car model**



Source: Authors

### 3. Discussion and conclusion: Is distant sourcing strategy bound to last?

The discussion in this chapter indicates that a substantial share of the auto parts used in the assembly of cars in emerging economies is sourced from distant regions, and that the pipelines of most components are consolidated in the PCCs. Does this situation reflect a temporal solution before achieving follow sourcing (i.e., the suppliers on advanced economies bring their refined technology directly to the local parts plants on developing economies), or does it come about in the context of a logistics system that is bound to last? This is not only important for firms involved in the automotive supply chain, but also for firms and institutions in ports that are taking advantages of the opportunities provided by the extension of automotive supply chains. Given the risks and uncertainty associated to emerging markets, we expect that distant sourcing from advanced to emerging economies would remain at high levels in the coming years. Based on this scenario, ports would handle increasingly important volumes, in the context of extended supply chains. However, value creation cannot be taken for granted for every port: most of the activities are cross-docking and repackaging and do not require special skills. Both local institutions and 3PL providers have interests in encouraging the development of more value-added activities, and can eventually support the development of support activities to these flows. Ports and logistics facilities that can provide high value-added services will be selected and clustered there.

Distant sourcing of car components [increases as new assembly plants come into operation in emerging economies](#). [Except engines and gearboxes, most of the components used in the production of hybrid and electric vehicles are similar to those used for traditional \(internal combustion engine\) ones \(Klier and Rubinstein, 2021\)](#). PCCs are called to play a critical role ensuring vendor consolidation and the management of inventories. There is a move of suppliers to follow source overseas for many car components, but there is also a trend to long distance sourcing of parts from European suppliers, particularly for complex or high technology components. With the expansion of suppliers in emerging economies, the question of their location of suppliers' research and development centres in the global network will become increasingly important. If key components, such as engines, gearboxes, and electronics components can be sourced locally in emerging economies, to what extent long distance will be necessary to source from advanced economies (i.e., Western Europe)? For instance, MES have not been reached for most of key parts to achieve the follow sourcing strategies ([namely, the production volumes of new cars are too small to justify the creation of a new supplier plant in the country](#)). Maybe the only exception is China, where the enormous market and the presence of a lot of part suppliers are important attractors for implementing follow sourcing strategies. In other

emerging economies, such Brazil and Northern Africa, the size of the market and its stability do not seem to be large enough and highlight the need for caution.

For the Seine Valley Corridor, the opportunities to capture value in the automotive supply chains are real but depend much on their respective locations **and on the type of vehicle propulsion**. Since vehicle customization takes place close to the final markets, the ports of destination of parts seem to be better positioned than those **of departure** (Carbone and De Martino, 2003, Dias et al., 2010). However, the introduction of new types of propulsion, such as hybrid and electric cars, are bringing new opportunities to European ports. For example, electric batteries imported **from East Asia** by Stellantis for its hybrid vehicles are charged in the Gefco PCC in Le Havre. Although these value-added activities are still marginal, representing less than 3% of **the PCC** activity, they can further develop with the growth of **other bulky and technology-intensive components imported from abroad**. **This chapter provided a study of parts consolidation for car manufacturers located relatively close to a port**. It could be interesting to study other spatial configurations, in other parts of the world, for example when a car manufacturing region is equally distant to several competing ports, as it appears to be the case in Bavaria (Germany) or in Wuhan (China).

The contents in this chapter should not be interpreted as definitive statements of the current and future logistics strategies of car manufacturers. Other aspects, such as evolving power relationships with large parts' suppliers, the development of emerging technologies, such 3D printing would undoubtedly impact them. Indeed, with the increasing possibility of 're-shoring' (e.g., Trump's policy of 'America First' during his time in office) and 'friend-shoring' (e.g., the establishment of the Regional Comprehensive Economic Partnership (RCEP) trade agreement effective in January 2022, the launching of the Indo-Pacific Economic Framework (IPEF) announced by President Joe Biden in May 2022) thanks to the increasing rivalries in global politics, the impacts of the Covid-19 pandemic, and the recent Russo-Ukrainian conflict, a lot of new opportunities (and challenges) are being offered to the future of global supply chains and, indeed, global value chains. Nonetheless, our findings strongly support that distant sourcing from the advanced economies to emerging ones is bound to last in the automotive industry, and ports can certainly play some critical roles on its future well-being.

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