

# GOOD MULTIMODAL PRACTICES IN GM- SPAIN

- CASE STUDY -

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## 1. INTRODUCTION

Logistics costs in the Spanish automotive sector are high, even exceeding the cost of labour. They account for approximately 10% of the manufacturing cost of a vehicle. The supply chain is very complex sector. Parts and materials from different sources successively pass through their different links, from suppliers located in different countries to reach the final assembly line of a manufacturer. The first-tier suppliers (Tier 1) are usually located near these factories, in dedicated parks, to ensure a delivery adjusted to production schedules, supplying parts and product systems to the factory in very short answer times.

In Spain the mode of transport most used in provisioning is the road, although a large part of components imported for the sector come in through the ports, as does imported vehicles. Shipping and rail transport, with market shares of 50% and 14%, respectively, are especially relevant in the vehicles distribution. Although slower and flexible, they are very efficient transport modes considering the long distance between the factories and outlets and also the volume and weight of the goods. Both rail and maritime transport, usually short distance (short sea shipping), are used in combination with road transport, for themselves lack the necessary reach.

The transportation of finished vehicles requires very specific facilities and means (trucks and wagons car holders, pure car carrier ships), due to the size of the transported product, which cannot be used to transport other goods. Large areas of land are also required to temporarily store the vehicles and zones to perform modal shift loading and unloading operations. These areas must be safe and well-lit. In ports with high tides adjustable mobile ramps are required, while in ports with little available parking surface height should be constructed. The operation of loading and unloading demands a labour-intensive and skilled labour. Product handling should be especially careful at every point of logistics, being a high value product that is further transported without packaging chain.

Ports are the modal shift node by excellence. The sector is constantly evaluating the efficiency of different Spanish port terminals specialized in this type of traffic. The quality of rail

connections to ports (frequencies, flexible schedule, and duration of transport), costs and times in the loading and unloading operations during the mode of transport changes, time flexibility or agility in customs procedures, among others, are critical factors, which favours growth optimization of multi-modal traffics through ports.

The Motorways of the Sea are an excellent choice for ro-ro transport and in particular for the movement of new vehicles. MoS Gijón - Nantes has been very successful during the operating period from 2010 to 2014. Throughout its four years of operation it managed to consolidate a line of great interest to the automotive sector. Specifically, at one moment it transported 25,000 new cars and 3,000 new trucks, per year, manufactured in Spain. MoS Vigo - Saint Nazaire is also of great interest to the automotive sector given the proximity of some of the car factories in Spain.

Within manufacturers located in Spain, General Motors is a company that distinguishes itself by its good practices in multimodal transport organization, both of components supplies to the factory as well as vehicles manufactured from the Factory to different markets in which they are distributed to end customers. The company moves large amount of materials and vehicles using alternative modes of transport to road, also making multi-modal transport rail-port.

## 2. GM ACTIVITIES IN SPAIN

One of the important carmakers in Spain is General Motors. General Motors España has settled in Figueruelas (Zaragoza) in 1982 with the purpose of manufacturing a small car - the Opel Corsa - for a new market that had substantially changed its demand patterns following the oil crisis. Since then, the Zaragoza plant has also produced the Kadett, Astra, Tigra, Combo, Meriva and Mokka models. The main activity carried out in the plant is the manufacture of vehicles and components.

The plant is located in the industrial complex of Entrerríos, an industrial area 27 km from Zaragoza. It is located between the right bank of the Ebro River and the left bank of the Jalón River. The access to the site is made through the National Road N-232, which connects the city of Zaragoza and Logroño; the Basque-Aragonese motorway AP- 68 that connects the north of the country with the Mediterranean, and through the road Rivera del Jalón; besides having a rail freight access.

It occupies an area of 3.10 km<sup>2</sup>, with a built area of 605,600 m<sup>2</sup>, distributed in 4 main industrial facilities and other complementary buildings. The remaining ones are dedicated to the parking of finished cars, employees' parking, green areas, 12 kilometres of roads and 13 internal railways, totalling an additional 17 km. (Image 1)

IMAGE 1. AERIAL VIEW OF THE *OPEL ESPAÑA* PLANT IN FIGUERUELAS, ZARAGOZA



Within the Figueruelas plant there are two entities of the Corporation in which GM España is integrated: General Motors Europe Holdings and General Motors Automotive Holdings, whose goals include cost control, project assessment and financial planning.

There is an additional GM work centre in Spain located in Alcobendas (Madrid) in which are located the main Marketing, Sales, Customer Service, Communication and Corporate Relationship departments.

GM España is held by the European Opel Adam AG, which is headquartered in Rüsselsheim (Germany). It was also integrated in the multinational GM Corporation, re-founded in 2009 under the designation GM Company. The worldwide headquarters of the company are located in Detroit and employs around 202,000 people. Its product lines are extremely wide as GM holds different brands: Chevrolet, Buick, GMC, Cadillac, Holden, Jiefang, Wuling, Baojun, Vauxhall and Opel. Opel is the second most important brand of GM's passenger cars and the third best-selling brand of passenger cars in Europe.

The Opel plant in Zaragoza is especially important for the Spanish automobile industry, contributing significantly to place Spain as the country's second largest producer of passenger cars and the first in Europe as for industrial vehicles. The Zaragoza plant has 5,434 employees,

representing 10.4% of the total employment on the car plants in Spain and 20% of the manufacturing workforce of the GM group in Europe (Figure 1).

FIGURE 1. CAR PRODUCTION PLANTS IN SPAIN



The number of companies from the automotive industry located in Spain is 9, with a total of 16 factories. The relationship between companies and their respective brands and models is summarized in Table 2, while Table 1 displays the total of jobs per factory.

TABLE 1. JOBS PER FACTORY, 2015

Factories	Jobs
Mercedes-Vitoria	3,500
PSA-Vigo	6,000
PSA-Madrid	1,850
GM - Figueruelas (Zaragoza)	5,434
VW - Navarra	4,500
FORD - Almussafes (Valencia)	8,000
SEAT - Martorell (Barcelona)	6,700
RENAULT – Palencia	1,800
RENAULT – Valladolid	4,400
NISSAN – Barcelona	4,900
IVECO - Valladolid	1,015
IVECO - Madrid	2,600
NISSAN – Ávila	476
MERCEDES-Cantabria	253
NISSAN-Cantabria	700
RENAULT –Sevilla	850

TABLE 2. LIST OF BRANDS AND MODELS, 2015

<b>Maker</b>	<b>Factories</b>	<b>Models</b>
MERCEDES	Mercedes-Vitoria	Class V
CITROËN	PSA-Vigo	C4 Picasso 5, C-ELYSEE
	PSA-Madrid	C4 CACTUS
PEUGEOT	PSA-Vigo	207 CC
	PSA-Madrid	301
OPEL	GM - Figueruelas (Zaragoza)	MERIVA, CORSA, MOKKA
VW	VW - Navarra	POLO
FORD	FORD - Almussafes (Valencia)	KUGA, MONDEO, TOURNEO, S-MAX, GALAXY
AUDI	SEAT - Martorell (Barcelona)	Q3
SEAT	SEAT - Martorell (Barcelona)	ALTEA, IBIZA, LEON
RENAULT	RENAULT – Palencia	MEGANE, KADJAR
	RENAULT – Valladolid	TWIZY, CAPTUR
NISSAN	NISSAN – Barcelona	PULSAR, PATHFINDER, NAVARA
<b>Commercial vehicles</b>		
<b>Maker</b>	<b>Factories</b>	<b>Models</b>
MERCEDES	MERCEDES-Vitoria	VITO
CITROËN	PSA-Vigo	BERLINGO
PEUGEOT	PSA-Vigo	PARTNER
FORD	FORD - Almussafes (Valencia)	TRANSIT CONNECT
NISSAN	NISSAN – Barcelona	NV 200
RENAULT	RENAULT – Palencia	MEGANE VU
IVECO	IVECO - Valladolid	DAILY
	IVECO - Madrid	STRALIS, TRAKKER
NISSAN	NISSAN – Ávila	NT 500, NT400 CABSTAR
<b>Components</b>		
MERCEDES-BENZ	MERCEDES-Cantabria	Chassis
NISSAN	NISSAN-Cantabria	Components
RENAULT	RENAULT – Valladolid	Engines
RENAULT	RENAULT – Sevilla	Transmissions

Furthermore, the GM España plant has become an essential pillar to the economy Aragón, to the region in which it stands, due to both the volume of the investment and the direct jobs it has generated, as well as boosting in the area an important auxiliary industry.

The plant has carried out continuous investments since its creation, which up to date exceed 4,500 million Euros, of which more than 370 million Euros have been invested in 2013 and 2014 for the production of the new Mokka and Corsa models.

Its impact on the regional employment setting goes far beyond the volume of its workforce, adding the components industry based in Aragón that consists of nearly 300 companies employing more than 28,000 people. Therefore, GM España has become and continues to be the real engine of the Aragón economy.

Along the year of 2014, General Motors España has carried out three new vehicle launches. It started the year with the production of a new Meriva model, stating in September the production line and launch of the Mokka model, and ending the year producing the fifth generation of the Corsa model. This has enabled optimization of the production capacity of the plant. The GM España plant is the one holding the largest capacity of General Motors in Europe. It can produce 480,000 vehicles annually and 180,000 components to produce vehicles in Zaragoza and also vehicles from other GM plants, as the 3-door Corsa in Eisenach (Germany).

FIGURE 2. GM PRODUCTION IN SPAIN

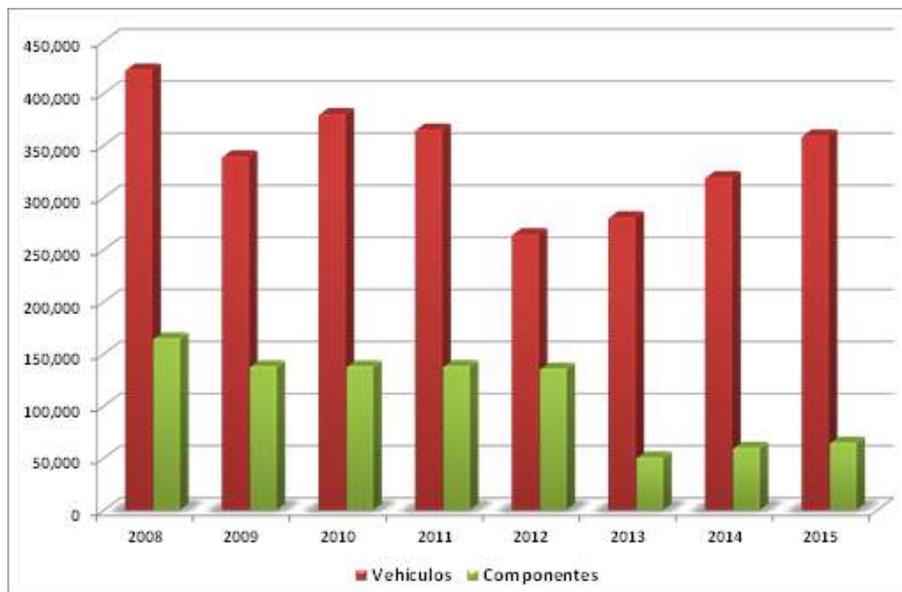
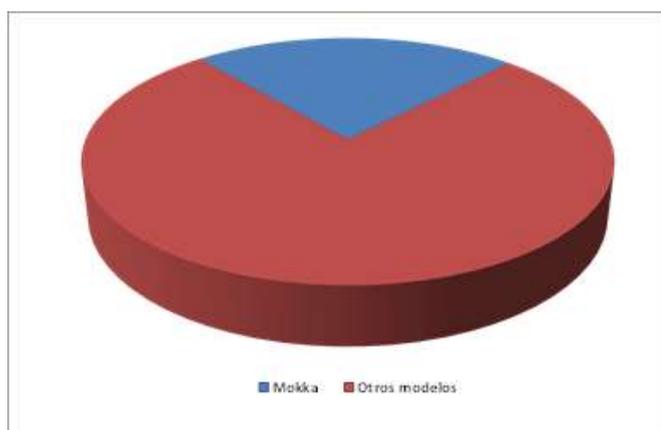


Figure 2 shows the evolution of the plant production since 2008. During 2014 it has manufactured 319,586 vehicles and nearly 60,000 components. This production represented 36% of all GM Europe Group, increasing by 14% compared to 2013, and 21% more than in

2012. In 2014 it exported 90.4% of its manufacturing, 88.7% to the European Union and 1.7% to other countries. The main destinations were the United Kingdom (72,208 units), Germany (60,291), Italy (37,013), Spain (30,612), France (28,561), Turkey (13,230), Belgium (10,276), Poland (10,646) and the Netherlands (8,142).

In 2015, the company goal was to significantly increase the production of 2014 with the help of the additional units of the Mokka, the renewed Meriva and the new Corsa. The final volume of manufactured units in 2015 totalled 359,600 vehicles, 12.5% higher than the previous year. The Opel Mokka production reached 20,996 units in 2014, amounting to 83,832 in 2015. This represents 23.3% of the total production of GM España in the last year (Figure 3). The plant will strongly increase capacity over 2016, partly due to the strategic alliance between the PSA Peugeot Citroën and the GM to manufacture B-MPVs for both brands in Zaragoza. Pre-production commences in 2016 and series production will follow in 2017.

FIGURE 3. SHARE OF THE MOKKA MODEL IN THE *GM ESPAÑA* PRODUCTION, 2015



### 3. TRANSPORT POLICY

Zaragoza has an efficient logistics setup across Spain, which is also well connected to the rest of GM's European supply chain. The company has always sought the most efficient and sustainable transport means, combining various transport modes (maritime highways, railways, highways, etc.) to reach its markets and also for supply.

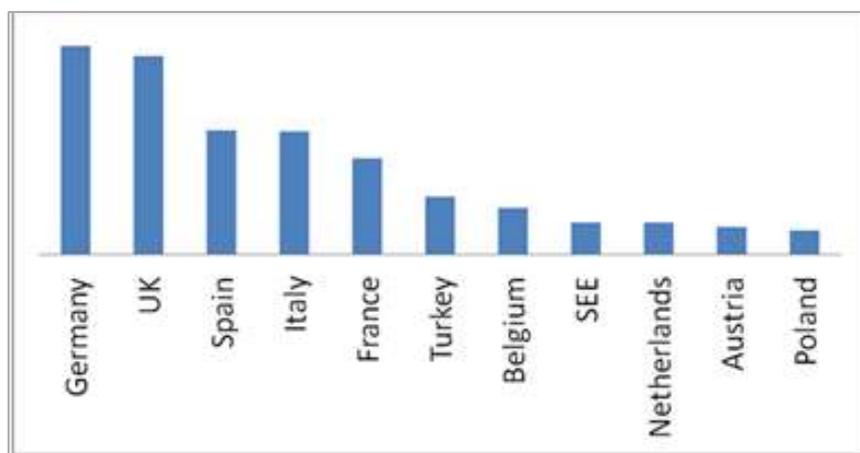
That is important since some suppliers are as far as 2,200 km away. In its transport policy, the company values not only the cost but other aspects such as the environmental impact.

Truck is the dominant mode for Spanish and European suppliers, amounting to 50.000 full truckloads per year. GM uses 5.000 rail wagons per year to import engines and transmissions from GM-allied plants in Europe, which represents around 2% of the total inbound volume. Approximately 78% of volume arrives directly from suppliers, 21% through milk runs, and 1% through a regional distribution centre in Germany. The company review key indicators such as truck utilisation, container utilisation, and the number of direct routes versus consolidated routes, which are much more expensive. Truck utilisation is around 83%.

After the production of the vehicle, the company takes an average of two weeks until the final delivery to the customer. In 2014 exported 90.4% of its production, 88.7% to the EU and 1.7% to other countries. The main destinations in 2014 were the United Kingdom (72.208 units), Germany (60.291), Italy (37.013), France (28.561), Turkey (13.230), Belgium (10.276), Poland (10.646) and the Netherlands (8.142).

During 2015, 88% of production was exported, while the remaining 12% was sold in Spain. Overall, the main markets in 2015 were Germany and the United Kingdom, followed by Spain, Italy, France, Belgium, the Netherlands, Austria and Poland (Figure 4).

FIGURE 4. MAIN MARKETS OF GM SPAIN, 2015

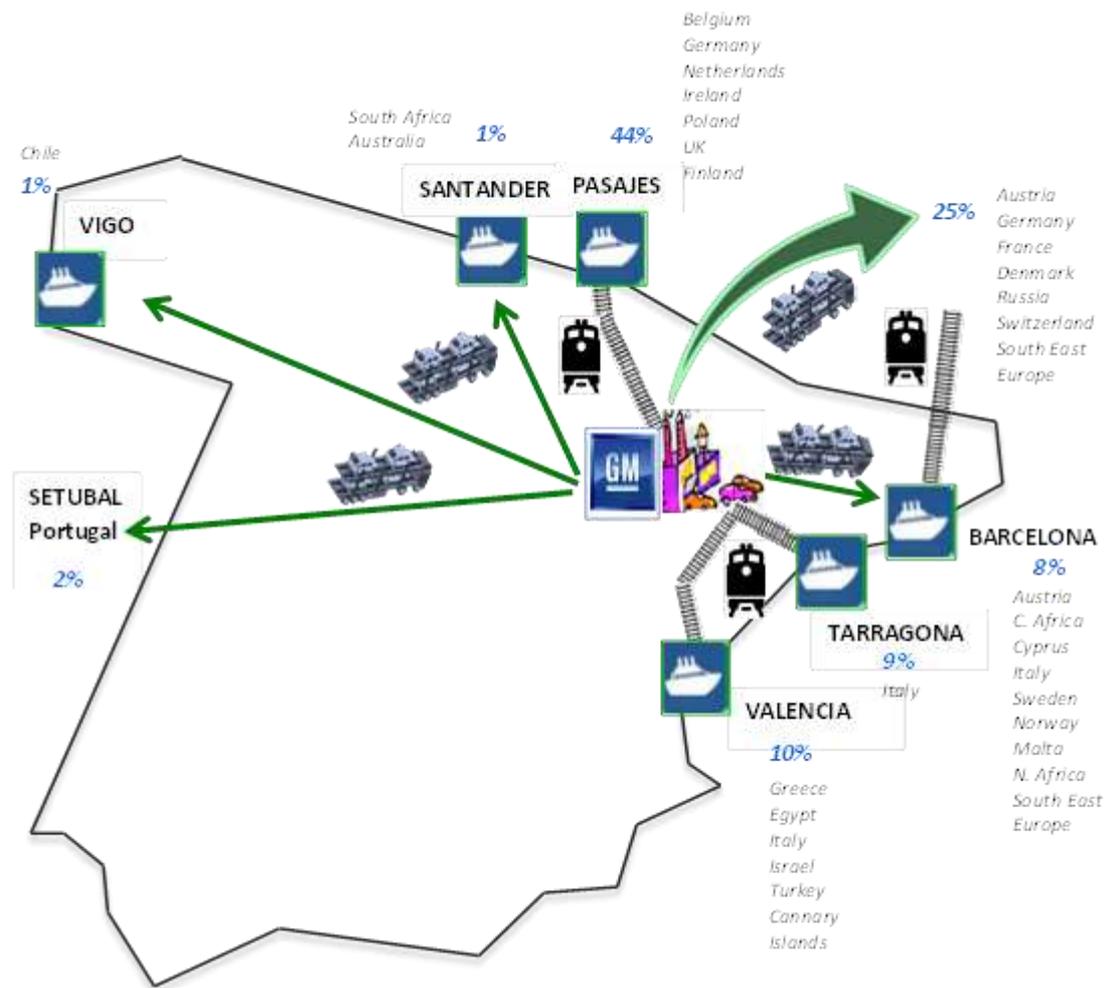


In 2015, approximately 100 trucks and 5 rail wagons left each day from Figueruelas with 1,700 cars destined for the mentioned markets. The intermodal level of the transport is very high, combining the use of railways, trucks and ships. Of those 1,700 cars about 850 travelled in 4 or 5 trains, while 100 trucks were used for the other half.

Ports are very important for GM España. 73% of the transport abroad is carried out by ship. Thus, more than 40% of the vehicles manufactured in the company during 2015 were distributed to northern Europe from the port of Pasajes (Guipúzcoa). Many of them are transported to Portbury (England) for distribution in the British market. Others are transported by ship from this Port of Pasajes (5 kilometres from San Sebastián) to Antwerp and Zeebrugge (Belgium) and to Hamburg (Germany) for distribution to central Europe and northern Germany.

The company also exports to Mediterranean countries (please see Figure 5). In this case, the maritime terminals are chosen by the GM are located in the Ports of Valencia, Tarragona and Barcelona, in that order. For other markets, the company takes its vehicles to Santander or Vigo.

FIGURE 5. DISTRIBUTION OF THE GM ESPAÑA PRODUCTION BY TRANSPORT MODE, HISTORY OF THE COMPANY, 2011



The flow of vehicles in the Ports is carried out in both directions, as the export of the Corsa and Meriva joins the importation of other models manufactured by the GM in other European locations to supply these to the Spanish agents, as well as materials needed in the Zaragoza Plant as plates, car bodies and engines.

Land transportation also plays a key role, as some shipments to Europe (Germany, Denmark and France) are made by truck or railway. The latter is the mean of transport that has gained more ground, since it already comprises 50% of the transport from the Figueruelas plant compared with 40% a few years ago. Currently, the company is working on the development of the railway corridor of Zaragoza-Port of Valencia through Teruel, and also on the consolidation of dispatching volumes in 550 meters long trains from Zaragoza, with connection to the European cooperation trail (UIC – International Union of Railways) in Barcelona for the German market.

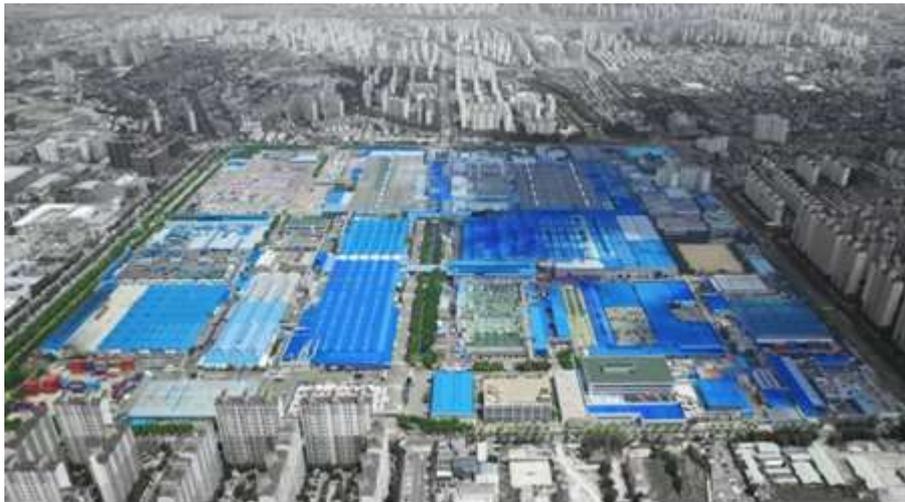
It is noteworthy that carmakers in Spain make intensive use of the railway, despite the fact that for the whole of the Spanish economy this barely represents 2% of all domestic traffic. Thus, the railway represents more than 28% of the modal allocation of domestic distribution of vehicles manufactured in Spain.

#### 4. A GOOD EXAMPLE: THE MOKKA APPROACH

The production of the Opel Mokka in Spain has been an important innovation in all steps of the GM supply chain, combining efficiency and multimodality. This logistics chain involves transporting parts from Korea to the Port of Barcelona by sea and from there by railway and truck to the Opel plant in Zaragoza. It is a complex logistical organization where each member plays a key role in ensuring the continuous supply of components to the Plant. Its implementation in record time has been a key feature to the success of the Opel Mokka production project in Spain.

The Opel Mokka is a SUV crossover with high acceptance in European markets. It is also marketed as the Vauxhall Mokka in the United Kingdom and as the Buick Encore in North America and China. Until beginning the production in Spain, this model was exclusively manufactured in the Bupyeong Plant (South Korea) for the rest of the world (Image 2).

IMAGE 2. OPEL PLANT IN BUPYEONG, KOREA



The 'Mokka Project' was conceived in 2013 aiming to reduce delivery times for orders from European customers. For this, the most suitable production location was identified to be on the continent, being chosen the Opel Plant in Figueruelas (Zaragoza, Spain) due to its high quality standards, productivity and professionalism. Also determinants of choice were the facilities and services offered by the Port of Barcelona and its railway connection with Zaragoza. It is also planned the use of the Port of Valencia, if necessary.

A multidisciplinary team was formed in June 2013 with the participation of the GM and the GEFCO (GM's European logistics operator) to plan the required supply chain to bring the vehicle components from Korea. In a very short time, September 2014, the European manufacturing of the Opel Mokka successfully began in the Spanish GM Plant, achieving a reduction of 5 weeks in the delivery time.

In addition to the Opel Mokka, the Zaragoza plant also manufactures the Opel Corsa and Opel Meriva and it has already awarded the manufacturing of the Citroen C3 Picasso, in result of the collaboration between the GM and the French group PSA Peugeot- Citroën. The alliance with the PSA is also reflected in GM's logistics in Europe, where GEFCO has been its 4PL since April 2013, responsible for contracting with carriers and 3PLs. The PSA and the GM signed a contract to this effect following their alliance and before the French carmaker sold a majority of its shares in GEFCO to Russian Railways in 2012. The GM-GEFCO relationship is important for Spain; while GM has full responsibility for inbound logistics planning and optimisation, GEFCO plays a key support role in its global supply chain. GEFCO also has responsibility for outbound logistics planning.

GM's supply chain here is unique compared to other OEMs in Spain. Because the Mokka was shifted to the plant from South Korea, it is built using a high proportion of imported parts. For the Mokka, which accounts for about 85,000 units per year, around 60% of inbound material by volume is imported, while 40% is from Spain (across all models built at the plant, Spanish content rises to 60%). That means around 17% of inbound volume arrives by ocean – about 10,000 40ft containers – primarily through the Port of Barcelona.

The Mokka Project received in 2015 the award “Excellence in Supply Chain Award 2015”, in recognition of its magnitude, efficiency, complexity and success. The following paragraphs describe the different stages of this supply chain system designed following the KD-PBP system (Knock Down-Part by Part).

#### 4.1 THE KD CENTRE OF THE GM KOREA

The KD centre (packaging and shipping warehouse) of the General Motors Korean subsidiary close to the Bupyeong Plant is responsible for receiving from the Korean suppliers the components needed by the Spanish subsidiary for manufacturing. Then, they are stuffed in containers and sent weekly by sea. The use of containers is optimized through the use of different types of packaging, of single use (one way packaging), according to the geometric characteristics and gross weight of the parts.

The GM Korea delivers the goods to the Port of Incheon on FOB terms (Free on Board) to ensure better coordination between the supplier and the carrier company

#### 4.2 MARITIME TRANSPORT

The Maersk is the shipping company chosen by the GM/GEFCO to carry out the transport of containers from the Port of Incheon (Korea) to the Port of Barcelona. The containers are transported by feeder from Incheon to the Chinese Port of Ningbo, from where they are sent to Barcelona in transoceanic container maritime lines.

The excellent facilities at the Port of Barcelona and its efficient rail link to the city of Zaragoza were key to defining Port of Barcelona as a point of entry into Spain. The duration of the total maritime traffic, including stays in ports, is 41 days. The maritime transport service includes all concepts until setting the container on train (FOR).

The process is efficient for shipping. GM uses 40ft high-cube containers, with different types of packaging according to geometrical characteristics and gross weights. It ships around 200 containers per week from Korea with an average utilisation rate of around 90%. However, the cost and lead times require special management. Total order lead times are eight weeks, while customer orders are released four weeks before production. This means all overseas material is ordered based on forecasts, and market fluctuations can have a dramatic impact on material availability.

#### 4.3 LAND TRANSPORT UP TO DESTINATION

The land transportation service from the Port of Barcelona to the containers' deconsolidation centre (Decon Center, managed by the Sesé group) is also the responsibility of the Maersk, who coordinates the intermodal activities and the specialized companies listed below. Every day complete trains are loaded at the Port of Barcelona, operated by the company TCB Railway, which are sent to the maritime terminal of Zaragoza (TMZ) (Image 3). If necessary, several daily loads can be carried out. There is a commitment to carry out the stripping of all containers received in Barcelona during the weekly scale before the arrival of the next ship, in daily batches approximately homogeneous (PUSH daily batches).

IMAGE 3. THE TMZ TERMINAL



Containers that the GM and the GEFCO identify as urgent before or after they arrive at the Port of Barcelona are transported by truck directly to the TMZ.

The additional volume of the Mokka operation has consolidated the TMZ terminal as the second domestic maritime freight terminal in Spain. The TMZ terminal is a paramount link in the logistics chain for the production of the Opel Mokka. It has an area of 12,000 square meters to receive the suppliers' containers for the Plant in Figueruelas. Once they arrive to the TMZ, the containers are stacked according to their date of arrival, under a FIFO system (First in First out) with a stay period of approximately one week. The containers are transported 24 hours a day, by platform truck from the TMZ to the deconsolidation centre

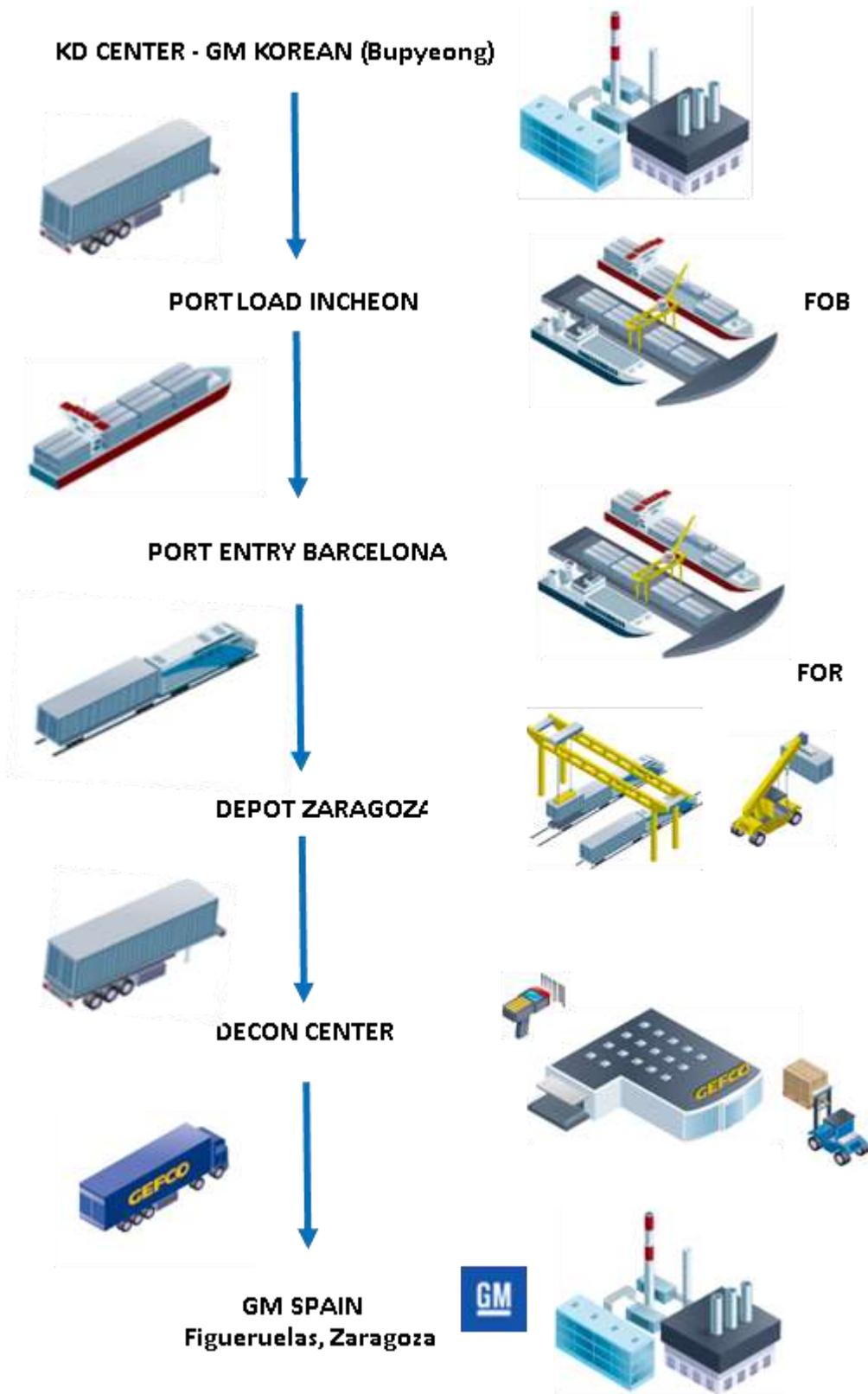
During this entire process, Maersk Line provides a web-based tracking tool to help communication and improve visibility for shipping and land transport.

Figures 6 and 7 show how transport logistics chains of components for GM Opel Mokka in Spain are organize.

FIGURE 6. TRANSPORT LOGISTICS CHAIN FOR OPEL MOKKA COMPONENTS IN SPAIN



FIGURE 7. TRANSPORT LOGISTICS CHAIN FOR OPEL MOKKA COMPONENTS IN SPAIN



#### 4.4 STRIPPING CENTRE

The company appointed by the GM/GEFCO to manage the deconsolidation centre is the Sesé group, which manages a 30,000 m<sup>2</sup> building near the GM España Plant. At the deconsolidation centre, parts are unpacked and the containers are repackaged or transferred; material is moved to the plant according to automated requests issued by the GM through a pull system based on an EDI communication framework using advanced scanning and inventory management systems.

The warehouse keeps a one week safety stock for each reference and has implemented a minimum stock system, enabling to act quickly should there be a contingency. The deconsolidation centre operates in three shifts and their activity levels are set by the production program of the GM España.

#### 4.5 CUSTOMS CLEARANCE

Customs clearance of all products is held by a specific department at the GM facilities. The GM/GEFCO has awarded to the operator Salvat the issuing of the documents for the facilitated railway traffic between the Port of Barcelona and the TMZ. It is also responsible for issuing the T1 document, relevant in case of urgent road transport, and for the coordination between land transport agents and the customs authorities.

Though lengthy, the supply chain is well honed and allows for high utilisation of containers and inland transport. It also has a major environmental benefit: the switch of transport from road to rail between the Port of Barcelona and the production centre in Zaragoza (Image 4).

IMAGE 4. ASSEMBLY LINE OF THE OPEL MOKKA



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