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Maritime Transport as a Key Element in the Automotive Industry

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ABSTRACT

Nowadays, Automotive Industry is one of the most competitive sectors. Manufacturers try to reduce production costs without any decrease in quality standards. On average, 7% of the final cost of a vehicle is divided into both, the logistic cost derived from the transportation of pieces and components to factories and the cost derived from the transportation of vehicles from factories to selling points and dealers. At this point, logistics and maritime transport play an important role in the improvement of competitiveness.

In this paper, we will try to prove how maritime transport cost is much lower than ground transport (either for pieces and components or manufactured vehicles) despite of the fact that distances, most of the times, may be much longer in maritime transport. This study has been particularly developed for the Japanese Nissan trucks factory in Ávila (Spain).

1. Introduction

In the current industrial environment, the automotive industry is today one of the most competitive. Manufacturers continually seek to reduce costs and cheapen their products with no loss of quality offered to customers (Zielinski, 2008).

There are different elements that make up the final cost of the vehicle, such as the purchasing of parts to suppliers, labour for assembly, painting and vehicle mount – manufacturing cost –, development costs, marketing and advertising, etc.

If we think this carefully, it is clear that another important cost factor in the total cost of the vehicle is the logistic cost, resulting from both the transport of parts and components to the manufacturing plant –what is known by the term "Inbound Logistic"– such as the movement of finished vehicles from the manufacturing plant to various car dealers or points of sale – called "Outbound Logistic". All this logistic cost represents approximately 7% of the total cost of the vehicle.

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This logistic cost is even more important today because of the current phenomenon of globalization, which vehicles manufacturers do not escape, since many of the components are received from countries known as LCC (Low Cost Countries) such as China, India or Thailand, and vehicles can be exported from the point of manufacture anywhere on the globe, so going from a more local logistic model to a more global one.

2. The role of containers and ro-ro ships on competitiveness

In this context, logistics, and maritime transport in particular, plays a key role in the continuous improvement of competitiveness. A few years ago, it was very difficult to think that a manufacturer located in Europe, would rise the possibility of bringing pieces from as far away places as mentioned above, because transport costs were much higher than savings obtained in manufacturing costs. It has been in recent years, with the rise and improvement of competitiveness experienced for maritime transport mainly due to the phenomenon of containerization (Nortteboom, 2007) and the progress in the design and performance of the Ro-Ro ships (for road transport), when manufacturers have raised that possibility that is already a reality.

3. Nissan logistics

The light trucks manufacturing plant that the Japanese company Nissan has in Avila (Spain) is not an exception. Three basic models are currently produced in its facilities: the Cabstar, a chassis-cab Nissan brand with a range of PMW (permissible maximum weight) from 2.8 to 4.5 MT, the Maxity, basically the same range as the previous one but marketed under the Renault Trucks brand, and finally the Atleon, also a cab chassis-cab but with different cab, mechanical design and covering a range from 3.5 to 15 MT of PMW, all them with a huge variety of engines, options and specifications.

The first -Cabstar- is a vehicle that is manufactured in Spain and whose main market is Western Europe, but also it has been marketed in Mexico and most recently in markets such as Russia and Ukraine. Furthermore, this model is a "global" model, that is to say, manufactured in other plants to other markets, in this case in Japan for its own market and in Taiwan for the Asian market. As discussed below, this model of global manufacturing has some important implications in logistics, especially in shipping due to the location of the various production centers and suppliers.

The second -Maxity- manufactured to Renault Trucks is also destined, in addition to the above mentioned for the Cabstar, markets of North Africa countries (Tunisia, Algeria and Morocco).

Finally, Atleon, is a product only for the European market, but it has a variant in CKD regime for Colombia. What does regime CKD (Completely Knocked Down) mean? In our case it means that Nissan sells part of this vehicle - in this case the chassis and all mechanical parts – disassembled so as to a third party, a manufacturer based in Colombia, assemble and do the bodywork to market it, in this case like a bus, no longer being Nissan.

Only on the basis of the above, we can see the diversity of markets that the finished product - whether complete or under CKD regime - is to be transported. In the entire distribution network, shipping is one of the most important and fundamental to distribute vehicles in an efficient and competitive manner.

Thus, vehicles for the European market are transported by rail to the port of Barcelona, and hence by sea to countries like Italy, Greece, and Israel. It is also distributed from there to the Balearic Islands and to the Canaries Islands.

Another focal point for maritime transport of vehicles produced by the plant is the port of Santander. From here, vehicles manufactured for Russia, Ukraine, Germany, Belgium, Holland and the UK, leaving the peninsula towards their destinations by sea routes touring northern Europe. Also from the same port, this time across the Atlantic, units bounded to Mexico are shipped.

The same goes for units supplied to Colombia in CKD regime. The components are stowed in the most optimized way possible in containers, which are transported from the plant to the port of Bilbao, where they are shipped by sea to Colombia.

4. Transportation costs

The following table (Table 1) shows the transportation cost per unit depending on the destination, to the main markets in which these vehicles are marketed. In the table is separated the cost of road transport and the cost of shipping (already included other associated costs such as port charges, storage in distribution open fields, insurances, etc.).

The road transport costs, including the transport cost from factory to port of origin plus a distribution average cost from the port of destination to the various sell points in that country. Clearly, with a single glance at the table, we can see that the shipping costs is much less than the distribution by road costs, even being distances much more higher in the case of maritime transport.

Table 1. Transportation costs per container according to the destination.

Destination	Road transport costs	Maritime transpor costs	Total transport cost
Spain	230 €	——	230 €
France	580 €	——	580 €
UK	216 €	250 €	466 €
Germany	290 €	190 €	480 €
Austria	370 €	190 €	560 €
Italy	520 €	160 €	680 €
Russia	530 €	480 €	1.010 €

Source: Authors

Now let's look around at the side of the supply of components and parts to the plant (Gonzalez-Rodriguez, 2007), Inbound Logistics. As mentioned above, one of the models produced at the plant in Avila-the Cabstar- also is produced in Japan and Taiwan. This model was first industrialized in Avila -the mother plant for manufacturing light truck in Nissan- and later in Japan and Taiwan. To do this possible, so that the total cost of the vehicle was as competitive as possible, the various parts and components are manufactured at a single point and delivered to different factories, that is to say, one piece, made for example in Spain, will be provided to Avila, Japan and Taiwan. Similarly, there are parts manufactured by providers located in Japan which will be supplied to the other plants. In the case of European model, approximately 15% of the parts are received from Japan, in what is called KD regime.

What is the reason for this? It is very simple. To make a piece requires a very important investment in tooling -injection molds, stamping dies, etc. -. In the period of design, development and assignment of parts to suppliers, when the overall profitability of the project is studied, it is found that it is much more profitable to transport parts from a single point to different plants than make this investment in different suppliers to fabricate the same piece. In summary, the logistic costs, particularly sea transport, outweigh the depreciation charges of investments.

Let's look at some real facts that explain themselves indicated above. For a 40-feet container, with a capacity of about 60 cubic meters, and assuming a minimum percentage optimization of 70% -that is, we have been able to use at least 70% of usable space in the container- we have the following shipping costs (Table 2) expressed in €/m³, depending on the point of origin and having as destination the port of Barcelona. These prices are already included port taxes.

Table 2. Maritime transport costs

China	70 €/m³
Japan	49 €/m³
India	56 €/m³

Source: Authors

5. Logistics studies

Let's compare now these costs with the road transport ones. The following table (Table 3) shows the average transportation cost per cubic meter from different parts of Europe and Spain, where are located different suppliers of the plant, to the center of the peninsula.

For Nissan's plant in Avila, the total cost of transporting parts from Japan would be the sum of the cost of maritime transport plus the cost of road transport from Barcelona to Avila, ie, 49 +19 = 68 € / m³, from India 56 +19 = 75 € / m³. As can be seen, this logistics costs is less than the cost of bringing pieces from European countries.

Table 3. Road transport costs

Madrid	8 €/m³
Spanish Northwest area	21 €/m³
Barcelona	19 €/m³
France	47 €/m³
UK	81 €/m³
Germany	82 €/m³
Poland	95 €/m³
Hungary	88 €/m³
Italiy	80 €/m³

Source: Authors

In the case of India, in addition to this logistical savings, better pricing on parts is achieved due to the large difference in the cost of labor.

In the case of Japan where the labor costs is similar or slightly higher than in European countries, to the benefit of the logistics costs with respect to these countries is added, as already indicated above, the reduction of investments and development expenditure.

These costs are paid once, and depreciation costs are shared between the vehicle parts manufactured in Japan and manufactured in Europe. Thus, parts of high cost and high complexity of technological development -control units, ABS systems, instrument panels- which can only be developed by very specialized suppliers such as Robert Bosch, Siemens or Magneti Marelli, are clear candidates to be developed on a single place -either Europe or Japan - and supplied by sea to the other part of the world.

Let's see an example analyzing the case of the instrument panel. During the development phase of product first costs studies of the piece are performed to determine who will be the part supplier and where it will be manufactured, considering the planned life for the product and the number of units planned to manufacture during it and the development, logistics and manufacturing costs offered by the provider. For a life cycle of about ten years, is estimated a production in this period of about 24,000 units/year between Japanese and European model, which represent about 240,000 units in the whole period, distributed over an estimated 150,000 units in Europe and 90,000 units in Japan. Thus is determined that the manufacturing cost is almost the same in a location that at another, so that the decision will be given by other factors. For this piece, the costs of development and industrialization -tools and production equipment- is estimated about 250,000 euros, this means, making a simple calculation of the depreciation charges, a cost of 1.05€/piece throughout its life. If those tools would be doubled in Europe and Japan, the costs would rise to 500,000 euros, which would imply that the costs would raise to 2.1€/piece.

When is carrying out the logistics study, the optimum packaging for this piece is designed, calculating that with the dimensions obtained we can put 90 pieces per cubic meter. As we have seen before, the logistics cost from Japan, including transport by land and sea from port to plant, is less than the transport from European countries. For the worst case -for example, a part fabricated in Barcelona- we have the following situation:

The logistics cost per part from Japan is 68€/90 parts or 0.75€/part. If the part would be fabricated in Barcelona, the logistics cost per part would be 19€/90 parts or 0.2€/ part. Clearly in this case is 0.55€/piece cheaper to transport from Barcelona than from Japan, but the savings in development costs of 1.05€/piece is greater. As a whole, we are getting a saving 0.50€/piece for the model manufactured in Spain -this increase in logistics cost does not exist for the model manufactured in Japan- which is along the product life savings of 0.50€ x 150,000 units = 75,000€ in Europe and 1.05€ x 90,000 units = 94,500€ in Japan, making a total of €169,500 savings in life product.

This is a clear example of the competitive advantages thanks to shipping are available.

6. Opening new markets

But shipping, allows not only savings in development costs. As we have already explained before, thanks to it, we have been able to open channels to the LCC countries.

To explain this we are going to see another example with much simpler and smaller volume parts, as can be brake hoses, small plastic parts, etc. Let's suppose the brake hoses. The average cost of a part made in Barcelona or Madrid is about 3 or 4 €, depending on the size of the tube. This cost, is reduced an average of 0.45€/part if produced in China, due to lower labor costs in this country (about 4-5€/hour compared to 20€/hour on average the auxiliary automotive sector in Spain). It is estimated that about 500 pieces per cubic meter can be carried. Thus, the logistics cost per piece will be:

Barcelona: 19€/500 parts = 0.04€/part
China: 89€/500 parts = 0.18€/part

The increase in logistics cost is 0.14€/part, well below the savings achieved in the part of the part, representing a total saving 0.31€/piece.

Consider a more concrete example of a large metal support, with stamping, welding and black-painted piece previously made by a supplier in Madrid –Table 4- that has been decided to move its production to Taiwan –Table 5- in order to the overall reduction in part costs that is achieved.

Table 4. Breakdown of cost per part in the event be manufactured in Madrid

Manufacturing costs	Road costs Madrid- Avila	Total cost
19.1 €	0.10 €	19.2 €

Source: Authors

Table 5. Breakdown of cost per part in the event be manufactured in Taiwan

Manufacturing costs	Depreciation charges	Maritime transport costs	Taxes	Road costs Bcn-Avila	Total costs
10.8 €	0.70 €	0.32 €	2.8 €	0.29 €	14,91 €

Source: Authors

7. Establishment of PCC

As we have seen in every case previously shown, maritime transport proves to be highly profitable and competitive. Because of this, PCC (Parts Consolidation Center) has been established by Nissan, logistics centers that are located in different countries where different parts coming from various area providers are received in a suitable packed way, and loaded into containers, optimized to the maximum to be sent to the destination (Kisiel, 2008). For these consolidation and posterior parts distribution centers, locations close to the sea are searched, with easy access to the port for quick and economic dispatch of cargo containers.

Thus, in the case of Cabstar, Nissan has established a PCC in Barcelona, where parts are received from suppliers in Spain and Europe, are loaded into containers that are sent to the port of Barcelona for shipment to Japan and Taiwan.

The same is true in Japan where there is a PCC for parts made there, which come to the port of Barcelona by sea and after are transported to the plants in Avila and Barcelona.

Likewise, commercial vehicles like van NV200 – also mounted in Japan - or Navarra and Pathfinder 4x4 - also assembled in the USA- are mounted at Nissan plant in Barcelona.

Obviously and despite all the above, not for all the parts supply KD is profitable, so that, once put into production and began the marketing in Europe, for every part are carry out studies about which is the optimal provider and location for manufacturing, taking into account the factors we have discussed above, in order to optimize the vehicle total costs.

8. Conclusions

The first conclusion that can be drawn from this study is that the rise of maritime transport and its shown competitiveness, jointed to the low manufacturing costs in emerging countries, have brought, that increasingly, component manufacturers in such countries are seeking, because despite the distance and as we have seen, it is generally more economical (Canup, 2007).

All this has also made that Nissan, like other manufacturers, adapt to the new situation by reorganizing its organizational structure to the new scenario. Thus, in addition to strengthening the logistics and transport departments, Nissan already has among its workforce with staff dedicated to the management of customs of all the material that is daily moved by sea from one point to another on the Earth.

Also by sea, and using again the port of Bilbao as destination point, components for assembly are received from suppliers located in Mexico. There is a particular case, which shows clearly what we have mentioned in the previous paragraph. The provider - a major multinational engaged in the manufacture of components for the automotive industry - with production plants in Spain, Europe and America, in the face of the continuing demands to improve competitiveness and cost reduction, decides, according to Nissan, move their production from its plant in Spain to another plant in Mexico, where obviously will need to transport its production by sea from. The result is that both the supplier -getting cut costs and improve its margin- and Nissan -getting a reduction in the purchase price of such parts - obtain benefits of the transaction, all thanks to a lower manufacturing costs and competitive logistics costs associated to the maritime transport.

Therefore, Nissan continues to explore new opportunities to exploit the advantages offered by maritime transport, considering the possibility of establishing in the future new PCCs, in Thailand, India or Mexico.

As a final conclusion, note that although it is not the case for the plant of Nissan light trucks in Avila -a plant with many years of history- currently, most vehicles production plants and especially those of new construction, are located as close to the sea as possible or with good access. This is the case of Nissan and Seat in Barcelona, Ford in Valencia, PSA in Vigo, or in other countries Nissan in Sunderland (UK) or the new plant that the mark has been established in St. Petersburg, because it is a clear competitive advantage, since as we have seen earlier, saves logistics costs of land transport of parts from port to factories and finished vehicles in reverse.

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