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The importance of port logistics on the cost of transport and stowage at ports

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SUMMARY - The author describes the Port of Tarragona, mainly in the field of cereal and by-products traffic and their volume in the past years. He explains the factors which determine the harbour evolution and the costs of transport for supplying raw materials to feed manufacturers and the harbour, storage and distribution costs. The transport cost by road and by railroad are also explained.

Key words: Harbour, cost, railroad, transport, feed.

RESUME - *"L'importance de la logistique portuaire sur le coût de transport et de chargement au port". L'auteur décrit le port de Tarragone, en ce qui concerne principalement le transport de céréales et de sous-produits et leurs volumes pendant ces dernières années. Il explique les facteurs qui déterminent l'évolution d'un port ainsi que les coûts de transport pour l'approvisionnement en matières premières des fabricants d'aliments pour bétail et les coûts d'entreposage et distribution du port. Les coûts de transport par route et par train sont aussi expliqués.*

Mots-clés : *Port, coût, chemin de fer, transport, aliments pour bétail.*

The Port of Tarragona

The Port of Tarragona is the second most important port in Spain in total volume of goods. In 1995 it exceeded 28 million tons.

It is located in a strategic enclave on the Spanish Mediterranean coast, at the confluence of the Ebro Valley and the Levant, two areas of major economic and industrial growth in Spain.

The Port eminently specializes in bulk, as much in liquids as in solids (energetic products and for the manufacture of Feed). During 1995, liquids were estimated at about 20 million tons, solids at about seven million tons and general merchandise reached almost 800.000 tons.

Characteristics

This brief introduction on the Port of Tarragona draws up three important characteristics:

- Its strategic location with regard to its hinterland.
- Its specialization in bulk.
- Its importance as a massive cargo port.

When treated as a port with such a high volume of merchandise from the energy sector and for the manufacture of animal alimentation products, a very important fourth characteristic appears; that is, its role as importer.

Taking into account the former characteristics, with special reference to solids, it becomes evident that large vessels arrive to the Port of Tarragona with prolonged stays for unloading, for which large storage space and deep water wharfs are required.

This brief description perfectly centres the activity which takes place in the Port of Tarragona, where normally the products are then shifted towards the interior of the territory.

Cereals and sub-products at the port of Tarragona

Within the entirety of solid bulk merchandise, cereals and subproducts used for animal feed manufacture represent an important volume. In 1995 a total of 3.5 million tons were turned over, (maize - 600.000 tons, soybean meal - 470.000 tons, tapioca - 430.000 tons and corn gluten feed - 400.000 tons).

In total, more than 30 types of different products entered into the port of Tarragona of which only one, wheat meal in bags totaling a volume of 70.000 tons was for exportation.

A total of 328 vessels transported these goods in 1995, which assumes an estimated 11.000 tons per vessel. The largest vessels were those that carried soybean meal, with approximately 40.000 tons per vessel.

From the seasonal point of view, in 1995, the most significant months were August, September and October when approximately 1.3 million tons were unloaded, making it become evident that this aspect must be taken into account. The emphasized droughts which affected the country that year induced the importation of a significant volume of these products, which in fact, arrived during the most rigorous months of the year.

For the storing of these products, the Port provides closed horizontal installations and vertical silos with a storage capacity of almost 272.000 tons.

Another important feature is the international character of these products, dependent both on PAC as on the commercial agreements between USA and UE. This circumstance provokes uncertainties on the evolution of the movement of these products in the ports.

Regarding the raw materials used for the manufacture of feed, as Spain stands out as a producer of only three types of cereals (wheat, barley and maize), expectation of a significant growth in imports was considered crucial. In the case of soybean meal and soybean, as Spain has always been deficient in proteins for animal alimentation there is a need to import vast quantities of these products.

Finally, with respect to animal feed and forage, its importation is conditioned by both the production of cereals in as much as the possibility of substitutes in the formulation because of its lower cost. That is, its utilization fundamentally depends on supplying the interior market with cereals from the UE.

The area of influence

Normally, ports in their early stages are servants to their local industry, then, slowly become serviceable to more extensive areas, growing in parallel with the growth of industry in these areas.

When the movement of a product reaches a determined level, the economic scales of a port allow it to cater for wider and more profitable services to areas even more distant. It becomes clear that everything depends on the state of interior communications, and therefore, on the accessibility of new markets and clients.

So, the area of influence of a port is clearly related to the location of industry, normally within close distance to the areas where the raw materials are produced, to the consumers and to the existing communications network. Its development comes automatically in accordance to the economic growth taking place in the area.

In the case or the Port of Tarragona, in relation to the raw materials required for producing animal feed, its area of influence is principally centred around the Province of Tarragona, Lleida, Barcelona, Castellón, Huesca and Zaragoza.

In these areas, 32% of the meal producing companies in Spain can be found and 45% of the animal feed producing companies. The Port of Tarragona imports 65% of the raw materials used for feed fabrication.

Logistics and the Port of Tarragona

The growth and development of any port in the world depends, as already mentioned, on its location and logistic importance with respect to its area of influence. Area, on the other hand, has a dynamic component deriving from the accessibility and the competition from neighbouring ports.

We may affirm then, that an importer or shipowner elects a port taking into account three conditions: strategic or its location, its logistic character i.e. its capacity to offer extensive services and finally its competitiveness whose main exponent are the costs of such services and the various tariffs.

Therefore, ports find themselves with the need to be able to adapt rapidly to the requirements of their clients, extending and improving their offers of services and promoting quality.

From the point of view in reference, the election of a port for unloading bulk lies clearly in function to the consumer market and its distance to the port, taking into account transport costs, services available, port costs and the general efficiency of the port.

In order of priorities it seems that the competitiveness aspect is the principle factor when electing a port, as distance and accessibility to the markets becomes reduced as result of constantly improving land connections. Therefore, the need to adapt to new requirements is directly tied to the increase in competitiveness.

In contrast, measurable differences in freight costs in the transport of bulk products do not exist upon ports in Western Europe.

The unloading of products for the fabrication of feed

Loading operations differ notably to unloading operations, in that the former require a specific superstructure, normally with conveyor belts to cater for specific quantities. Therefore, the rhythm of loading tends to be elevated, with high productivity but without the need to specially treat the merchandise.

The unloading, in contrast, requires that the superstructure adapts to the type of merchandise and the vessel, which impedes the establishment of a standardization of operations. The systems employed, though, tend to be traditional; Cranes with grabs of a determined size, established in function to the product.

On the other hand, the lack of continuity in the cycles of movement of a crane in the unloading process reduces productivity in comparison to loading. In this case, however, the performance obtained depends on the type of product. Unloading maize would have different results to unloading tapioca or pellets of other products, though in the Port of Tarragona the unloading of 21.500 tons of maize has been recorded for one day.

Another accountable factor in the unloading of such products is the problem of contamination produced during the operation: The need to achieve fast and efficient unloading creates a notable increase in levels of dust, provoking extreme cases of air pollution during unfavourable wind conditions. Evidently, the battle against contamination assumes extra cost.

Undoubtedly, if investment requirements during loading operations are estimated to be higher than those during unloading because of high-cost automation procedures, in reality unloading also requires costly investment -cranes of different tonnage, anti-pollution hoppers, absorption systems for unloading etc. only compensated by the use of human labour as opposed to mechanism.

So then, it may be affirmed that the unloading of solid bulk assumes high costs. It constitutes greater utilization of manpower, high costs for vessel stays and unloading times and in some cases, greater storages costs as the silos are used as regulators and distributors of merchandise. Next we will see how costs are distributed in port logistics and during the operations of unloading.

Port costs

Port costs in relation to the movement of merchandise in the port, are composed of those as a result of the docked vessel - port tariffs, pilots, tugs, vessel moorers, supplies, agents, etc. - and those as a result of the actual unloading operations-stevedores, customs, control and inspection bodies, cranes, weighing, warehouses etc.

With regards to costs deriving from the vessel, it can be affirmed that port costs, above all T-1, are the most significant, since they depend on the GT of the vessel and the time it spends in the port. Bulk - carriers are those which tend to spend most time at port as well of being the greatest in size.

The costs of towing, which depend on the circumstances of the moment, tend to represent approximately 10% to 15% of the cost scale of a vessel.

Other costs deriving from the vessel's stay at port, including agency fees, average approximately 5 or 10% of the total.

The port tariffs on the merchandise, T-3, are situated at less than 50% of overall costs. It should be mentioned at this point that the allowances on this tariff at the Port of Tarragona start at 10% minimum reduction reaching in some cases 35% of the base tariff.

If the costs of unloading are considered in relation to port costs the former are situated at approximately 70% of the total, where all costs are also included-storage, weighing etc.- with a clear tendency to drop when using cranes of greater capacity and efficiency. About 30% would correspond to port costs.

Unloading costs

The elevated length of time at port and the subsequent high cost of unloading time is fundamentally a result of the difficulties faced during unloading operations. However, there are other factors of importance which also affect the overall costs.

Normally the merchandise carried by a vessel, when there are diverse products, are separated into distinct holds. Unfortunately, various products may arrive in a single hold, distributed horizontally, and only separated by sheets of plastic, which only serves to complicate the unloading process due to having to change grabs, mixing products etc. Also, although this is less of a problem, the merchandise may be the property of more than one receiver which generates complications due to changes in loading companies, unloading to open space or to silos, etc. Both circumstances tend to produce unforeseen additional costs.

It is worth mentioning at this point that there are 6 stevedore companies specializing in bulk in the Port of Tarragona with a total manpower of 173 persons available for the corresponding operations. In 1995, 26.219 work shifts were registered.

Crane efficiency, as already mentioned depends on the type and weight of the product. As an example, 16 ton cranes in the Port of Tarragona in 1995 reached and average output ranging from 294 tons/hour for unloading wheat to 167 tons/hour for cotton seed.

Actually, the majority of cranes are the property of the Port Authority and their use is controlled by tariffs depending on their individual capacity. In 1995, they were in operation for an estimated total of 16.650 hours.

With regards to the human factor in unloading operations the manpower applied goes in function with the process: vessel-shore, vessel-lorry, direct to silo, etc.

As an example, the cost of unloading cereal from a vessel averaging 22.000 tons, under normal circumstances, is approximately 263 pesetas per ton. Obviously, if the operation takes place direct to hopper or rail, costs will alter considerably due to a drop in work effort, producing completely distinct logistic estimates.

The most habitual problems during unloading, i.e. hold sharing, percentage of unloading by hopper, rate of arrival for lorries or trains etc. are usually the result of the lack of liaison from exterior companies making accurate planification an extremely difficult task. These problems can only be solved, at short notice, with the use of electronic data transmission systems.

Storage costs

The average estimated volume of merchandise stored at port is approximately 54% of the total volume unloaded, although this porcentage may alter significantly during irregular campaigns or as a result of various vessels coinciding on the same day.

The average storage cost, under normal circumstances for single bulk products, is about 60 pesetas per ton, with a 10 day franchise. However, such cases are rare as the holds normally contain various products, which in turn assumes that a warehouse has to be sub-divided into three sections; two for products and one which corresponds to the mixing which has taken place during the journey and unloading process. As a result, storage costs escalate considerably reaching an average of about 130 pesetas per ton. Merchandise remains in a warehouse for an average period of about 20 days.

It may be assumed that the lack of information on transport conditions has direct repercussions on the programming and availability of space.

There also exists the possibility of using other warehouses that are not situated in the actual port. These are usually located within close distance and their use does not generally effect the overall costs. However, during off- season months, when costs generally drop due to excess offer, and due to an increased flexibility on deliveries, exterior warehouses may be assumed to be at an advantage.

Distribution

Distribution of products from the port operates in function to the necessities of the manufactures and costs. The storage level of the industry of a determined product will mark the process of distribution.

The usual systems of distribution, from the unloading point of view, tend to be direct to hopper or by transport after storing, whether by road or by rail.

As previously indicated, 46% of unloading is hopper-direct although with a notable lack of foresight in that the rest that is stored produces a flow of deliveries in function exclusively with the needs of the enterprises.

In direct hopper deliveries, as a result of its consequent problems (pace, planification, reliability, etc.), the stevedore needs the availability of constant movement of lorries to complement the transporters of the manufacturing companies.

In the case of deliveries by hopper to rail, the operations must be carried out by using the lorry or unloading to ground, since loading wagons is slow due to the composition and manoeuvrability of the train.

The costs of delivery are situated at around 180 pesetas per ton, precisely because of the lack of planning previous to the operations.

Transport costs

Finally, the costs of transport from the port to the animal feed manufactures, remain to be briefly analysed.

Giving that the location of most industry is within a radius of about 150 km, 95% of transport tends to be carried out by road. However, railways are making great effort to remain in the market,

Now, each of the features of both forms of transport used for distribution, will be analysed.

Road transport

Road Transport in unloading operations at ports like that of Tarragona is of vital importance, not only for delivering the merchandise but also for its role in transporting within the actual port. There exists an important volume of merchandise directed to interior warehouses, which, in the case of multiple product vessels produces a reshuffle of merchandise to the silos.

The cost of transport within the port is very flexible as it depends on the deliveries, by use of hopper, produced in each case. The impossibility to adequately plan these deliveries makes the cost of transport rise to as much as 200 pesetas/PT, when the normal cost is situated at around 180 pesetas/PT.

On the other hand, the cost of transporting bulk from the port depends on the distances involved and ranges between 540 pesetas per 31-50 km and 1350 pesetas per 141-150 km.

Undoubtedly, the Port's specialization in bulk importation, produces an added inconvenience for road transport which is the cost of the return journey. Lorries which are not the property of the animal feed factories tend to make unladen returns to port without being able to take advantage for delivering products back for consequent sea transport.

Railway transport

Railway transport is of little importance regarding these products, since, as already mentioned, unloading operations direct from the vessel are slow and costly and, moreover, the factory involved needs an adequate unloading infrastructure with stockyards and wharfs which, with difficulty, can be used with other companies.

Taking into account the difficulties faced when unloading direct to the wagon, the movement of these products by rail is produced only from the silos at the port which assumes higher transport costs.

The cost of railway transport from the port to a distance of about 100 km is approximately 600 pesetas/PT: Onto this amount, haulage to destination (if the infrastructure is inadequate), all have to be added. Taking all these overheads into account, it becomes evident that railway transport is not competitive, even though the base cost is inferior to road transport.

In concrete cases, such as the saturation of delivery and consequent overuse of lorries available, railways get to play a more significant role. As is the case when long distances are involved, where there is no doubt that railway transport provides convincing competition to road transport.

Besides what has been said, it has to be emphasized that as basic costs are inferior to those of road transport its potential is enormous. Assuming with changes and adequate development of the superstructures for loading and unloading, undoubtedly, the participation of the railways for transporting raw materials is destined to increase.

Conclusions

Unloading and storage costs at Spanish ports like that of Tarragona, assume almost 70% of the total cost of vessel unloading, although a significant decline is being produced as a result of significant increase in productivity.

Road transport assumes high participation in merchandise distribution with possibilities of further cost reductions if solutions are found for the return journeys.

At present, a series of problems exist for railways to compete with roads for distribution, although with an enormous potential if they achieve adequate superstructure development.

Important planning difficulties exist in the logistic and distribution chain provoking an increase in global costs. Information transmission systems, such as EDI, could be the key to cost reduction and a means to give aid to services such as, recognition of cargo, its tracking, control and planning.

There is a clear concern in all sectors of the ports involved with unloading to improve the quality of service, while at the same time, to reduce in cost the passage of all merchandise into port.

In the following years, concern for environmental problems related to bulk operations in the ports will become a serious issue.