OPTIMIZATION OF SUPPLY CHAIN ACTIVITIES WITHIN A COMPANY

LĂZĂRESCU Petru-Eduard [1]

Professor COORDINATOR: Prof. dr. eng. **Cristina MOHORA** [2]

SUMMARY: The paper presents the synthesized activity of a company dealing with the supplying of parts and their expeditions in different countries across the Globe. Logistics plans are put in place and the most profitable flows between the suppliers and their customers are discovered. All the information regarding the parts, packages, suppliers, deadlines and cadence is added to the logistic plan based on the results of the transport tests made by the cost analysts using different tools.

KEYWORDS: ILN (International Logistics Network), Packaging, Transport, Costing

1 INTRODUCTION

Logistics management is the governance of supply chain functions. Logistics management activities typically include inbound and outbound transportation management, fleet management, warehousing, materials handling, order fulfillment, logistics network design, inventory management, supply/demand planning, and management of third party logistics services providers. To varying degrees, the logistics function also includes customer service, sourcing and procurement, production planning and scheduling, packaging and assembly.

The mission of the company in terms of logistics is coordinating and optimizing the transportation by using the best filling rates and finding the most profitable solutions in order to deliver the goods to the client as agreed. By this, the rules of quality, costs, deadlines, human resources and environment must be respected.

A key component for logistics system that is discussed here is the analysis of the packaging of parts. Herewith, the type of packages used in the company, their specifications, manipulation rules, alongside with the protections of parts and labeling conditions will be described for a better understanding of how to optimize the inbound and outbound transport.

[1] Concepție şi Management în Productică, IMST Faculty, POLITEHNICA University of Bucharest; E-mail: eduard.lazarescu@yahoo.com;

[2] Prof. dr. eng. Cristina Mohora, POLITEHNICA University of Bucharest; E-mail: cristinamohora@yahoo.com

2 PACKAGE SPECIFICATIONS

These specifications refer to all parts suppliers that are delivering the packages to the company (first fit assembly, mechanical and body components and parts) for export. It applies to production and "post-production phase" flow in ISO High Cube containers via ILN logistics centers to customer plants using the following means of transport:

- Truck
- Boat
- Train

* plane in exceptional cases (carry over the range of packages from these specifications).

It is designed to regulate the design of packaging to meet the requirements:

Of the ILN involved in terms of:

- Quality: The packaging protects the quality of parts against impact, deformation (mechanical or weather constraints) as well as against oxidation from its date of manufacture, during transportation and storage until acceptance at the client's plant.

- Densification: optimizing the use of space in packaging is vital to ensure the most cost-effective logistics.

Of the final customer (plant) in terms of:

- Monthly use of parts

- Line side installation (safety and ergonomics requirements included).

3 RESPONSIBILITIES

The proposed packaging must comply with the transportation legislation in force (IMDG International Maritime Dangerous Goods).

The internal arrangements (bracing, separators, etc.) must comply with the specifications and protects the quality of parts against impact and deformation, the supplier being responsible for the quality of its parts.

*Wood

Any wood used for packaging must comply with ISPM15 [3]. Example: wooden pallet, wooden packages, additional wood bracing, etc.

*Cardboard

Packaging compliance will always be checked from a qualitative point of view (wood thickness, cardboard, ISPM15, etc.). The Engineering Department is prepared to provide Technical Assistance to define packaging whenever a supplier so requests, without however releasing the supplier from its final responsibility.

*PDS

The supplier undertakes to fully comply with the specifications by filling out the Package Description Sheet. Packaging deliveries to the ILN may not be accepted without the supplier PDS duly completed and validated by the engineering department.

3.1 Protective materials

The objective is to ensure that the product is protected, from the supplier, and parts sourced in plants up to the point of consumption (assembly plants).

These recommendations apply to all sheet, metal or mechanical parts to be stored and/or transported in order to minimize the risks of oxidation incurred by these operations.

Product protection can only be ensured if all the recommendations within this scope are strictly complied with.

Corrosion is the deterioration of a material due to a redox reaction between the metal and an oxidant present in the environment directly surrounding the metallic part.

The main causes of corrosion that we encounter when shipping parts concern the alteration of material exposed to air or where water is present. This is thus atmospheric or aqueous corrosion.

Corrosion can affect ferrous (steel, cast iron) and non-ferrous (aluminium, copper, alloys) metals. The most corrosion-sensitive metals are, however, ferrous metals.

[3] A copy of ISPM15 is available at the following address: www.ippc.int

3.2 Type of protection

The parts the most sensitive to corrosion are parts which are not pre-protected by surface treatment. Zinc-coated parts or parts coated with a protective layer are less exposed to corrosion.

Corrosion protection must therefore be greater for parts that are not pre-protected (bare steel, cast iron, sheet metal, etc.)(see table 1 below)

Table 1. Example of applications

Type of packaging	Characteristics of the part	Example of relevant parts
 No protective packaging required	Part integrity guaranteed by its treatment (galvanised or painted bare part)	Exhaust silencer Spring Sub-frame
 Polyethylene (Plastic bag)	Weight/part <1kg Moderate resistance to impacts Vulnerable to dust and oils Standard gsm = 60 - 100µm Use a higher gsm if weight/part > 1kg	Electric cables Door facing Nuts Dashboard
 Bubble wrap or bag	Part sensitive to impacts *Note: Flat side of the plastic protection in contact with the parts* *Plastic bubbles facing outward*	Headlight Door lock
 Corrosion prevention Film, VCI bag	Part sensitive to corrosion Unpainted, non-electrogalvanized part	Engine flywheel Nuts Screws
 Cross/separator cardboard	Weight/part > 1kg Resistance to impacts Bracing of the part in its cell Improves vertical compressive strength Available with single or double groove	Starter Alternator

3.3 Packaging densification

The company is endeavouring to optimise the use of space in the ISO high cube maritime container through denser packaging.

To achieve a good level of densification of parts in the packaging, the supplier must adhere to the following calculation rule: Volume of the sum of the parts / Packaging interior volume

Part

Length = 0.12m

Width = 0.125m

Height = 0.08m

Volume = 0.12x0.125x0.08= 0.0012m3

Packaging

Length = 0.123m

Width = 0.13m

Height = 0.085m

Volume = 0.123x0.13x0.085= 0.00136 m3

Densification ratio = (0.0012/0.00136)x100% = (0.882)x100%=88.2%

The densification ratio absolutely must be as close as possible to 100% in compliance with the

maximum authorised weight.

3.4 Container densification

To achieve a good level of container filling, the supplier must develop the packaging in accordance with the size given in the specifications and the packaging recommendation expressed by the engineering department.

The proposed range of packaging is based on:

- returnable package (metal Handling Unit or plastic Packaging Unit)

- "disposable" cardboard packages or in exceptional cases in wooden packages (cardboard or wooden

Handling Unit and cardboard Packaging Unit).

Most used container: 40-Foot High Cube container size (see figure 1)

Exterior: 12,192mm x 2,438mm x 2,900m

Interior: 12,010mm x 2,340mm x 2,690mm (2,590mm to the door)

Fig. 1. 40-Foot High Cube container

4 GENERAL RECOMMENDATIONS

4.1 Returnable packages

A commitment between the company and the supplier should be co-signed prior to deploying the packages. These packages are strictly dedicated to the supply of parts to customer plants. The supplier will use suitable handling equipment. It will have to manage the stock and ensure the cleanliness of these packages.

There are 2 types of returnable packaging available:

- Plastic cases that can be gripped by hand (PU=Packaging Unit) (see figure 2)

- Metal packages (HU=Handling Unit) (see figure 3)

Fig. 2. Returnable plastic case

Fig. 3. Returnable metallic package

The supplier shall, at the company's request, use this type of packaging. The supplier will thus be informed at the time of requesting the PDS.

Finally, the allocation of returnable packaging will be the company’s responsibility.

4.2 Disposable packages

There are 2 types of packaging available (see figure 4):

- Cardboard boxes that can be gripped by hand (PU)

- Cardboard boxes clamped to the pallet (HU)

- Exceptional case: Wood crates (HU).

Fig. 4. Disposable packages

Cardboard packaging is to be preferred to the wooden packaging given the cost of materials and ergonomic constraints.

Nevertheless wooden packaging offers greater resistance and is therefore appropriate for packaging heavy parts.

4.2.1 *Cardboard packaging units standard composition*

The standard cardboard packaging units are carton boxes that are handled by hand and need to have the resistance compliant with the cardboard pads and respect the following recommendations so that they can be gripped by the personnel and resist in different climate conditions:

- The cardboard box need to have a bell cover
- The outside cover of the cardboard box absolutely must be made of KRAFT.
- By way of an exception, it is accepted the use of 1,000 or 1,200 mm cardboard boxes in case the part measures approx. 1,000 or 1,200mm.
- The packaging must be closed by plastic strapping or adhesive tape, excluding staples and metal ties.
- The use of PVC adhesive tape is prohibited.
- Maximum weight: 15 kg max.
- Exception: package size > 1,000mm: 10 kg max.

4.2.2 Palletising standard composition

The palletising refers to the arrangement of multiple packaging units on wooden pallets that need to have the following requirements:

- Wood compliant with Standard ISPM No. 15* (marking of the pallet on 2 opposite sides)
- Dimensions: 1,200 x 1,000 x 145, 5 bases (see figure 5)
- Softwood choice 2. Maximum humidity 17%. Debarked timber.
- Assembly using three 60 mm nails twisted at each intersection.
- Pallet diagram: www.galia.com [4]

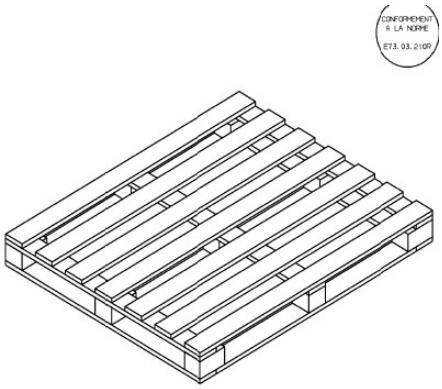

Fig. 5. Standard pallet, 5 bases

[4] www.galia.com is the official site for « Groupement pour l'Amélioration des Liaisons dans l'Industrie Automobile » and provides information on packages and palettisations

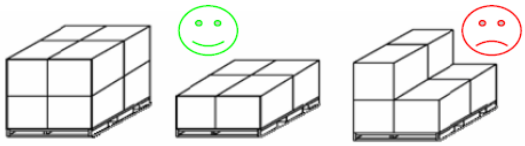

Fig. 6. Arrangement of boxes per pallet

- The successive layers must be superimposed. The superimposed stacking provides greater vertical compressive strength (see figure 6).
- The load must be distributed over the surface of the pallet.
- The palletised load may not extend beyond the surface of the pallet.

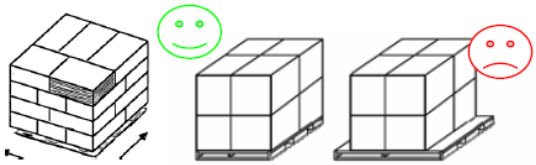

Fig. 7. Standard arrangements

- The block thus formed must not exceed the height of 1,250 mm (pallet included).
- Weight 250 kg max. (unless exempt by the ILN Engineering department concerned if heavier)
- All cardboard boxes must be grouped together on the wooden pallet and joined by covering or stretch wrapping (see figure 7).
- ILN reserves the right to request additional protection to reinforce the safety of parts.
- If the supplier deems it necessary, it may also add cardboard corner pieces and a lid as shown in figure 8 in order to strengthen the assembly.

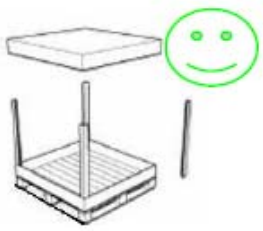

Fig. 8. Palletising with corners and lid

4.2.3 Cardboard Handling Units standard composition

The cardboard handling units are the most used due to the fact that they can carry heavy parts and have a very good resistance during transport and in storage. They come in different dimensions depending on the parts geometry.

The handling units need to respect the following:

- Use of wooden pallet perimeters, 4 lead-ins (except 4C 1,140mmx475mmx640mm packaging)
- Wood compliant with ISPM No.15
- Softwood choice 2. Maximum humidity 17%. Debarked timber.
- With or without lid depending on model
- Semi-American cardboard casing
- Inner belt
- Bell lid
- KRAFT cardboard outer lid
- The types of packages shall be marked on the packaging.
- The cardboard box must be secured to the pallet.
- Toy tabbing attachment is used.
- Wooden reinforcements, if necessary, are toy tabbed to the cardboard box.

There are 2 ways to attach the lid to the packaging. Depending on the supplier's resources, the lid may either be:

- Toy tabbed at the places provided for this purpose (see figure 9)

Fig. 9. Toy tabbing

- Strapped with plastic strips (see figure 10)

The fact of strapping the pallet and cardboard box simultaneously makes the module more resistant during handling by forklift.

- The strips must not be placed under the pallet.
- PVC and metal strips are prohibited.
- The strip must be sealed, either by a seam, or a plastic or metallic u-clip.
- Reinforcements may be put between the lid and the strip.

Fig. 10. Usage of plastic strips

4.3 Storage and stacking rules

The heaviest packaging must occupy the lower level.

* Special case: It is essential to add 4 cardboard corner pieces in the angles between the casing and belt for cardboard packages weighing more than 400 kg (see figure 11).

The length of the corner pieces will be the same as the height of the cardboard box belt.

Fig. 11. Corners angles and positioning

The set of packages being transported supports a maximum dynamic load of 750 kg.

The stacked total height for transport (including the lower load), shall not exceed 2,550 mm.

5 MAIN ACTIVITIES OF THE ILN

The ILN's role is to deliver parts ordered by distant assembly plants (generally overseas) under the best quality, cost and lead-time conditions.

These conditions are met thanks to:

- the choice of the best mean of transport (ship, road or multimodal transport)
- flows volume optimization
- appropriate packaging
- a strict supplier deliveries follow-up and management

The customers send to ILN their detailed needs with the requested date and number of parts, and the ILN platform manages the suppliers capacity, manages the supplier relationship and the suppliers' quality/cost/lead-time performances. When the parts are supplied by ILN, the lead-time between the customers' order and the deliveries can vary from 5 to 10 weeks (see figure 12):

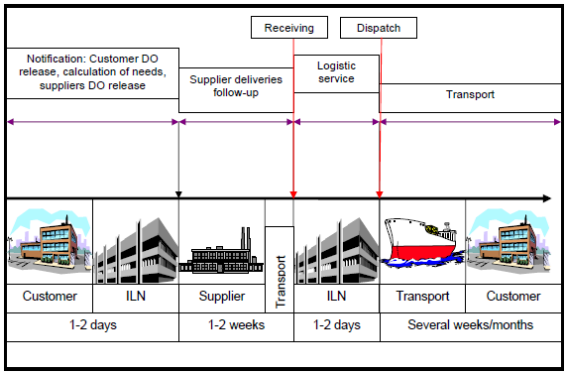

Fig. 12. Main activities and flow of an ILN

5.1 Logistic Service

The ILN's main process is unloading the transport units that carry the parts from the suppliers and after that the parts are sorted out by Customer and are then directed according to the kind of logistic service they need before being dispatched.

5.1.1 Direct flow

The packs delivered by the supplier are dispatched without any change. They are large enough to be directly loaded in a container. They go directly from the receiving zone to the dispatch zone (see figure 13).

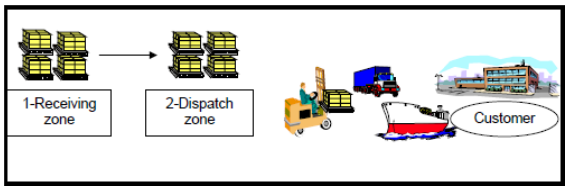

Fig. 13. Direct flow diagram

It is the shortest flow; it is the most optimized flow as far as logistics is concerned.

5.1.2 Grouping

The packaging unit (PU) ordered by the Customer is too small to be directly loaded in a container. Therefore, several PU are grouped together and form a grouping pack (see figure 14).

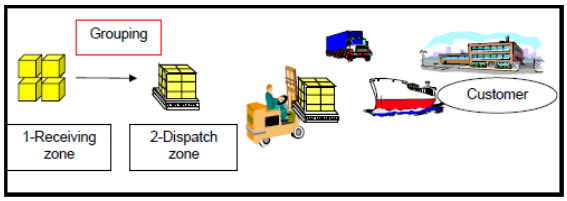

Fig. 14. Grouping diagram

After being labeled once, all the PU of one customer are grouped together in order to form complete packs for container loading.

5.1.3 Repacking

The pack delivered by the supplier does not comply with the transport and customer constraints. The parts are repacked (see figure 15).

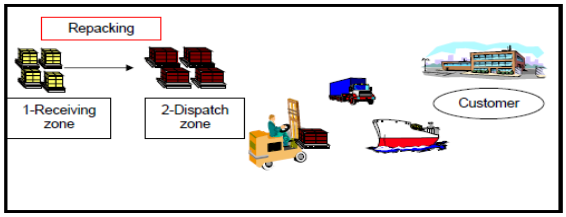

Fig. 15. Repacking diagram

Examples of situation in which repacking are necessary:

- Body part delivered in non-folding metal packaging
- Metal unit needing anti-corrosion protective covers
- Parts transported in returnable pack between the supplier and the ILN platform.

5.1.4 Repacking and grouping

It sums up the two previous flows (see figure 16).

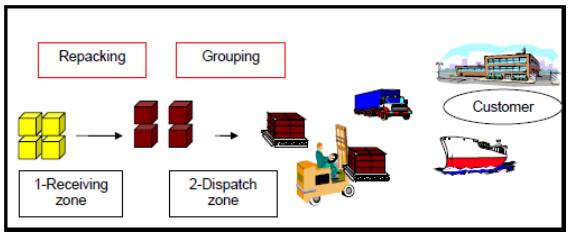

Fig. 16. Repacking and grouping diagram

The parts are repacked according to the customer's expectations and are then grouped together to form complete packs.

5.1.4 Dispatch

Dispatch includes:

- Collection and loading in containers of the packs of a precise customer.
- Edition of the documents going with the load.
- Communication by computer of the data necessary to follow-up and receiving (dispatch note).
- Registration in the invoicing and customs systems of the information necessary to invoice release and to export and import customs clearance in the customer's country.

6 TRANSPORT RULES

The ILN has strict rules and documentation on how to load the trucks in order to have the best filling rate and security of the parts.

6.1 Staking rules in transport

The rule for dynamic weight in the transport unit is that the maximum agreed weight above the package sitting on the bottom is 600 kg so that any damages can be avoided (see figure 17).

The BMH rules specific for stacking wooden and carton packages are:

H (Haut – Up): 200 kg max;

M (Milieu – Middle): from 201 kg to a maximum of 400 kg;

B (Bas – Bottom): from 401 kg to a maximum of 1000 kg.

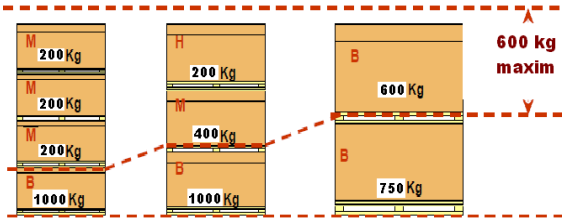

Fig. 17. Dynamic stacking rule

There can also be stacked packages of the same type: M over M, H over H or B over B, taking into account that the packages with the biggest weight should be placed at the bottom and the other packages to be put in descending order of their weights.

6.2 Weight saturation of containers

Another objective that needs to be taken into consideration is knowing which is the weight saturation of each container leaving the company to its customers, depending on the customs rules of each country.

The ILN obtains the appropriate file from the customs with the country road restrictions and calculates the expeditions made until that point in order to have an overview on future deliveries.

When establishing the weight saturation of each truck, the tractor, the chassis and the container's weight need to be taken into account (see figure 18).

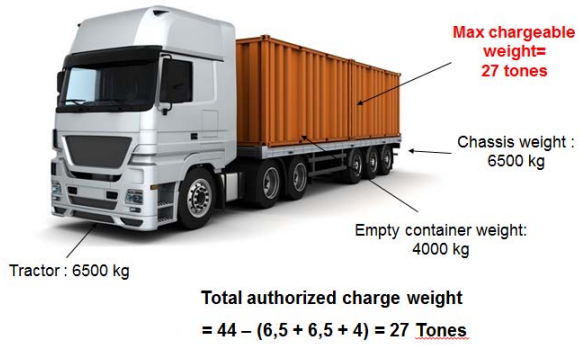

Fig. 18. Weight saturation of a truck

7 COSTING AND INVOICES

At the beginning of the invoicing process, each pair (ILN – Customer) is granted a SAP purchasing contract. This contract includes all the data necessary to invoicing:

- List of the items potentially requested by the Customer to a specific ILN platform
- Unit selling price of the parts
- Invoicing currency
- Customer's payment conditions
- Essential note on invoices

The list of the references included in the contract comes directly through the informatics system and it is the interface between the two entities. It simply

sends the information about validated part numbers specifying the ILN platform and the customer.

The cost analysts calculate on a daily basis the costing for all references in project phase and serial life and work together with the purchasing department and project manager in order to find the best flows in terms of means of transport and suppliers.

All the results are gathered and presented to the buyers. After the solutions are chosen a logistic plan

8 CONCLUSIONS

The logistic center that has been analyzed is one of great importance worldwide, having many customers in different countries and using all the tools of the logistics management. Due to this fact it was found the need of optimizing the processes and finding the best solutions for cost savings.

The topics brought into discussion were found based on feasibility reports and were underlined as areas for improvement where money can be saved and quality should be monitored more closely.

Tests and analyses were conducted for each work area and the results were made visible within this article. Quality, lead-times and customers satisfaction were the main objectives that lead to finding the optimization ideas of storage and transport units, packages and workflows.

9 REFERENCES

[1] Chang, Y.H. (1998) Logistical Management. Hwa-Tai Bookstorem Ltd., Taiwan.Ssdf

[2] Fair, M.L. and Williams, E.W. (1981) Transportation and Logistics. Business Publication Inc., USA.

[3] Ross, D.F. (1998) Competing through Supply Chain Management: Creating Marketwinning Strategies through Supply Chain Partnerships. Chapman and Hall, New York.

[4] Thomas, D.J. and Griffin, P.M. (1996) Invited review coordinated supply chain management, European Journal of Operational Research, Vol. 94, 1-15.

[5] Cooper, M.C., Lambert, D.M. and Pagh, J.D. (1997) Supply chain management: more than a new name for logistics, International Journal of Logistics Management, Vol. 8, No. 1, 1-13.

[6] www.ippc.int

[7] www.galia.com