The Hunt - A Greener Supply Chain

Being in a fast moving and ever changing environment with toughening competition and raised customer demands, even in markets previously spared from the global competition, companies are exploring all competitive edges available to strengthen their market shares. One of the hottest topics in this field is the transformation of the environmental policies from a cost to a strategic resource. From being a “nice-to-have” the customers are now setting environmental sustainable operations as a threshold for doing business in some markets.

It is in the light of this development Tetra Pak has investigated how to make their spare part distribution more sustainable. Tetra Pak is building and providing processing and packaging equipment for companies in the food sector, where the packaging division is focused on packages made of cartoon only. The company has for long been market leader in a branch with little of the fierce competition seen in other branches but as the market has evolved so has the competition. Not only from the competition of equals but in perhaps even greater extent from other concepts of packages such as PET-bottles and glass containers. To be able to keep their dominating market position they need to offer their customers excellence in all fields and at the same time being competitive in terms of pricing.

The paper is written in the spare parts division at Tetra Pak, Technical Service, and is focusing on the internal shipments from the central warehouse in Lund to the regional distribution centres all around the world.

Tetra Pak is situated in a branch which has been exposed for environmental pressure for a long time since packages is a thankful target in the environmental discussion due to the visual aspects of disposed containers. Even though Tetra Pak in general might be in focus of the environmental debate the spare part division has certainly not been involved anywhere close to that extent. But to give a believable environmental message the idea of sustainability must be reflected throughout the company nowadays.

The last decade has been an amazing journey for Tetra Pak Technical Service AB with an annual growth of several percentages each year. Growing in that pace makes old truths obsolete and it is important to question every aspect of the business to continue the growth and still keep profitability and customer satisfaction. One of these questions has been the choice of transportation, is it economically and environmentally defendable to send almost all shipments by airplane? The routes that have been investigated and deemed most interesting are the following:

- Lund -> Chicago (US)
- Lund -> Mexico City (Mexico)
- Lund -> Sao Paolo (Brazil)
- Lund -> Dubai (UAE)
- Lund -> Shanghai (China)

The data has been collected in a major extent by interviews with persons inside the organization, both in the sales offices in the regional distribution centres, and especially with
people situated at the central warehouse in Lund. The difficulties have not been to find the inventory control data, since the study is based on quite basic findings in that area, but to translate it into the actual situation and make the findings applicable in a wider context than Technical Service. This work should be looked upon as a pre-study for further investigations.

To understand how to translate the theory to reality the most important step is to understand the reality the organization is facing and how they are set up. Technical Service is an organization that has evolved a lot during the last years and being part of, and dependant on, the Tetra Pak organization in full makes it a complex business. Technical Service is mainly divided into two sectors, the distribution of spare parts and the service and repair of the machines. This means that they are responsible for neither the evaluation of suppliers nor the design of the items. Of course that is not the whole truth since the need from the aftermarket should be included both in development and sourcing. But since this report will be focusing solely on a topic clearly associated with the distribution the remaining organization will be left to its destiny until further.

The distribution organization within Technical Service, Parts Supply Chain (PSC), is a global organization with warehouses all around the world with two central hubs, one in Lund and one in Shanghai. Historically the hub in Lund has been the central point but since the Asian market has been growing and the suppliers has to some extent been moved to that region the two hubs are now sister locations. Almost all components are outsourced to external suppliers except critical components or other special cases. Nevertheless in PSC point of view all suppliers are treated alike and the set up is that all materials enter one of the two central hubs and then are distributed within the network. A material have is only assigned too one source, i.e. it has either Lund or Shanghai as entry point, not both. As always exceptions occur and some components are bought locally by some sales offices but the main flow is as described above. Furthermore the supply chain is set up with regional distribution centres to give even better support to all the local sales offices. The world is divided in mainly four areas,

- Lund supporting Europe
- Shanghai supporting Asia
- Dubai supporting Africa and the Middle East
- Mexico City supporting America

The observant reader notices that the study has two more locations in scope, Chicago and Sao Paolo, why? The placement of Mexico City is enough to cover the American demands in terms of geography but this region has a difficult political and cultural situation. Both the American and Brazilian sales offices are strong sites with demanding customers and the custom situation in South America makes the transaction from distribution from Lund to Mexico difficult, the regional distribution centre in Mexico is a newly implemented solution. As the US concern the complexity is more of a cultural aspect since they have a historically independent and strong site. Hence are both taken into scope in the report.

Leaving the general set up and focusing on the scope for this study, the transports between Lund and the regional distribution centres, brings us to the first question, how is the current situation? Almost every shipment out from Lund goes by airplane today, the exception is very heavy shipments that are sent by boat but no general rules are in place it is a judgement from case to case. Shipments are sent daily to the different sites, at least by air.
In other word is there a large flow of air shipments and a very limited flow of sea shipments and if PSC would have been a stand along organization the case would have been a completely different since the negotiation situation would have been very poor with the transporters but luckily Tetra Pak has a global transportation agreement for both sea and air shipments. This contract is based upon the total shipments in the entire organization and there within are all sea shipments of packaging materials which is a tremendous volume. An interesting factor in the PSC situation is the general attributes of the materials sold, e.g. comparing with the sales of packaging materials which is extremely heavy materials, with low value per kilo, the spare parts business is often dealing with materials in the other end of the scale with relatively high value per kilo. An even bigger difficulty is the large number of materials handled and the small batch sizes of each part.

Added to the complexity of dealing with a large number of materials is the complexity of dealing with the different cultures and political aspects of the sites. As mentioned earlier is the custom situation in each of the countries are extremely different but they all have their own challenges. In Shanghai a special complex set up exist but generally the custom situation could be very difficult even if a very good communication is established and in Dubai the site is situated in a trade zone close to the harbour and the air shipments have a special set up with door-to-door services and pricing.

Beside the purely logistical discussion in the report is a parallel discussion regarding the price of being environmental, what is an investment in a sustainable supply chain allowed to cost? It is easy to say that the environment is important and that it should be an aspect of all decisions but to implement it is not easy since many parameters could be adjusted to be more or less affecting due to the natural softness in these parameters. Tetra Pak is not an exception when it comes to having loosely formulated environment policies. In this report a calculation of the carbon dioxide is used which is based on empirical data from actual transports. These values combined with the price from NASDAQ's carbon dioxide emissions market gives an estimation of what the impact causes.

Based on the above mentioned discussions two alternatives, sea or air, are compared by setting up the cost equation. In an inventory control point of view the system PSC uses is quite straight forward, the material is classified according to a matrix where the axis consists of on one side the value of annual usage (i.e. the demand multiplied with the cost) and on the other hand the number of times the item has been bought the last twelve months. All materials are then classified in the matrix and a service level target is given according to the position. In this particular case a high service level is used since PSC is using a generally high level and especially for high frequent materials. They are in the making of shifting system but even though there is a change the underlying logic is the same if so a bit more complex. The biggest change in this new planning system will be that the materials will be planned globally; hence the result will not be affected. In those areas where it has been possible the new system’s parameters and calculations has been chosen. An important aspect in the calculation is the number of orders per year and here has the Wilson formula been applied in accordance with the new system. Since no simulations will be made in this report a selection of materials has been made to represent the total assortment. The report only consider material with high forecast since it is assumed that it is only them that would be profitable to change mode of transport. Materials have been chosen based on five criteria’s, demand, standard deviation of demand, value, weight and volume. In the first step materials where not chosen from real life but created from an analysis of the whole
assortment. Each criterion was assigned one high and one low value. Then a sensitivity analysis was made for a couple of affecting parameters to see how the model reacted for different material types. The sensitivity analysis gives a good indication of which parameters affect the result in one or the another direction but the interesting conclusion is how much each parameter affect each other when set in relation each other. By analysing the results from each graph and combining the result a general formula is achieved, a simplified expression of the original cost calculations. This expression has then been compared to the result in the calculation model. Real materials with actual parameters were selected for the assignment and the selection where made from the earlier assortment analysis and materials that represented as large amount of materials as possible were selected for the comparison. The material showed that the expression was a good estimation of the previous model and it showed that the expression became less valid the lower the demand and the higher the standard deviation of demand was which is in accordance to the restrains of the original calculation. By the help of the simplified expression the result could be translated for all materials, at least high frequent, and to visualize the result from the expression the materials get a new parameter, the ratio between weight and value. Below are two graphs for Lund-Mexico City and Lund-Shanghai. The both graphs shows on the y-axis the weight/value-ratio and all materials where sorted with the lowest gain as number one and the x-axis is showing that position. For Shanghai it is material number 470 that is the first material with a positive gain of changing to sea shipments while it is material number 109 for Mexico City.
The summarized result for each site is clearly stating a switch to sea transportation but before jumping to conclusion the result need a more detailed inspection. Even if the total result looks positive the materials that generate the result are very few, i.e. a few numbers that should most definitively be sent by boat. Combining this result with the above graphs gives a good picture of what materials those are suitable for sea shipments. The result might not be dazzling since it shows that material with a high weight/value-ratio should be freighted by boat. This could easily been obtained by an intuitive discussion but this result is specific for PSC and even if not directly applicable to other business it gives good indications for similar companies in the same situation. The graphs shows that both sites have a clear breakpoint where the materials starts to be profitable to change set up and gives an approximated ratio for profitable materials. The closer investigation of the result also shows that the biggest cost for sea shipments are not the increased buffer stock but the cost of capital during the transportation.

How should this result be interpreted? There are most certainly materials that should be shipped by boat but most of these materials are most certainly already shipped from the ad hoc decision process since the cost reduction is extremely visual. But apart from the obvious materials the result is not strong enough to clearly support the change. What has been realized is more or less what consequences a change would mean if the environmental impact would be a demand from the market. I.e. back in the question what environment is allowed to cost and as previously discussed this needs to be communicated clearly within the organization since it is an active decision of which direction the company should take and what image to pursue, a decision that needs to be taken with the umwelt in mind and the emerging market needs.

Suggested way forward is to create a structured process regarding the shipments with clearly defined decision making with a system support, focusing on the top gain materials. There are several interesting areas which would be interesting to develop and investigate further. First of all the interesting topic of what the environmental work is worth, both in the Tetra Pak and PSC organization and in a more general discussion. Moving away from the concept the boat is the only option to make an eco-friendly supply chain it would be interesting to investigate the possibilities to change the chain completely and source material locally, extend the possibility of global purchasing contracts and actively tie new global partners.